Turkish Journal of Physiotherapy and Rehabilitation

Türk Fizyoterapi ve Rehabilitasyon Dergisi

www.dergipark.gov.tr/tjpr
Volume/Cilt 33, Number/Sayı 2, 2022

ISSN: 2651-4451 • e-ISSN: 2651-446X

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Türkiye Fizyoterapistleri Derneği adına
(On Behalf of Turkish Physiotherapy Association)
Tülin DÜGER

Editör ve Yazı İşleri Müdürü
(Editor in Chief and Managing Editor)
H. Serap İNAL

TÜRKİYE FİZYOTERAPİSTLER DERNEĞİ'nin bilimsel yayın organı ve yaygın süreli yayınıdır.
(The official scientific journal of Turkish Physiotherapy Association)

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"Açık Erişim Dergi" yılda 3 kez (Nisan, Ağustos, Aralık) yayınlanır.
"*Open Access Journal" published 3 times (April, August, December) a year.*

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Dergi Basım Tarihi: 20.08.2022

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YAZARLARIN DİKKATİNE
Genel Bilgiler

Genel Bilgiler

Türkiye Fizyoterapistler Derneği'nin resmi yayın organı olan Türk Fizyoterapi ve Rehabilitasyon Dergisi, bağımsız, tarafsız ve çift kör hakemlik ilkelerine uygun bir şekilde elektronik ve basılı olarak yayımlanan açık erişimli, ücretsiz, bilimsel bir yayın organıdır. Dergi, Nisan, Ağustos ve Aralık olmak üzere yılda 3 kez yayımlanır. Yazım dili Türkçe ve İngilizcedir. Bununla birlikte İngilizce gönderilen makalelere yayımlanma aşamasında öncelik verilecektir. Dergi, özgün araştırmalar, çağrılı derlemeler, sistematik derleme ve meta-analiz çalışmaları, ilginç olgu sunumları ve editöre mektupları yayımlamaktadır.

Derginin amacı fizyoterapi ve rehabilitasyon ile ilgili en yüksek bilimsel, etik ve klinik değere sahip orijinal çalışmaları yayımlamaktır. Türk Fizyoterapi ve Rehabilitasyon Dergisi, yayımladığı makalelerin daha önce başka bir yerde yayımlanmamış veya yayımlanmak üzere gönderilmemiş olması, ticari kaygılarda olmaması şartını gözetmektedir. Yayımlanacak makalenin tüm yazarlar tarafından ve çalışmanın yapıldığı yerdeki sorumlu kişi tarafından dolaylı olarak veya açık bir şekilde onaylandığını ve kabul edilmesi halinde aynı biçimde Türkçe, İngilizce veya başka bir dilde başka bir yerde yayımlanmayacağını taahhüt eder. Dergi, bilimsel kalitesi yüksek ve atıf potansiyeline sahip bir yazının yayına kabul edilmesi için en önemli kriter olan özgünlük ilkesini benimsemektedir.

Derginin yazım kuralları Uniform Requirements for Manuscripts Submitted to Biomedical Journals - International Committee of Medical Journal Editors (http://www.icmje.org) ve Committee on Publication Ethics (COPE) (https://publicationethics.org) tarafından yayımlanan rehberler ve politikalar dikkate alınarak hazırlanmıştır.

Türk Fizyoterapi ve Rehabilitasyon Dergisi (Türk Fizyoter Rehabil Derg / Turk J Physiother Rehabil), dünyanın her yerinden makaleler yayımlamaktadır ve aşağıdaki özelliklere sahip makalelere öncelik vermektedir:

- Fizyoterapi ve rehabilitasyon uygulamaları üzerinde etkisi olacak önemli araştırma sorularını ele alan ve hipotezleri güçlü yöntem ve araştırma tasarımı ile test eden özgün çalışmalar
- Klinik veya saha uygulamaları için temel teşkil edebilecek laboratuvar tabanlı çalışmalar
- Rehabilitasyon uygulamaları, politikaları, eğitimleri veya araştırmalarda karar vermeyi kolaylaştırmaya ve geliştirmeye yardımcı olabilecek çalışmalar.

ETİK SORUMLULUK

Editör ve Alan Editörleri

Editör ve alan editörleri, açık erişim olarak Committee on Publication Ethics (COPE) tarafından yayımlanan "COPE Code of Conduct and Best Practice Guidelines for Journal Editors" ve "COPE Best Practice Guidelines for Journal Editors" rehberleri temelinde etik görev ve sorumluluklara sahiptirler. Editörler ve alan editörleri:

- Dergide yayımlanan her makalenin dergi yayın politikaları ve uluslararası standartlara uygun olarak yayımlanmasından,
- Derginin kalitesini, özgünlüğünü ile okunurluğunu geliştirmekten,
- Fikri mülkiyet hakları ile etik standartlardan taviz vermeden şeffaf bir şekilde iş süreçlerini yürütmekten,
- Makalelerin tarafsız ve bağımsız olarak değerlendirme süreçlerinin tamamlanması için yazarlar, hakemler ve üçüncü kişiler arasında oluşabilecek çıkar ilişkisi ve çatışmalarına karşı önlem almaktan sorumludurlar.

Editörler, çalışmaların önemi, özgün değeri, geçerliliği, anlatımın açıklığı ve derginin amaç ve hedeflerine dayanarak olumlu ya da olumsuz karar verirler. Dergi yayın politikalarında yer alan "Kör Hakemlik ve Değerlendirme Süreci" politikalarını uygulamaktadırlar. Bu bağlamda editörler her çalışmanın değerlendirme sürecinin çıkar çatışması olmadan, adil, tarafsız ve zamanında tamamlanmasını sağlarlar.

Derginin editör veya editör kurulu üyelerinin yazar oldukları makalelerin değerlendirme süreçlerinin yönetilmesi için dışarıdan bağımsız bir editör davet edilebilir.

Hakemler

Türk Fizyoterapi ve Rehabilitasyon Dergisi'ne gönderilen yazılar çift kör hakem değerlendirme sürecinden geçer. Tarafsız bir değerlendirme sürecini sağlamak için her gönderi, alanlarında uzman olan en az iki bağımsız hakem tarafından incelenir. Hakemler yazıya ilişkin bilgileri gizli tutmakla yükümlüdür. Hakemler, çıkar çatışması olması halinde bu konu hakkında Türk Fizyoterapi ve Rehabilitasyon Dergisi'ne bildirimde bulunur.

Hakemler kendilerine gönderilen çalışmayı değerlendirme süreci tamamlanıncaya ve yayına verilinceye kadar herhangi bir amaç için kullanamaz. Hakemler makaleyi değerlendirirken nazik ve yapıcı bir dil kullanmalı, kötü yorum ve ifadelerden kaçınmalıdırlar. Hakemler makaleyi zamanında ve etik kurallara dikkat ederek değerlendirmekle sorumludurlar.

Yazarlar

Yazıların bilimsel içeriği ve etik kurallara uygunluğu yazar/yazarların sorumluluğundadır. Deneysel ve klinik çalışmalar ile olgu sunumlarının araştırma protokollerinin uluslararası anlaşmalara (World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" www.wma.net) uygun olarak, etik kurul tarafından onaylanması gerekmektedir. Dergiye, etik kurul onayı almış ve Helsinki Bildirgesi'nin en güncel versiyonuna uygun yürütülmüş araştırmalar kabul edilir. Yazarlar, insan öğesi ile yapılmış çalışmalarda makalenin "YÖNTEM" bölümünde bu prensiplere uygun olarak çalışmayı yaptıklarını, kurumlarının etik kurullarından ve çalışmaya katılmış insanlardan "bilgilendirilmiş olur veya onam formlarını" (informed consent) aldıklarını belirtmek zorundadırlar. Yazarlar gerektiğinde hastalara veya katılımcılara ait bilgilendirilmiş olur veya onam formlarını belgeleyebilmelidir. Katılımcının onayı ile ilgili bilgiler, etik kurulun adı ve etik komite onay numarası da yazının "YÖNTEM" bölümünde belirtilmelidir. Etik kurul onayı gerekmeyen çalışmalar için çalışmanın tasarımı ve içeriğine uygun etik kurullardan alınan muafiyet belgesi veya sorumlu yazar tarafından yazılan bilgi amaçlı bir beyanın (meta-analiz, sistematik derleme, çağrılı derleme için) sisteme yüklenmesi gerekir. Çalışmada hayvan öğesi kullanılmış ise yazarlar, makalenin "YÖNTEM" bölümünde Guide for the Care and Use of Laboratory Animals (http://www.nap.edu/catalog/5140.html) prensipleri doğrultusunda çalışmalarında hayvan haklarını koruduklarını ve kurumlarının etik kurullarından onay aldıklarını belirtmek zorundadır.

Yazar olarak listelenen her kişi, International Committee of Medical Journal Editors (ICMJE-www.icmje.org) tarafından önerilen ve aşağıda gösterilen yazarlık kriterlerinin dördünü de karşılamalıdır:

- Çalışmanın planlanmasına, verilerin toplanmasına veya verilerin analizine ve yorumlanmasına katkısı olmalıdır,
- Makale taslağının hazırlanması veya revize edilmesine katkıda bulunmalıdır,
- Makalenin dergiye gönderilecek ve yayınlanacak son halini okuyup kabul etmelidir,
- Çalışmanın herhangi bir bölümünün doğruluğu veya bütünlüğü ile ilgili soruların uygun bir şekilde araştırıldığı ve çözümlendiği konusunda diğer yazarlarla hemfikir olmalı ve çalışmadan tüm yönleriyle sorumlu olmalıdır.

Makalelerin bilimsel içeriği ve etik kurallara uygunluğu yazarların sorumluluğundadır. Tüm çalışmalar lisanslı bir benzerlik tespit yazılımı (CrossCheck tarafından iThenticate/Turnitin vb.) tarafından taranıp ilgili rapor belge olarak başvuru sırasında sisteme yüklenmelidir. Kaynaklar, tablo ve şekil içerikleri haricindeki yazının içeriğinde benzerlik oranı %20'nin üzerinde olmamalı ve yazarların önceki çalışmalarıyla bir benzerliği bulunmamalıdır. Benzerlik oranı %20'nin üzerindeki makaleler hakeme gönderilmeden reddedilir. İntihal, alıntı manipülasyonu ve veri sahteciliği/uydurma gibi durumlardan şüphelenilmesi veya tespit edilmesi halinde yayın kurulu COPE yönergelerini izleyecek ve bunlara göre hareket edecektir.

İletişimden sorumlu yazar makalenin sunum aşamasından basımına kadar olan süreçlerde her türlü yazışmaları gerçekleştiren yazardır. İletişimden sorumlu yazar:

- Etik kurul onay belgesi,
- Telif hakkı devir formu (e-imza veya ıslak imzalı olmalıdır. Bu formda imzası bulunanlar dışında sonradan yazar ismi eklenemez ve yazar sırası değiştirilemez.)
- Yazar katkı formu
- Çıkar çatışması formu belgelerini sisteme taratıp yüklemelidir.

Makalede, kitaplarda veya dergilerde daha önce yayımlanmış alıntı yazı, tablo, şekil vb. mevcutsa, yazarlar ilgili yazı, tablo, şekil, anket ve ölçeğin (geçerlilik, güvenirlik çalışmaları ile kullanımı için özel izin, sertifika istenen anket/ölçekler) telif hakkı sahibinden ve yazarlarından yazılı izin almak; izin yazısını makale ile birlikte göndermek ve bunu makalede belirtmek zorundadır. Hastaların kimliğini açığa çıkarabilecek fotoğraflar için hasta veya yasal temsilcisinin imzalı izinleri eklenmeli ve "YÖNTEM" bölümünde bu izinlerin alındığı ifade edilmelidir. Bilimsel toplantılarda sunulan bildiler özet şeklinde daha önce sunulmuş ve/veya basılmış ise başlık sayfasında mutlaka belirtilmelidir.

Yazım Kuralları

Makaleler, ICMJE -Recommendations for the Conduct, Reporting, Editing and Publication for Scholarly Work in Medical Journals (updated in December 2019 - http://www.icmje.org/icmje-recommendations.pdf) uyarınca hazırlanmalıdır. Yazarların CONSORT'a uygun olarak makale hazırlaması gerekmektedir. Orijinal araştırma çalışmaları için STROBE kılavuzları, sistematik incelemeler ve meta-analiz için PRISMA yönergeleri, deneysel hayvan çalışmaları için ARRIVE yönergeleri kullanılmalıdır.

Türkçe makalelerde Türk Dil Kurumu'nun Türkçe Sözlüğü esas alınmalıdır. İngilizce makaleler ve İngilizce özetlerin, dergiye gönderilmeden önce dil uzmanı tarafından değerlendirilmesi gerekmektedir. Editör veya alan editörleri gerekli gördükleri hallerde İngilizce makale veya İngilizce özet için redaksiyonun sertifikasını talep edebilirler.

Özgün Makale: Güncel ve önemli bir konuda temel veya klinik bilgi sunan, önceki çalışmaları genişletip ilerleten veya klasik bir konuda yeni bir yaklaşım getiren türde araştırmalardan oluşur. Özgün makaleler 4000 kelimeyi ve kaynak sayısı 40'ı aşmamalıdır.

Olgu Sunumu: İlginç olguları, yeni fikirleri ve teknikleri tanımlamaktadır. Şekiller, tablolar ve kaynaklar yazıyı açıklamaya ve desteklemeye yetecek en az sayıda olmalıdır. Kelime sayısı 2000'i, kaynak sayısı 20'yi geçmemelidir.

Editöryal Yorum: Editörler Kurulu, eğitim ve klinik uygulamalar konusunda uzman bir yazarı belli bir konuda bilgilendirici bir yazı yazmak veya yorum yapmak üzere davet edebilir. Kelime sayısı 1000'i, kaynak sayısı 10'u geçmemelidir.

Çağrılı Derleme/Sistematik Derleme/Meta-Analiz: Sistematik derleme ve meta-analizler doğrudan, çağrılı derlemeler ise davet edilen yazarlar tarafından hazırlanmaktadır. Fizyoterapi ve rehabilitasyon bilimi ve klinik uygulamaları hakkında olabilecek her türlü konu için güncel literatürü de içine alacak şekilde hazırlanmalıdır. Yazarların o konu ile ilgili basılmış yayınlarının olması özellikle tercih nedenidir. Kelime sayısı 6000'i, kaynak sayısı 100'ü geçmemelidir.

Editöre Mektup: Editörler Kurulunun onayı ile yayımlanmaktadır. Mektup, dergide yayımlanmış bir makaleye yorum niteliğinde ise hangi makaleye (sayı, tarih verilerek) ithaf edildiği kaynak olarak belirtilmelidir. Mektuba cevap, editör veya makalenin yazar (ları) tarafından, yine dergide yayımlanarak verilir. Mektuplarda kelime sayısı 500, kaynak sayısı beş ile sınırlıdır.

Dergide yayımlanmak üzere gönderilen makaleler;

- Yazım sayfası A4 boyutunda olacak şekilde, PC uyumlu Microsoft Word programı ile yazılmalıdır.
- "Times New Roman" yazı tipi kullanılarak 12 punto ve makalenin tüm bölümleri 1,5 satır aralıklı yapılmalıdır.
- Sayfanın her kenarında en az 2,5 cm boşluk bırakılmalıdır.
- Sayfalar (sağ alt köşede) ve satırlar numaralandırılmalıdır.
- Makalenin ana başlıkları (Giriş, Yöntem, Sonuçlar, Tartışma, Kaynaklar) büyük harf kullanılarak ve koyu olarak belirtilmelidir.
- Alt başlıklar ise baş harf büyük ve koyu renk olacak şekilde yazılmalıdır.
- Metin içinde verilen sayısal değerlerde Türkçe makalelerde virgül (,); İngilizce makalelerde nokta (.) kullanılmalıdır. Verilen bu sayısal değerlerde virgül veya noktadan sonra p ve r değerleri hariç sayının iki basamağı daha verilmeli (Örnek: 13.31 veya 15,21); p ve r değerleri ise virgülden/noktadan sonra üç basamak olacak şekilde yazılmalıdır.
- Kısaltmalar, kelimenin ilk geçtiği yerde parantez içinde verilir ve tüm metin boyunca o kısaltma kullanılır. Uluslararası kullanılan kısaltmalar için 'Bilimsel Yazım Kuralları" kaynağına başvurulabilir.

Başlık Sayfası

Makalenin başlığı kısa fakat içeriği tanımlayıcı ve amaçla uyumlu olmalıdır. Başlıkta kısaltma kullanılmamalıdır. Makale başlığı Türkçe ve İngilizce yazılmalıdır. Türkçe ve İngilizce başlıkların tamamı büyük harfler ile koyu olarak yazılmalıdır. Ayrıca yazının 40 karakterlik kısa bir başlığı da Türkçe ve İngilizce olarak başlık sayfasında belirtilmelidir. Makalenin kelime sayısı (başlık sayfası, kaynaklar, tablolar, şekiller hariç) yazılmalıdır. Tüm yazarların açık adları, soyadları (büyük harf ile yazılacak) ve akademik unvanları, çalıştıkları kurum, iletişim bilgileri, Open Researcher and Contributor ID (ORCID) numaraları, çalışmanın yürütüldüğü kurumun veya kurumların açık adı ve adresi belirtilmelidir. Her yazar için üst numaralandırma kullanılmalıdır. İletişimden sorumlu yazarın iletişim bilgileri ayrıca sunulmalıdır. Başlık sayfası her yazarın iletişim bilgilerini, adres, güncel e-posta adresi ve iş telefon numarasını içermelidir.

Özetler

Her makale Türkçe ve İngilizce özet içermelidir.

Türkçe Özet ve Anahtar Kelimeler

Türkçe özet ayrı bir sayfadan başlamalı ve 250 kelimeden fazla olmamalıdır. Türkçe özet bölümü çalışmanın amacını, uygulanan yöntemi, en önemli bulguları ve sonucu içermelidir. Özet, "Öz" başlığını taşımalı ve "Amaç", "Yöntem", "Sonuçlar" ve "Tartışma" alt başlıklarına ayrılmalıdır. "Sonuçlar" kısmında p değeri belirtilmelidir. Türkçe makale özetlerinde ondalık sayılarda virgül (,) kullanılmalıdır.

Anahtar kelimeler 3'ten az, 5'ten çok olmamalıdır. Anahtar kelimeler "Türkiye Bilim Terimleri" listesinden (http://www.bilimterimleri.com) seçilmelidir. Bu listede henüz yer almayan yeni bir kavram için liste dışı kelimeler kullanılabilir. Anahtar kelimelerin her biri büyük harf ile başlamalı; virgül ile birbirinden ayrılmalı ve alfabetik sıraya göre yazılmalıdır. Makale Türkçe ise İngilizce özet kısmındaki anahtar kelimeler (keywords) Türkçe anahtar kelimelerin alfabetik sıralamasına uygun sıralanmalıdır.

İngilizce Özet (Abstract) ve Anahtar Kelimeler (Keywords)

İngilizce özet ayrı bir sayfadan başlamalı ve 250 kelimeden fazla olmamalıdır. İngilizce özette ondalık sayılarda nokta (.) kullanılmalıdır. İngilizce özet "Purpose", "Methods", "Results" ve "Conclusion" alt başlıklarına ayrılmalıdır. İngilizce özet ve anahtar kelimeler, Türkçe özet ve anahtar kelimelerin birebir aynısı olmalıdır. Anahtar kelimeler "MeSH (Medical Subject Headings)" terimlerinden seçilmiş olmalıdır. MeSH listesinde henüz yer almamış yeni bir kavram için liste dışı kelimeler kullanılabilir. Anahtar kelimelerin her biri büyük harf ile başlamalı; virgül ile birbirinden ayrılmalı ve alfabetik sıraya göre yazılmalıdır. Makale İngilizce ise İngilizce anahtar kelimelerin (keywords) alfabetik sıralamasına göre, Türkçe anahtar kelimeler sıralanacaktır.

Araştırma Makalesinin Bölümleri

Makale metni Türkçe makalelerde "Giriş", "Yöntem", "Sonuçlar" ve "Tartışma" bölümlerinden oluşur. İngilizce makalelerde ise "Introduction", "Methods", "Results" ve "Discussion" bölümleri yer alır. Metin içinde beş defadan fazla tekrar eden ifadeler için standart kısaltmalar kullanılabilir. Kısaltmanın açıklaması metinde ilk geçtiği yerde belirtilmelidir.

Giriş

Çalışma konusuyla ilgili önceki yayınlardan elde edilen temel bilgilerin özetini içermelidir. Çalışmanın yapılmasındaki gereklilik ve amaç kısaca belirtilmelidir.

Yöntem

Çalışmadaki klinik, teknik veya deneysel yöntemler açıkça belirtilmelidir. Yöntem için uygun kaynaklar verilmelidir. Bu bölümde yazarlar, insanlar üzerinde yapmış oldukları çalışmaları Helsinki Bildirgesi prensiplerine uygun olarak yürüttüklerini, ilgili etik kuruldan onay aldıklarını (etik kurulun adı, tarih ve protokol numarası yazılmalıdır) ve katılımcılardan bilgilendirilmiş onam alındığını belirtmek zorundadır. Yöntem bölümü "İstatistiksel analiz" alt başlığını içermelidir. Çalışmada hayvan ögesi kullanılmış ise yazarlar, Guide for the Care and Use of Laboratory Animals (http://www.nap.edu/catalog/5140.html) prensipleri doğrultusunda hayvan haklarını koruduklarını ve ilgili etik kuruldan onay aldıklarını belirtmek zorundadırlar. Katılımcıların kimliğini açığa çıkarabilecek fotoğraflar için yayın onayı alındığına yönelik bir ifade bu bölümde yer almalıdır.

İstatistiksel analiz için herhangi bir istatistik programı kullanılmış ise kullanılan yazılım programının adı, sürüm numarası, yer, tarih ve firma bilgileri yazılmalıdır. İstatistiksel analiz yöntemleri ve örneklem büyüklüğünün hesaplanması ile ilgili bilgiler gerekçeleri ile birlikte sunulmalı, gerektiğinde kaynaklarla desteklenmelidir.

Sonuçlar

Sonuçlar sayısal verilere dayanmayan herhangi bir yorum içermemelidir. Tablolarda sunulan verilerin, metin içinde tekrar edilmesinden kaçınılmalı, en önemli sonuçlar vurgulanmalıdır.

Tartışma

Tartışma, çalışmada elde edilen en önemli sonuçlara ait bilgiler ile başlamalıdır. Çalışmadan elde edilen sonuçlar yorumlanmalı ve önceki çalışmaların sonuçları ile ilişkilendirilmelidir. Tartışmada çalışmanın kısıtlılıkları, literatüre ve klinik uygulamalara olan katkısı belirtilmelidir. "Sonuçlar" bölümünde ve tablolarda yer alan bulguların, detayları ile tartışma bölümünde tekrar edilmesinden kaçınılmalıdır. Araştırmada elde edilmeyen veriler tartışılmamalıdır.

Aşağıdaki başlıklar tartışma kısmından sonra açıklamalarıyla beraber eklenmelidir:

- *Destekleyen Kuruluş:* Destekleyen kuruluşlar varsa belirtilmelidir.
- *Çıkar Çatışması:* Çıkar çatışması varsa belirtilmelidir.
- *Yazar Katkıları:* Yazarların makaleye yönelik katkıları belirtilmelidir. Katkılar fikir/kavram, tasarım, denetleme/ danışmanlık, kaynaklar ve fon sağlama, materyaller, veri toplama ve/veya işleme, analiz ve/ veya yorumlama, literatür taraması, makale yazımı, eleştirel inceleme başlıkları altında toplanmalıdır.
- *Açıklamalar:* Yazı özet ve/veya bildiri şeklinde daha önce sunulmuş ise, sunulduğu bilimsel toplantı, sunum yeri, tarihi ve basılmışsa basımı yapılan yayın organına ilişkin bilgiler "Açıklamalar" kısmında belirtilmelidir.
- *Teşekkür:* Yazar olma kriterlerini karşılamayan ancak araştırma sırasında destek sağlayan (makaleyi okuma, yazma, teknik destek, dil ve istatistik desteği vb.) bireylere ve/ veya kuruluşlara ilişkin bilgiler olabildiğince kısa ve öz bir şekilde "Teşekkür" kısmında belirtilmelidir.

Kaynaklar

Kaynaklar makale ana metinden hemen sonra yer almalıdır. Kaynaklar metinde geçiş sırasına göre, cümle sonunda (noktadan önce), Arabik rakamlarla, parantez içine alınarak numaralandırılmalıdır [Örnek: ..... meydana geldiği bulunmuştur (21).]. Kaynak sayısının 40'ı aşmamasına ve 10 yıldan eski tarihli kaynak kullanımının toplam kaynak sayısının % 15'ini geçmemesine özen gösterilmelidir. Gerekmedikçe kitapların, web sayfalarının, yayınlanmamış gözlem ve kişisel görüşmelerin kaynak olarak kullanımından kaçınılmalıdır. Birden çok kaynağa atıf varsa kaynaklar arasına virgül konulmalı ve virgülden önce ya da sonra boşluk bırakılmamalıdır. Örnek olarak (3,7,15–19) verilebilir; burada "15–19", 15. kaynaktan 19. kaynağa kadar olan beş yayını kapsamaktadır. Ana metin içinde isim belirtilerek referans gösterilmesi gerektiğinde, makalenin yazım dili İngilizce ise "Yazar adı et al." (Örnek: Burtin et al.); makalenin yazım dili Türkçe ise "Yazar adı ve diğ." (Örnek: Burtin ve diğ.) şeklinde yazılmalıdır.

Dergi adları Index Medicus'a göre kısaltılmış olarak sunulmalıdır. Standart dergide yayınlanmış bir makalede, yazar sayısı 6 ve daha az ise tüm yazarların adı yazılmalıdır. Yazar sayısı 6'dan çok ise, ilk 6 yazar yazılmalı, diğer yazarlar Türkçe makaleler için "ve diğ.", İngilizce makaleler için "et al." olarak belirtilmelidir. Endnote, Mendeley gibi program kullanacak yazarlar programların içerisinde bulunan "VANCOUVER" stilini kullanmalıdır. Vancouver stilinde verilen bir referansta mutlaka olması gereken bilgiler aşağıda belirtilmiştir: - Yazar(lar) ad(ları), - Makale adı, - Dergi adı (Index Medicus'a göre kısaltılmış), - Basım yılı, - Dergi volümu ve sayısı, - Sayfa aralığı (Örnek:10-5).

Kaynak yazım örnekleri aşağıdaki gibidir:

- *Makaleler;* Burtin C, Saey D, Saglam M, Langer D, Gosselink R, Janssens W, et al. Effectiveness of exercise training in patients with COPD: the role of muscle fatigue. Eur Respir J. 2012;40(2):338-44.
- *Dergi ilavesinde yayımlanan çalışmalar;* Hielkema T, Hadders Algra M. Motor and cognitive outcome after specific early lesions of the brain–a systematic review. Dev Med Child Neurol. 2016;58(Suppl 4):46-52.
- *Kitap;* Murtagh J. John Murtagh's general practice. 4th ed. Sydney: McGraw-Hill Australia Pty Ltd; 2007.
- *Kitap b*ölümü; Cerulli G. Treatment of athletic injuries: what we have learned in 50 years. In: Doral MN, Tandogan RN, Mann G, Verdonk R, eds. Sports injuries. Prevention, diagnosis, treatment and rehabilitation. Berlin: Springer-Verlag; 2012: p. 15-9.
- *Kongre Bildirisi;* Callaghan MJ, Guney H, Bailey D, Reeves N, Kosolovska K, Maganaris K, et al. The effect of a patellar brace on patella position using weight bearing magnetic resonance imaging. 2014 World Congress of Osteoarthritis Research Society International, April 24-27, 2014, Paris. Osteoartr Cartilage; 2014;22(Suppl):S55.
- *Web sayfası;* Diabetes Australia. Gestational diabetes [Internet]. Canberra (AU): Diabetes Australia; 2015 [updated 2015; cited 2017 Nov 23]. Available from: https://www.diabetesaustralia.com.au/gestational-diabetes.

Tablolar

Tablolar, Microsoft Word dosyası formatında hazırlanmalı, her biri ayrı sayfalarda olacak şekilde makalenin sonunda yer almalı ve ana metinde geçtikleri sıraya göre numaralandırılmalıdır. Toplam tablo ve şekil sayısı en fazla 6 olmalıdır. Tablolarda her sütun başlığına kısa bir başlık yazılmalıdır. Tabloların sütunlarında her kelimenin ilk harfi büyük olmalıdır. Tablo numara ve başlığı tablonun üst kısmında yer almalı; tablo numarası koyu renk ile yazılmalı, tablo başlığından nokta (.) ile ayrılmalıdır (Örnek: **Tablo 1.** Katılımcıların Sosyodemografik Özellikleri). Tablolarda dikey çizgi kullanılmamalı sadece ilk satır üstünde, altında ve son satırın altında yatay çizgiler olmalıdır. Tabloda yer alan p değerleri *, ** ile gösterilmelidir. Notlar ve tabloda kullanılan kısaltmaların açıklamaları tablonun alt kısmında yazılmalıdır. Kısaltmaların açıklamasının yazımında önce kısaltma yazılmalı, iki nokta üst üste (:) işaretinden sonra kısaltmanın açık hali yazılmalıdır. Kısaltmalar birbirinden virgül ile ayrılmalıdır. Tabloda kullanılan değişkenlerin birimleri parantez içinde belirtilmelidir. Belirli bir aralığı kapsayan birimler aralık dilimi ile sayısal olarak ifade edilmelidir. Tabloda verilen ondalık sayılarda, Türkçe makalelerde virgül (,); İngilizce makalelerde nokta (.) kullanılmalıdır. Tablolarda verilen ondalık sayılarda virgül veya noktadan sonra iki basamak yazılmalıdır (Örnek: 31,12 veya 20.10). Ortalama, yüzde ve ortanca değerleri dışındaki değerler (p, r, vb.) virgülden/noktadan sonra üç basamak olarak yazılmalıdır. Tablo örneği aşağıda bulunmaktadır.

Tablo 1. Grupların Bilgi Testi Sonuçları

Bilgi Testi	TU Grubu (n=20)	SH Grubu (n=20)	TU-SH Grubu (n=20)	t	p§
Ön Test	60,50±13,17	69,05±14,11	67,14±14,54	0,002	0,051
Son Test	83,00±14,18	73,50±9,33	83,33±10,17	0,002	**0,001**

*p<0,05. §Kruskal Wallis Analizi. TU: Teorik/uygulamalı ders grubu, SH: Simüle hasta grubu, TU-SH: Teorik/uygulamalı ders ve simüle hasta grubu.

Şekiller

Şekil başlıkları tablolardan sonra ayrı bir sayfada yer almalıdır. Şekiller ise ayrı bir dosya olarak JPEG, TIFF, PNG formatında yüksek kalitede yüklenmelidir. Makale içinde kullanılan fotoğraflar net olmalıdır. Fotoğraf ve şekiller metin içinde geçiş sırasına göre numaralandırılmalıdır. Yazarlar, insan öğesinin bulunduğu fotoğraflarda, kişiden yazılı izin ve kimliğini gizleyecek önlemler almalıdırlar. İzin metni makale ile birlikte dergiye gönderilmelidir. "YÖNTEM" bölümünün ilk paragrafında yayın onayı alındığına dair bilgi verilmelidir.

Makale Gönderme Formatı

Makaleler Microsoft Office Word dosyası formatında hem yazar isimleri olan hem de yazar isimleri içermeyen iki kopya şeklide DergiPark (http://dergipark.gov.tr/tjpr) sistemine kullanıcı olarak kayıt olunduktan sonra yüklenecektir. Yazar isimlerinin bulunmadığı Word dosyasında adı geçen tüm kurumların (etik kurul onayın alındığı kurum da dahil olmak üzere) "X" ile kapatılması gerekmektedir.

Makale Değerlendirme Süreci: Derginin yayın süreci, Uluslararası Tıbbi Dergi Editörleri Komitesi (ICMJE), Dünya Tıbbi Dergi Editörleri Birliği (WAME), Bilim Editörleri Konseyi (CSE), Yayın Etiği Komitesi (COPE), Avrupa Bilim Editörleri Birliği (EASE) ve Ulusal Bilgi Standartları Organizasyonu (NISO) kılavuzları ile uyumludur. Yazar makalenin değerlendirme sürecini DergiPark (http://dergipark.gov.tr/tjpr) sisteminden takip edebilmektedir. Dergiye gönderilen yazılar ilk olarak, teknik editör tarafından yazının dergi yönergelerine uygunluğu açısından değerlendirilecektir. Derginin yönergelerine uymayan yazılar, teknik düzeltme talepleriyle birlikte yazara tekrar gönderilecektir. Makaleler ilgili alanda uzman en az iki dış hakem tarafından değerlendirmeye tabi tutulacak ve hakem raporları, iletişimden sorumlu yazara bildirilecektir. Revizyon gerektiren makalelerde yazarın hakem yorumlarını birebir yanıtlaması ve makalenin revize edilmiş versiyonunu yüklemesi gerekir. Bu süreç, yayın kurulu makaleye onay verene kadar tekrarlanır.

Telif Hakkı

Dergimizde yayınlanan yazıların tüm telif hakları Türkiye Fizyoterapistler Derneği'ne aittir.

Sorumluluk Reddi

Türk Fizyoterapi ve Rehabilitasyon Dergisi'nde yayımlanan yazılardaki ifadeler veya görüşler, editörlerin, yayın kurulunun veya yayıncının görüşlerini değil yazarların görüşlerini yansıtmaktadır. Editörler, yayın kurulu ve yayıncı bu tür materyaller için herhangi bir sorumluluk veya yükümlülük kabul etmemektedir. Yayınlanan içerikle ilgili nihai sorumluluk yazarlara aittir.

Instructions for Authors

Turkish Journal of Physiotherapy and Rehabilitation is the official journal of the Turkish Physiotherapy Association. Turkish Journal of Physiotherapy and Rehabilitation is open-access, free, impartial, and employs a double-blind peer-review process published electronically and in print. It is published three times a year, in April, August, and December, in Turkish and English. The manuscripts submitted in English will be given priority in the publication process. We are pleased to receive articles reporting original scientific research, invited reviews, systematic reviews or meta-analyses, rare case studies, and letters to the editor.

The journal aims to publish original studies of the highest scientific, ethical, and clinical value on physiotherapy and rehabilitation. Submission of an article implies that the work described has not been published previously, that it is not under consideration for publication elsewhere, that it is not having commercial concerns. The publication of an article is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in Turkish, English or any other language. The journal adopts the principle of originality, which is the most important criterion for an article with high scientific quality and citation potential to be accepted for publication.

The editorial rules of the journal are based on the guidelines published by Uniform Requirements for Manuscripts Submitted to Biomedical Journals - International Committee of Medical Journal Editors (http://www.icmje.org) and Committee on Publication Ethics (COPE) (https://publicationethics.org).

Turkish Journal of Physiotherapy and Rehabilitation (Turk J Physiother Rehabil) publishes articles from all over the world and gives priority to articles with the following characteristics:

- Original studies that address important research questions that will have an impact on physiotherapy and rehabilitation practices and test hypotheses with a strong method and research design
- Laboratory-based studies that can be the basis for clinical or field applications
- Studies that can help facilitate and improve decision-making in rehabilitation practices, policies, education, or research.

ETHICAL RESPONSIBILITY

Editorial Board

Editors have ethical duties and responsibilities based on the "COPE Code of Conduct and Best Practice Guidelines for Journal Editors" and "COPE Best Practice Guidelines for Journal Editors" published by the Committee on Publication Ethics (COPE) as open access. **Editors:**

- Every article published in the journal is published by journal publication policies and international standards,
- To improve the quality, originality, and readability of the journal,
- To conduct processes transparently without compromising intellectual property rights and ethical standards,
- To complete the impartial and independent evaluation processes of the articles, they are responsible for taking precautions against conflicts of interest that may arise between the authors, reviewers, and third parties.

Editors make positive or negative decisions based on the importance, original value, and validity, clarity of the narrative, and the journal's goals and objectives. They apply the "Blind Peer-Review and Evaluation Process" policies included in the publication policies of the journal. In this context, the editors ensure that the evaluation process of each study is completed in a fair, impartial, and timely manner without conflict of interest.

An independent external editor may be invited to manage the evaluation processes of the articles in which the editorial board members are the authors.

Reviewers

Manuscripts submitted to the Turkish Journal of Physiotherapy and Rehabilitation go through a double-blind peer-review process. To ensure an unbiased review process, each submission is reviewed by at least two independent reviewers who are experts in their fields. The reviewers are obliged to keep the information about the article confidential. In case of a conflict of interest, the reviewers notify the Turkish Journal of Physiotherapy and Rehabilitation.

The reviewers cannot use the article sent to them for any purpose until the evaluation process is completed and it is published. Reviewers should use kind and constructive language while evaluating the article and avoid bad comments and expressions. The reviewers are responsible for evaluating the article on time and by paying attention to the ethical rules.

Authors

The scientific content of the manuscripts and their compliance with ethical principles are under the responsibility of the author(s). The ethics committee must approve research protocols of experimental and clinical studies and case reports following international agreements (World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" www.wma.net). The journal accepts manuscripts which; have been approved by the relevant Ethical Committees and are by ethical principles stated in the Declaration of Helsinki. The authors must state that they conducted the study according to the abovementioned principles in the "METHOD" section for studies conducted on human subjects. They also must express ethical committee approval and obtain "informed consent forms" from volunteers who participated in the study. Authors should document informed consent or consent forms of patients or participants when necessary. Information about the approval of the volunteers, the name of the ethics committee, and the ethics committee approval number should also be stated in the "METHOD" section of the manuscript. For studies that do not require ethics committee approval, letter of an exemption from the ethics committee in accordance with the design and content of the study or an informative statement written by the responsible author (for meta-analysis, systematic review, or invited review) should be uploaded to the system. In studies involving "animals," the author(s) should state in the "Methods" section that they have protected the rights of the animals by the principles of "Guide for the Care and Use of Laboratory Animals" (http://www.nap.edu/catalog/5140.html) and obtained approval from the relevant Ethical Committees.

Each person listed as an author must meet the following 4 criteria for authorship recommended by the International Committee of Medical Journal Editors (ICMJE-www.icmje.org:

- Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND
- Drafting the work or revising it critically for important intellectual content; AND
- Final approval of the version to be published; AND
- Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

The scientific content of the articles and their compliance with ethical principles are the responsibility of the authors. All studies must be checked by a licensed plagiarism detection software (iThenticate/Turnitin etc., by CrossCheck) and uploaded to the system as a supplementary document at the time of application.

The similarity rate in the content of the article should not be over 20% and should not have any similarity with the previous works of the authors except for the references, table, and figure contents. Articles with a more than 20% similarity rate are rejected without being sent to the referee. In case of suspected or detected plagiarism, citation manipulation, and data forgery/fabrication, the editorial board will follow the COPE guidelines and act accordingly.

The corresponding author carries out all kinds of correspondence from the presentation stage to the printing of the article. The corresponding author should scan and upload the following documents to the system.

- Ethics committee approval form,
- Copyright transfer form (must be e-signed or original signed. Another author's name cannot be added later, and the order of authors cannot be changed, except for those whose signatures are on this form.)
- Author contribution form
- Conflict of interest form
- Publication rights agreement form

Suppose there are cited articles, tables, and figures previously published in articles, books, or journals. In that case, the authors must obtain written permission from the copyright holder for the table, figure, survey, and scale (validity, reliability studies and special permission for its use, certificate/scales), send the permission letter together with the article, and indicate this in the article. In addition, the signed permission of the patient or his legal representative should be attached for the photographs that may reveal the identity of the patient, and it should be stated in the "METHOD" section. Finally, if the papers are presented in scientific meetings and presented and/or published in the abstracts book, authors must be stated on the title page.

Instructions for Authors

Articles should be prepared following ICMJE -Recommendations for the Conduct, Reporting, Editing, and Publication for Scholarly Work in Medical Journals (updated in December 2019 - http://www.icmje.org/icmje recommendations.pdf). In addition, authors are required to prepare an article in accordance with the Consolidated Standards of Reporting Trials (CONSORT) Statement. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement should be used for original research studies, Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement should be used for systematic reviews and meta-analysis, and Animal Research: Reporting of In Vivo Experiments (ARRIVE) Statement for experimental animal studies.

Turkish dictionary of Turkish Language Institution should be considered in Turkish manuscripts. A native speaker should edit the manuscripts and abstracts in English before being submitted to the journal. Editors or field editors may request proofreading for English articles or English abstracts if they deem necessary.

Original Article: It consists of research that provides basic or clinical information on a current and essential topic, extends, and advances previous studies, or introduces a new approach to a classic topic. Original articles should not exceed 4000 words, and the number of references should not exceed 40.

Case Report: It describes interesting cases, novel ideas, and techniques. Figures, tables, and references should be as minimal as possible to explain and support the text. The number of words should not exceed 2000, and the number of references should not exceed 20.

Editorial Comment: The Editorial Board may invite an author who is an expert in education and clinical practice to write an informative article or comment on a particular subject. The number of words should not exceed 1000, and the number of references should not exceed 10.

Invited Review/Systematic Review/Meta-Analysis: Systematic reviews and meta-analyses are prepared directly, while invited authors prepare invited reviews. They should also include the current literature for any subject about physiotherapy and rehabilitation science and clinical applications. It is especially preferred that the authors have published publications on that subject. The number of words should not exceed 6000, and the number of references should not exceed 100.

Editorial Letter: It is published with the approval of the Editorial Board. If the letter is a commentary on an article published in the journal, it should be stated as the source to which article (number, date) it is dedicated. The answer to the letter is given by the editor or the author(s) of the article, again by publishing it in the journal. The number of words in the letters is limited to 500, and the number of references is limited to five.

Articles submitted for publication in the journal;

- The writing page should be A4 size, with a PC-compatible Microsoft Word program.
- "Times New Roman" font with a 12-font size should be used, and all parts of the article should be written with 1.5 line spacing.
- At least 2.5 cm of space should be left on each side of the page.
- Pages (bottom right corner) and lines should be numbered.
- The main headings of the article (Introduction, Method, Results, Discussion, and References) should be written in capital letters and in bold.
- Sub-headings should begin with a capital letter as a sentence case and bold.
- In the numerical values given in the text, a comma (,) should be used in Turkish articles and a period (.) in English articles. In these numerical values given, two more digits of the number should be given after the comma or period, excluding p and r values (Example: 13.31 or 15.21); the p and r values should be written as three digits after the comma/period.
- Abbreviations are given in parentheses at the first occurrence of the word, and that abbreviation is used throughout the text. Reference can be made to the scientific spelling rules for internationally used abbreviations.

Title Page

The title of the manuscript should be brief but descriptive for the content and compatible with the purpose. Article title should be written in Turkish and English. The Turkish and English titles should be written in bold with capital letters. Besides, a short running title (not exceeding 40 characters) should be specified both in Turkish and English on the title page. The number of words (excluding title page, references, tables, and figures) of the article should be written. Full names, surnames (written in a capital letter), academic titles, institutions, and digital identifiers Open Researcher and Contributor ID (ORCID) of the authors, full name and address of the clinic, department, institute, hospital, or university which the study was conducted at

should be declared using superscript numbers for each author. The contact information of the corresponding author should also be specified. The title page should include each author's contact information, address, current e-mail address, and business phone number.

Abstracts

Each manuscript should include both Turkish and English abstracts.

Turkish Abstract and Keywords

The Turkish abstract should begin from a separate page and not exceed 250 words. The Turkish summary section should include the purpose of the study, the methods, the primary findings, and the result. The abstract should be titled "Öz" and divided into subheadings of "Purpose," "Methods," "Results," and "Conclusion." The p-value must be specified in the "Results" section. A comma (,) should be used in decimal numbers in Turkish article summaries.

The number of keywords should not be less than 3 or more than 5. Keywords should be selected from the "Turkey Science Terms" list (http://www.bilimterimleri.com). The out-of-list terms may be used for a new concept. Each keyword begins with an uppercase letter, separated by a comma and written in alphabetical order. If the article is in Turkish, the keywords in the English abstract should be written in the alphabetical order of the Turkish keywords.

English Abstract and Keywords:

The English abstract should begin on a separate page and not exceed 250 words. A period (.) should be used in decimal numbers in the English summary. English abstract must be divided into subheadings of "Purpose," "Methods," "Results," and "Conclusion." The English abstract and keywords should be the same as the Turkish abstract and keywords. Keywords should be selected from "MeSH (Medical Subject Headings)" terms. The out-of-list terms may be used for a new concept that has not taken place in MeSH yet. Each keyword begins with an uppercase letter, separated by a comma and written in alphabetical order. If the article is in English, the keywords in the Turkish abstract should be sorted according to the alphabetical order of the English keywords.

Sections of the Original Research Articles

The sections of Turkish Article consist of "Giriş", "Yöntem", "Sonuçlar" and "Tartışma". In English articles, there are "Introduction," "Methods," "Results," and "Discussion" sections. Abbreviations can be used for the expressions repeated more than five times in the manuscript. The explanation of the abbreviation should be stated in the first place in the text.

Introduction

The introduction should summarize the basic knowledge obtained from previous studies related to the study topic. The rationale and purpose of the study should be described briefly.

Methods

The clinical, technical, or experimental methods in the study should be clearly stated. Appropriate references should be given for the method. In this section, the authors must state that they carried out their studies on humans in accordance with the principles of the Declaration of Helsinki, that they received approval from the relevant ethics committee (name of the ethics committee, date, and protocol number should be written) and informed consent was obtained. The method section should include the subtitle as "Statistical analysis." If an animal is used in the study, the authors should state that they protect animal rights in line with the principles of the Guide for the Care and Use of Laboratory Animals (http://www.nap.edu/catalog/5140.html) and have obtained approval from the relevant ethics committee. A statement that publication approval has been obtained for photographs that may reveal the identity of the participants should be included in this section.

If any statistical program is used, the name of the software program, version number, location, date and company information should be written. Information on statistical analysis methods and the calculation of sample size should be presented and supported with references when necessary.

Results

The results should not contain any interpretation that is not based on numerical data. In the text, repetition of the data presented in the tables should be avoided, and the most important results should be emphasized.

Discussion

The discussion should begin with information on the most important results obtained in the study. Results from the study should be interpreted and correlated with the results of previous studies. In the discussion, the limitations of the study, its contribution to the literature, and clinical practice should be stated. It should be avoided to repeat the findings in the "Results" section and the tables with their details in the discussion section. Data not obtained in the study should not be discussed.

The following titles should be added after the discussion section with their explanations:

- *Sources of Support:* If there are supporting organizations, it should be specified.
- *Conflict of Interest:* It should be stated if there is a conflict of interest.
- *Author Contributions:* Authors' contributions to the article should be stated. Contributions should be gathered under the headings of idea/concept, design, supervision/consulting, resources and funding, materials, data collection and/or processing, analysis and/or interpretation, literature review, article writing, critical review.
- *Explanations:* If the article has been presented in the form of an abstract and/or a conference proceeding before, information about the scientific meeting, place, and date of the presentation, and if published, the publication organ should be stated in the "Explanations" section.
- *Acknowledgement:* Information about individuals and/or organizations that do not meet the criteria for being an author but provided support during the research (reading the article, writing, technical support, language, and statistical support, etc.) should be stated in the "Acknowledgements" section as briefly and concisely as possible.

References

References should be placed after the main text. References should be numbered in the order of occurrence in the text, at the end of the sentence (before the point), with Arabic numerals, and in parentheses [Example: ..... it was found (21).]. The number of references should not exceed 40, and the use of references older than ten years should not exceed 15% of the total number of references. Unless necessary, the use of books, web pages, unpublished observations, and personal interviews as references should be avoided. If more than one reference is cited, a comma should be placed between them, and no spaces should be left before or after the comma. An example (3,7,15–19) can be given; "15–19" covers five publications from reference 15 to reference 19. If the article is in English, the references that the name will indicate in the text should be specified as "Author's name et al." (Example: Burtin et al.); if the text is in Turkish, the references that the name will indicate in the text should be specified as "Yazar adı ve diğ." (Example: Burtin ve diğ.).

Journal names should be presented in abbreviated form as in Index Medicus. All authors should be written if the number of authors is six or less in the standard journal. If the number of authors is more than 6, the first six authors should be written, and the other authors should be specified as "ve diğ." for Turkish articles and "et al." for English articles. Authors who will use programs such as Endnote, Mendeley should use the "VANCOUVER" style. The information that must be included in a reference given in Vancouver style is as follows:

- Author(s) name(s), - Article title, - Journal name (abbreviated as in Index Medicus), - Publication year, - Journal volume and issue, - Page range (Example:10-5).

Reference writing examples are as follows:

- *Article;* Burtin C, Saey D, Saglam M, Langer D, Gosselink R, Janssens W, et al. Effectiveness of exercise training in patients with COPD: the role of muscle fatigue. Eur Respir J. 2012;40(2):338-44.
- *Studies published as a supplement of the journal;* Hielkema T, Hadders Algra M. Motor and cognitive outcome after specific early lesions of the brain–a systematic review. Dev Med Child Neurol. 2016;58(Suppl 4):46-52.
- *Book;* Murtagh J. John Murtagh's general practice. 4th ed. Sydney: McGraw-Hill Australia Pty Ltd; 2007.
- *Book Section;* Cerulli G. Treatment of athletic injuries: what we have learned in 50 years. In: Doral MN, Tandogan RN, Mann G, Verdonk R, eds. Sports injuries. Prevention, diagnosis, treatment and rehabilitation. Berlin: Springer-Verlag; 2012: p. 15-9.
- *Congress Papers;* Callaghan MJ, Guney H, Bailey D, Reeves N, Kosolovska K, Maganaris K, et al. The effect of a patellar brace on patella position using weight bearing magnetic resonance imaging. 2014 World Congress of Osteoarthritis Research Society International, April 24-27, 2014, Paris. Osteoartr Cartilage; 2014;22(Suppl):S55.
- *Web page;* Diabetes Australia. Gestational diabetes [Internet]. Canberra (AU): Diabetes Australia; 2015 [updated 2015; cited 2017 Nov 23]. Available from: https://www.diabetesaustralia.com.au/gestational-diabetes.

Tables

Tables should be prepared in Microsoft Word file format, placed at the end of the article on separate pages, and numbered according to the order in which they occur in the main text. The total number of tables and figures should be at most 6. A short title should be written for each column heading in the tables. The first letter of each word in table columns must be capital. Table number and title should be at the top of the table; "table" should be written in bold, separated from the table title by (.) (Example: **Table 1.** Sociodemographic Characteristics of the Participants). Vertical lines should not be used in tables, and only horizontal lines should be used above and below the first line and below the last line of the table. The p values in the table should be indicated with *, **. Notes and explanations of abbreviations used in the table should be written at the bottom of the table. While writing the explanation of the abbreviations, the abbreviation should be written first, and the open version of the abbreviation should be written after the colon (:) sign. Abbreviations should be separated by commas. The units of the variables used in the table should be specified in parentheses. Units covering a certain range should be expressed numerically by the range segment. In decimal numbers given in tables, comma (,) in Turkish articles; point (.) in English articles should be used. In the decimal numbers given in the tables, two digits should be written after the comma or the point (Example: 31,12 or 20.10). Values other than a mean, percent, and median values (p, r, etc.) should be written as three digits after the comma/point (Please see the example table below).

Table 1. Knowledge Test Results of the Groups

Knowledge Test	Group TP (n=20)	Group SP (n=20)	Group TP-SP (n=20)	t	p§
Pre Test	60.50±13.17	69.05±14.11	67.14±14.54	0.002	0.051
Post Test	83.00±14.18	73.50±9.33	83.33±10.17	0.002	**0.001**

*p<0,05. §Kruskal Wallis Analysis. TP: Theoretical/practical course group, SP: Simulated patient group, TP-SP: Theoretical/practical course, and simulated patient group.

Figures

A list of figures should be placed on a page after the list of tables. The authors are expected to submit good quality figure(s) in JPEG, TIFF, or PNG versions as separate files. The photographs used in the manuscript should be clear. The photographs and figures should be numbered in the order in which they are referenced. If the manuscript involves humans, written consent of the participants should be collected, and precautions should be taken to disguise individuals' identities. The text of the consent form should be sent to the journal with the manuscript. It should be indicated in the first paragraph of the "METHOD" section that the written consent was collected from the participants.

Manuscript Submission

Two copies of the manuscript should be prepared for submission as Word files. One file must have all author details included, and the other must be anonymized. Both versions should include the title, abstract, body, and references. All institutions mentioned in the anonymous file (including the institution where the ethics committee approval was obtained) must be written as "X." Both copies will be uploaded (after registering as a user) in the DergiPark (http://dergipark.gov.tr/tjpr) system.

Peer Review Process: The editorial and publication process of the journal is shaped following the guidelines of the International Committee of Medical Journal Editors (ICMJE), World Association of Medical Journal Editors (WAME), Council of Science Editors (CSE), Committee on Publication Ethics (COPE), European Association of Science Editors (EASE), and National Information Standards Organization (NISO). The author(s) will be able to follow the evaluation process of the article from the DergiPark system (http://dergipark.gov.tr/tjpr). Manuscripts submitted to the journal will first go through a technical evaluation process where the editorial office staff will ensure that the manuscript has been prepared and submitted following the journal's guidelines. Submissions that do not conform to the journal's guidelines will be returned to the submitting author with technical correction requests. The articles will be evaluated by at least two external referees who are experts in the relevant field, and the referee reports will be sent to the corresponding author. If a revision is required, the author should respond to all referee comments and upload the revised version of the manuscript. This process will be repeated until the editorial board approves the manuscript.

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EDİTÖRDEN

Değerli Okurlarımız,

Türk Fizyoterapi ve Rehabilitasyon Dergisi'nin 2022 yılı Ağustos sayısında 12 araştırma makalesi ile karşınıza çıkıyoruz. Bu makalelerde pandemi sürecinde engeli olan çocukların fonksiyonelliği ve ebeveynlerin etkilenimi, kardiyopulmoner rehabilitasyon ve NMES'in kısa dönem etkileri, servikojenik baş ağrısında fizyoterapi ve Mulligan mobilizasyon tekniğinin karşılaştırılması, fizyoterapi ve rehabilitasyon bölümü öğrencilerinin online eğitim hakkındaki düşünceleri, antisipatuar postüral düzenleme üzerine işitsel ve görsel uyaranların etkileri, duyma bozukluğu olan çocuklarda ayakkabıların dengeye etkisi, kronik boyun ağrısının boyun farkındalığı ve diğer parametrelere etkisi, uyku bruksizmi olan miyofasyal temporomandibular disfonksiyon tanılı hastalarda tedavilerin karşılaştırması, karbon tabanlık kullanımının plantar basınç dağılımı üzerine etkileri, fiziksel engeli olan kişilerde sporun yaşam kalitesine etkisi, Parkinson hastalarının iş bırakma nedenleri ve abdominal bracing manevrasının farklı diz fleksiyon açılarında kas aktivasyonu üzerine etkisi incelenmiştir. Bu kıymetli çalışmalar ile fizyoterapi ve rehabilitasyon alanında güncel konuları sizlere sunmak bize editöryal ekip olarak kıvanç vermektedir.

Bilindiği gibi Türkiye Fizyoterapistler Derneği'nin resmi yayın organı olan Dergimiz, 1974 yılından itibaren aralıksız basılı ve elektronik dergi olarak yılda üç kez ulusal ve uluslararası bilim dünyasına katkılar sunmaktadır. Bunu gerçekleşmesinde gösterdikleri özen nedeniyle Derneğimiz Yönetim Kurulu'na ve Dernek üyesi olan tüm meslektaşlarımıza şükranlarımızı sunarız.

Ayrıca, bu sayıda yer alan makalelere kıymetli yorum ve önerileriyle katkı vererek dergimizi bilimsel olarak güçlendiren ve dergimiz aracılığıyla okurlara güncel bilimsel bilgiyi sunmada emeği geçen hakemlerimize editör grubu ve yazarlarımız olarak teşekkür ederiz.

Okuyucularımızın 8 Eylül Dünya Fizyoterapistler Gününü kutlar, 8-10 Eylül 2022 tarihlerinde Ankara'da ülkemizde mesleğimizin ilk tohumlarının atılmış olduğu Hacettepe Üniversitesi Fizik Tedavi ve Rehabilitasyon Fakültesi tarafından XVIII. Fizyoterapide Gelişmeler Kongresi'nin düzenleneceğini bildirmek isteriz. Bu önemli bilimsel toplantının ulusal ve uluslararası ortaklıkları artıracağını temenni ediyoruz.

Yayın Kurulu adına,

Saygılarımla

Prof. Dr. H. Serap İNAL

Baş Editör

EDITORIAL

Dear Readers,

We present you 12 research articles in the August 2022 issue of the Turkish Journal of Physiotherapy and Rehabilitation. In these articles, the functionality of children with disabilities and its effects on parents during the pandemic, the short-term effects of cardiopulmonary rehabilitation and NMES, the comparison of physiotherapy and Mulligan mobilization technique in cervicogenic headache, physiotherapy and rehabilitation students' thoughts about online education, the effects of auditory and visual stimuli on anticipatory postural regulation, the effect of shoes on balance in children with hearing impairment, the effect of chronic neck pain on neck awareness and other parameters, comparison of treatments in patients with sleep bruxism diagnosed with myofascial temporomandibular dysfunction, the effects of carbon insoles on plantar pressure distribution, the effect of sports on quality of life in people with physical disabilities, reasons for leaving work in Parkinson's patients and the effects of abdominal bracing manoeuvre on muscle activation at different knee flexion angles were investigated. As the editorial team, we are proud to present you current issues in physiotherapy and rehabilitation through these valuable studies.

As known, our Journal, which is the official publication organ of the Turkish Physiotherapists Association, has been contributing to the national and international scientific world three times a year as a printed and electronic journal since 1974. We would like to express our gratitude to the Board of Directors and members of our Association for the effort they have given to make this happen.

In addition, as the editorial group and the authors, we would like to thank to our referees who strengthened our journal scientifically by providing valuable comments and suggestions on the articles of this issue and ensured the delivery of up-to-date scientific information via our Journal to its readers.

We celebrate the 8th of September-World Physiotherapy Day of our readers and pleased to announce that the Congress of Advances in Physiotherapy, organized by Hacettepe University Faculty of Physical Therapy and Rehabilitation, where the first seeds of our profession were planted in Turkey, will be held in Ankara between 8-10 September 2022. We sincerely hope that this important scientific event will foster strong local and international partnerships.

On behalf of the Editorial Board,

Sincerely,

H. Serap İNAL, Prof, PT

Editor in Chief

ISSN:2651-4451 • e-ISSN: 2651-446X

İÇİNDEKİLER

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Turkish Journal of Physiotherapy and Rehabilitation

Türk Fizyoterapi ve Rehabilitasyon Dergisi

ARAŞTIRMA MAKALELERİ (ORIGINAL ARTICLES)

ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)13-22

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Received: *15.06.2021 (Geliş Tarihi)*
Accepted: *13.04.2022 (Kabul Tarihi)*

COMPARISON OF CONVENTIONAL PHYSICAL THERAPY AND MULLIGAN MOBILIZATION TECHNIQUE IN THE TREATMENT OF CERVICOGENIC HEADACHE

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this investigate the effectiveness of the conventional physical therapy and Mulligan mobilization technique in the treatment of Cervicogenic Headache (CH) and to compare the effectiveness of these two methods.

Methods: A total of 40 patients with CH were randomized into conventional physical therapy group (Group 1, n=20) and Mulligan mobilization group (Group 2, n=20). Neck lordosis, range of motion (ROM), Cervical Performance Tests, Visual Analogue Scale (VAS), Neck Disability Index, Beck Depression Scale measurements were recorded at baseline and at two weeks after the treatment.

Results: VAS, Neck Disability Index and Beck Depression Scale decreased and ROM, cervical performance and lordosis angle increased significantly in both groups (p=0.010).

Conclusions: Both treatments were found to have positive effects on radiological and clinical findings of CH, but Mulligan mobilization technique was found to be more effective in all evaluations except neck extension and right lateral flexion ROM measurements.

Keywords: Exercise Therapy, Headache, Musculoskeletal Manipulations, Neck Pain, Physical Therapy Modalities

SERVİKOJENİK BAŞ AĞRISI TEDAVİSİNDE KONVENSİYONEL FİZİK TEDAVİ İLE MULLIGAN MOBİLİZASYON TEKNİĞİNİN KARŞILAŞTIRILMASI

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı Servikojenik Baş Ağrısı (SBA) tedavisinde konvansiyonel fizik tedavi ve Mulligan mobilizasyon tekniğinin etkinliğini araştırmak ve bu iki yöntemin etkinliğini karşılaştırmaktır.

Yöntem: SBA'lı toplam 40 hasta konvansiyonel fizik tedavi grubu (Grup 1, n=20) ve Mulligan mobilizasyon grubu (Grup 2, n=20) olarak randomize edildi. Boyun lordoz açısı, eklem hareket açıklığı (EHA), Servikal Performans Testleri, Visuel Analog Skalası (VAS), Boyun Özür İndeksi, Beck Depresyon Ölçeği ölçümleri tedavi öncesi ve tedaviden iki hafta sonra kaydedildi.

Sonuçlar: Grup içi karşılaştırmada; VAS, Boyun Özür İndeksi ve Beck Depresyon Ölçeği her iki grupta da anlamlı olarak azaldı; EHA, servikal performans testleri, lordoz açısı ise anlamlı olarak arttı (p=0,010). Gruplar arası karşılaştırmada; servikal ekstansiyon ve sağ lateral fleksiyon hariç tüm boyun EHA değerleri grup 2'de servikal performans testi, boyun lordoz açısı daha fazla arttı. Ayrıca VAS, Boyun Özür İndeksi ve Beck Depresyon Ölçeği değerleri Grup 2'de daha fazla azaldı.

Tartışma: Her iki tedavinin de SBA'nın radyolojik ve klinik bulguları üzerinde olumlu etkileri olduğu ancak Mulligan mobilizasyon tekniğinin boyun ekstansiyon ile sağ lateral fleksiyon ROM ölçümü dışındaki tüm değerlendirmelerde daha etkili olduğu bulundu.

Anahtar Kelimeler: Egzersiz Tedavisi, Baş Ağrısı, Kas-İskelet Sistemi Manipülasyonları, Boyun Ağrısı, Fizik Tedavi Yöntemleri

INTRODUCTION

Cervicogenic headache (CH) is one of the common secondary headaches caused by the disorder of the neck region structures (1). The incidence of CH in chronic headaches is 15-20%. It is also known to affect 0.4-2.5% of the general population with females being four times more affected than men (2, 3). There may be a history of trauma as well as prolonged neck flexion or poor static postures in its etiology (3). Although the pathophysiology of CH is not fully explained, it is related to the connection between the nerves arising between the first three cervical vertebrae and the trigemineal nerve (2, 4). CH are thought to arise from musculoskeletal impairments. It is stated that these impairments originate from the joints, muscles, ligaments and other soft tissues in the neck. Some authors are supported atlantoocipital joint, atlantoaxial joint, C2-C3 zygapophysial joint, C2-C3 intervertebral disc, upper cervical spinal nerves and their roots, skeletal muscles and connective tissue in the region as a possible cause of impairment due to the etiology and pathophysiology of CH (3, 5). In the clinic of the disease, unilateral headache from the neck to the eye can be encountered, along with tenderness in the occipital region or upper back cervical muscles, decreased and painful cervical joint movement, and anxiety (6).

Treatments include invasive or non-invasive techniques (7). Physical therapy from noninvasive techniques is used for symptomatic treatment. Patients with CH can benefit from physical therapy techniques such as exercise, ultrasound (US), transcutaneous electrical nerve stimulation (TENS), manuel therapy (2, 6, 8). In patients with CH, joint mobility limitation, poor posture, muscle flexibility, muscle strength and endurance are evaluated and the exercise program is tailored to the patient's needs. In order to correct cervical retraction and to increase neck joint angle, early neck ROM exercises should be started in the early period. Afterwards, isometric neck exercises to increase neck muscle strength, and dynamic endurance training to reduce patient pain and increase function are applied. Also, sensorimotor exercise should include progressive exercises on the unsupported surface to improve postural and reflective stabilization. The last step in the rehabilitation program of patients with CH should be to improve functional activity (3, 9, 10). Hotpack, is a superficial warming agent, and US, warms the deep tissues, are effective in reducing pain (11, 12). TENS is transdermal electrical nerve stimulation to relieve pain and its role in pain reduction is explained by Gate Control Theory (13). The combination of Hotpack, US, TENS and exercises is a widely used treatment for neck pain and semptoms (12), but the effects of this combination have not yet been studied in CH. Mulligan mobilization technique in the treatment of CH which is a special form of manual therapy applied by trained physiotherapists is used to increase joint movement, pain relief, correction of biomechanics. Sustained Natural Apophyseal Glide (SNAG) technique and traction in the upper cervical region from Mulligan mobilization are important applications in the treatment of headache in reducing joint pain and increasing ROM. SNAG is the abbreviation for natural apophysial shifts in zygapophysial joint. Another technique is traction in the upper cervical region is a mild traction applied in extension to treat headaches caused by biomechanical problems. This methods effective on zygapophysial, atlantooccipitalis and atlantoaxialis joints (14).

CH is common in clinical practice seen and routinely treated, but limited research and experts lack of consensus by is one of the subjects (6, 15) and the effectiveness of its techniques has not yet been determined (3). To the best of our knowledge, there are only a few studies in the literature regarding the effectiveness of Mulligan mobilization technique in patients with CH (16-18). Two of these studies compared Mulligan mobilization with the placebo group (17, 18) while the other study compared it with another mobilization technique (16). However, there is no study on the effectiveness of only conventional physical therapy consisting of hot pack, US, TENS and exercise therapy. In addition, in these studies, the effectiveness of Mulligan mobilization was evaluated only with limited clinical measures of pain and functionality. Therefore, in this study, we investigated the effectiveness of the conventional physical therapy and Mulligan mobilization technique used in CH separately on clinical and radiological measurements of the cervical region and compared the effectiveness

of these two methods. The hypothesis of the study was that Mulligan mobilization was more effective than conventional physical therapy in patient with CH.

METHODS

Study design and recruitment of patients

This is a prospective, randomized controlled and pretest–posttest design study. Participants were randomized based on the generated random number for the order of arrival according to the simple randomisation method. The study was approved by Inonu University Malatya Clinical Research Ethics Committee (2016/200). The study was conducted in accordance with the principles of the Declaration of Helsinki and supported by Inonu University Scientific Research Projects Unit (2017/925). At the beginning of the study, patients were informed about the study and their written consent was obtained.

Patients diagnosed with CH by a doctor from Departments of Neurology in Malatya Training and Research Hospital, were screened for eligibility criteria from August 2017 and January 2018. The patients were treated in department of Physical Therapy and Rehabilitation in Malatya Training and Research Hospital. For patients to be eligible, they had to present with a diagnosis of CH according to the diagnostic criteria developed by the International Headache Society (19). Inclusion criteria were as follows: 18-70 years patients with neck pain and unilateral headache that begins and spreads in the neck frontotemporal area at least 5 times during the last 3 months, a minimum average pain intensity of 3 (0–10 scale), limited cervical ROM, tenderness in at least one of the joints of the upper cervical spine (C1-C3). Exclusion criteria were as follows: Specific disorders of the cervical spine, such as disc prolapse, spinal stenosis, post-operative conditions, history of severe trauma, instability, spasmodic torticollis, as well as peripheral nerve entrapment, fibromyalgia, inflammatory rheumatic diseases, severe psychiatric illness and and pregnancy. Patients with headache other than CH, surgery for CH, taking medication for headache, recent history of myocardial infarction, cardiac pacemaker, malignancy history, active infection, metal implant or prosthesis were also excluded.

40 participants (5 males, 35 females) aged 19-69 years with CH meeting these criteria were randomly selected and divided into two equal groups, Group 1 and Group 2, based on the order of arrival.

Outcome measures

At the beginning, demographic information of patients such as age, gender, body mass index (BMI), education, occupation and marital status were questioned. In addition, patients were evaluated from neck lordosis angle, ROM, Cervical Performance Test, VAS, Neck Disability Index and Beck Depression Scale Pre-treatment (PreT) and Post-treatment (PostT).

For neck lordosis angle, lateral radiographs were taken with Siemens Multix digital radiography device (Siemens AG Healthcare Sector, Erlangen, German). It was measured by Cobb method (20).

Neck ROM was measured using universal goniometer (Baseline Evaluation Instrument®, Fabrication Enterprises, Inc., White Plains, NY, ABD) using pivot, fixed arm and movable arm reference points determined according to Kendall-Mc Creary criteria (21).

Cervical muscle performance test, holding time in cervical flexion, extension right and left lateral flexion positions were measured with a chronometer. In the cervical flexion muscle performance test, the patient was instructed to raise the head and hold it while maintaining the chin tuck position. In the cervical extension muscle performance test, the patient was asked to raise the neck while in the prone position. In addition, in the cervical lateral flexion muscle performance test, the patient was asked to raise the neck while lying on the side. The patient rested between each test. All tests were repeated three times and the average of the tests was recorded. Based on the time the patient was able to hold the position, the assessment was as follows: 20-25 sec: functional, 10-19 sec: moderately functional, 1-9 sec: poor functionality, and 0 sec: non-functional. Evaluation of performance tests; 20-25 sec. movement functional, 10-19 sec. movement moderately functional, 1-9 sec. weakly functional, 0 sec dysfunctional (22).

VAS was evaluated in 3 ways as activity, rest and night. They were asked to score between 0-100

(22).

Neck Disability Index is a questionnaire developed to evaluate the functional impairment of neck pain. It consists of 10 parts: pain severity, personal care, load bearing, reading, headache, attention, work, driving, sleeping, and entertainment. There are 6 cases in each section; it is scored between 0-5 (0: best case, 5: worst case). The patient was asked to mark the most appropriate option. Rating is between 0-50. 0-4 points indicate that there is no insufficiency, 5-14 points mean mild insufficiency, 15-24 points mean moderate insufficiency, 25–34 points serious insufficiency and ≥35 points complete insufficiency. This was explained to the patients (22).

The mental state of the patients was evaluated with the Beck Depression Scale. The scale consists of 21 categories and each has four options. Each item has between 0 and 3 points. The total score ranges from 0 to 63 0-9 points are defined as minimal depressive symptoms, 10-16 points are defined as mild depressive symptoms, 17-29 points are defined as moderate depressive symptoms, 30-63 points are defined as severe depressive symptoms (22).

Interventions

Group 1 was applied conventional physical therapy techniques including Hotpack, US, TENS and exercise for 5 consecutive days for 2 weeks. 20 min Hotpack application (Chattanooga Medical Suplly Inc, Chattanooga, TN), 5 min right and 5 min left, US (Chattanooga Medical Suplly Inc, Chattanooga, TN) with 1-1.5 watts / cm^2 dosage was performed in trapezius muscle, upper cervical and occipitovertebral region, which is the most painful cervical region in a sitting position supported by a pillow. Conventional type TENS (Chattanooga Medical Suplly Inc, Chattanooga, TN) with a frequency of 50 Hz and a current transition time of 100 µs was applied to the neck area. Immediately after physical therapy agents, 10 repetitions all-round neck ROM and isometric exercises were performed.

In Group 2 was applied only Mulligan mobilization tecniques including SNAG and traction in the upper cervical region every other day for 3 days for 2 weeks. SNAG technique was performed with the patient sitting upright in a chair. The physiotherapist stabilized the occiput with the index, middle, and ring fingers of one hand while placing the little finger on the C2 spinous process. After placing the hands in this way, the head forearm stabilized by the support and gently push the spinosus process ventrally with the other hand. With this maneuver, C2 slides forward under C1, and therefore C1 moves forward relative to the skull (Figure 1). Upper cervical traction was performed with patient laying supine with the neck in a neutral posture. The physiotherapist placed the proximal part of his forearm under the cervical spine so that the radial border was tucked under the base of the occipital bone. The fingers of the other hand were placed over the patient's chin. The therapist applied traction through pronating the forearm and simultaneously imposed pressure over the chin to provide a translator component so that it was a combination of translation and rotation of the forearm. The force applied to the occiput and chin was equal (Figure 1). Physiotherapist made the movements for 10 seconds in each glide with a rest time of 30 seconds in between and 10 repetitions.

Figure 1. Mulligan mobilization tecniques

(A: SNAG, B: Traction in the upper cervical region)

Statistical Analysis

Statistical analysis was performed with IBM SPSS Statistics version 22.0 statistic package. The minimum required sample size for the study was calculated using G*Power Software (Version 3.0.10 University of Dusseldorf, Germany). The smallest sample size with 0.80 effect size, 5% type I error, 80% statistical power conditions was calculated at least 10 patients in each group. However, in order to increase the power of the research, a treatment group of 20 and

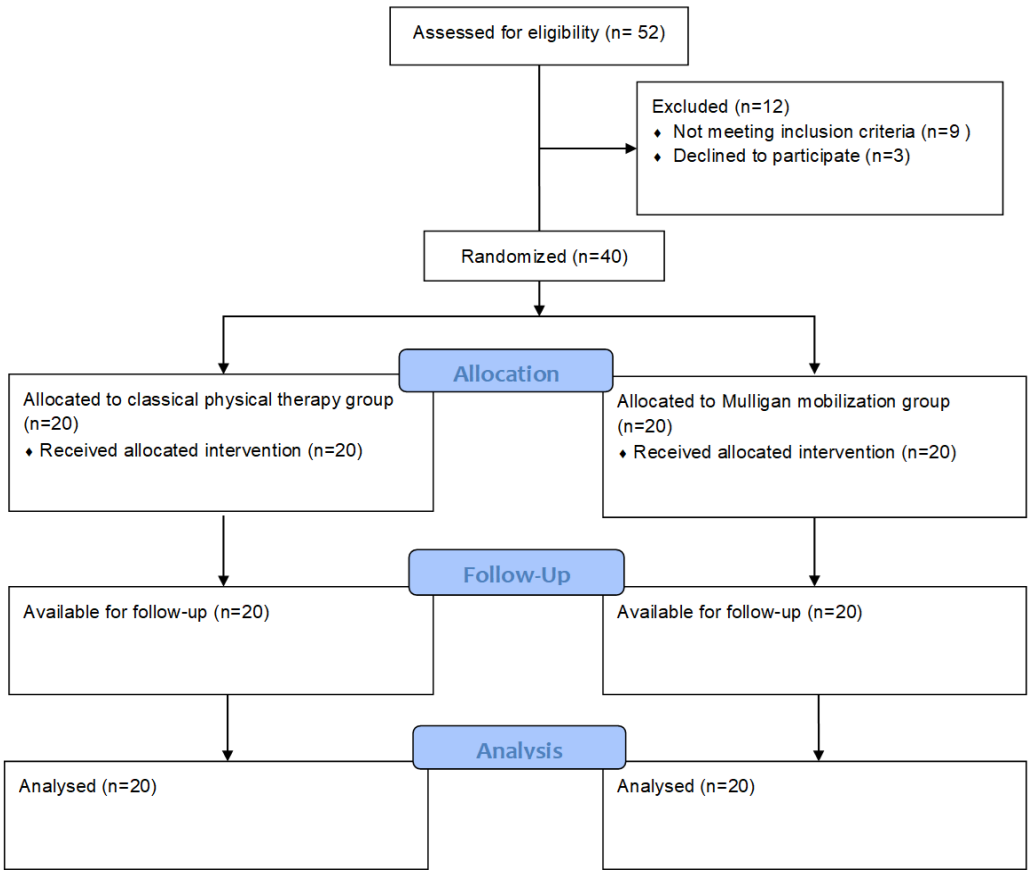

Figure 2. Flow diagram of the study

Table 1. Demographic Distribution of Patients

		Group 1	Group 2	P
Gender	Female	17 (85%)	18 (90%)	0.999
	Male	3 (15%)	2 (10%)	
Age, years		51 (19-69)	40 (23-64)	0.159
BMI, kg/m²		28 (21-34)	26 (21-32)	0.150
Working Condition	Working	3 (30%)	7 (70%)	0.518
	Retired	1 (50%)	1 (50%)	
	Houswife	13 (54.2%)	11 (45.8%)	
	Student	3 (75%)	1 (25%)	

a control group of 20 were randomly selected among 40 patients based on volunteering.

Normality distribution for all continuous variables was evaluated with the Shapiro-Wilk test. It was found that the data were not normally distributed. In the statistical evaluation of this study, the data were summarized by number % (percentage) or median (min-max). Mann Whitney-U Test was used to compare two independent groups in terms of quantitative variables. Wilcoxon Test was used to compare pre-test and post-test evaluations. p <0.05 was considered statistically significant.

RESULTS

A total of 52 patient were eligible to participate in the study. However, 12 patient refused to paticipate to the study were then excluded, thus totaling a sample of 40 patient with CH (Figure 2).

Demographic Findings

There was no significant difference between

groups in terms of gender distribution, mean age, BMI, occupational distribution (Table 1).

Clinical and Radiological Findings

When both groups were evaluated for VAS, the decrease in pain symptoms was more prominent in Group 2 with Mulligan mobilization. Neck extension and right lateral flexion were equally increased in both groups. Neck flexion, left lateral flexion and right-left rotation values were higher in Group 2. The increase in the measurement of cervical performance tests in both groups was found to be more prominent in Group 2 (Figure 3).

The decrease in Neck Disability Index and Beck Depression Scale measurement in both groups were found to be more significant in Group 2. When the increase in neck lordosis angle was compared in both groups, a more significant increase was observed in Group 2 (Figure 4).

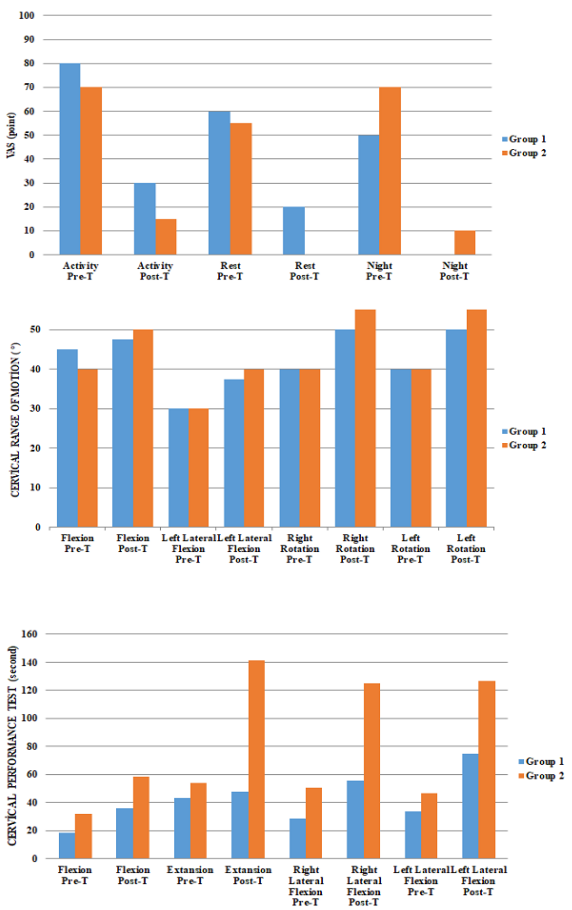

Figure 3. Comparison of VAS, cervical ROM and performance tests in Pre-treatment (Pre-T) and Post-treatment (Post-T) of Group 1 and Group 2 separately

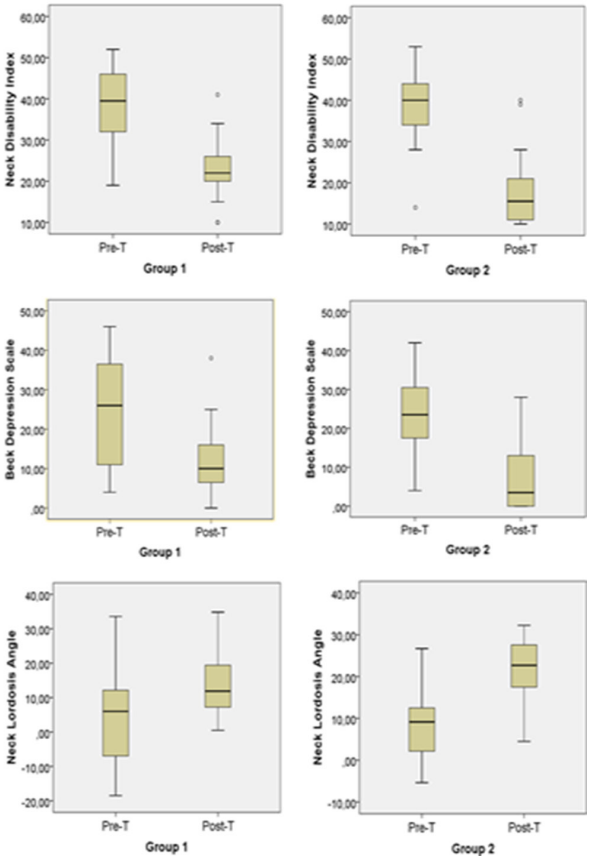

Figure 4. Group 1 and 2; Comparison of Neck Disability Index, Beck Depression Scale, Neck Lordosis Angle separately in Pre-treatment (Pre-T) and Post-treatment (Post-T)

DISCUSSION

The aim of this study is to investigate the effectiveness of the conventional physical therapy and Mulligan mobilization technique used in the treatment of CH separately on clinical and radiological measurements of the cervical region and compared the effectiveness of these two methods. We concluded that VAS, ROM, cervical performance test, neck lordosis angle, Neck Disability Index and Beck Depression Scale were significantly effective in both groups. In addition, Mulligan mobilization significantly improved VAS, neck lordosis angle, Neck Disability Index and Beck Depression Scale. The result shows that both treatments are scientifically suitable for CH, but Mulligan mobilization technique is more effective.

CH accounts for 15-20% of headaches that affect approximately 50% of the population (2). Racicki (3), reported that CH occurs in all age groups and is more common in women. In our

sample, which made up our study, Racicki's study supports the fact that the number of female patients was higher than the number of male patients. In addition, the age range of the patients in our study was from a young patient of 16 years old to an elderly patient of 70 years old.

CH with a complex pathophysiology includes nociceptive, neuropathic, referred pain. This pain associated with trigeminal afferent and efferent impulses from the upper cervical nerves of the nucleus trigeminocervicalis (23). Bronford (24) attributed the effect of manual therapy and exercise in CH to the relationship between the sensitization of the trigeminocervical nucleus and the activation of descending inhibitory pathways. Due to the predominance of peripheral input in the upper cervical region in CH, mobilizations of this region are recommended. Upper cervical traction in Khalil (25) study and SNAG application in Hall (18) and Shin (17) studies showed positive effects on pain. In addition, among the studies on exercise, McDonnell (26) found that spinal stabilization with lower abdominal and upper cervical flexion, shoulder flexion for the latissimus dorsi muscle, shoulder abduction and lateral flexion exercises for the pectoralis major/minor muscle were effective in pain in CH. In our study, we recorded improvement in pain in patients who applied SNAG and upper cervical traction from Mulligan mobilization, as did Khalil, Hall and Shin. In addition, we noted that the conventional physiotherapy consisting of hotpack, US, TENS and isometric-ROM exercise, which was recommended but no study on this subject in the literature, was effective in relieving pain, but Mulligan mobilization was better. Because of this result, we think that the use of Mulligan mobilization, which is non-invasive and has immediately hypoalgesia effect, is highly probable that it is due to a non-opioid mechanism of action, should be encouraged in the clinic, based on the therapist's assessment, findings and clinical judgment.

ROM is valuable in the diagnosis and evaluation of many diseases (27). The limitation in the range of motion of the cervical spine, which distinguishes CH from other headaches, is considered a reasonable biological marker for the diagnosis of CH, although its reliability and validity have not been confirmed in larger studies (28). Zito (29) emphasized that the musculoskeletal disorder in CH is mainly related to joint dysfunction and limited joint movement accompanied by pain. Khalil (25) improved neck rotation with upper cervical traction, while Hall (18) improved neck rotation with SNAG application. Jull (9) recorded improvement in all neck joint movements with low-dose endurance exercises in the cervicoscapular region. In our study, an improvement was observed in the range of motion of the joint in the group that was applied hotpack, US, and TENS in addition to isometric-ROM exercises. However, better improvement was noted in the Mulligan mobilization group in neck flexion, left lateral flexion, and right rotation. Based on the importance of rotational tests in the evaluation of CH, it can be said that Mulligan mobilization is a more acceptable treatment for CH, especially with excessive increase in rotational movements.

When cervical region muscles are evaluated in patients with neck pain, it has been shown in many studies that there is a relationship between pain and insufficient endurance (30, 31). In fact, an electromyographic study emphasized the importance of early fatigue finding due to the decrease in the endurance of the muscle rather than its strength (32). In CH with neck pain, we have not encountered any study in the literature on cervical performance testing. In our study, it was noted that there was an increase in both the Mulligan mobilization group and the conventional physiotherapy group in the neck flexion, extension, right and left lateral flexion performance test, which we performed to evaluate the functionality due to muscle performance. In this sense, we contributed to the literature by showing the effect of Mulligan mobilization and conventional physiotherapy in CH.

The International Headache Society emphasized that one finding of radiographic evaluation in CH is the change in cervical lordosis, which shows abnormal posture. Zito said in his study that changes in cervical lordosis and anterior position of the head were associated with neck-related headaches (29). Fortner (33) reported in the case report that reduction in cervical lordosis or kyphosis in CH may be biomechanical markers and that neck traction combined with cervical extension exercise is effective in gaining the normal lordosis angle. In our study, we eval-

uated neck lordosis with Cobb angle in CH, and we found that lordosis decreased and even went into kyphotic posture in these patients. This finding supports Zito and Fortner. We think that the musculoskeletal structures affected in the neck region also cause deterioration in the basic biomechanical balance, and abnormal changes in the neck lordosis cause neck pain and headache. In addition, in our study, similar to Fortner's approach, an improvement was observed in lordosis in both the conventional physical therapy group including head extension exercise and the Mulligan mobilization group containing traction, but this improvement was better in the Mulligan group.

Although there is a relationship between neck pain severity and neck disability, these two parameters should be considered and measured separately because pain affects each individual differently. In CH with neck pain-induced headache, Dunning (34) used a Neck Disability Indeks in a study comparing upper cervical-thoracic manipulation and C1-C2/T1-T2 mobilization+craniocervical flexion exercise. While it was almost 19 points before the treatment in both groups, it decreased to 11 points in the manipulation group and 6 points in the mobilization+exercise group after 4 weeks of treatment, improving disability. Khalil (25) noted that CD decreased from 46 points to 25 points after treatment in the Mulligan group where he applied upper cervical traction. In another study by Adham (35), Mulligan, using the SNAG technique from mobilization, recorded a 67% change in NDI with a 20 point decrease from 30 points. In our study, while neck disability was 40 points in both groups at the beginning of the treatment, it decreased above 20 points in the conventional physiotherapy group and below 20 points in the Mulligan mobilization group after the treatment. We think that this improvement in the Mulligan group is due to the greater increase in pain and joint range of motion compared to the conventional group.

Pourahmadi (36) stated that the patient's muscle endurance was reflected in his functionality and quality of life, and therefore led to depressive symptoms. In addition, it is stated in some sources that it is not clear whether the pain precedes the depression, occurs after the depression, or is a comorbid condition. However, while depression may be the result, not the cause, of such headaches, it is thought that depression and such headaches may have a common biological basis. It is known that the prevalence of depression in chronic headache is over 50%. The effect of botulinum toxin type A treatment on depression in CH by Karatas (37) et al. was evaluated with the Beck Depression Scale. Treatment has been shown to reduce depression in CH. There is no study in the literature on the effects of conventional treatment and Mulligan mobilization on depression in CH. In our study, both treatments were found to be effective on the level of depression, while Mulligan mobilization was noted to be more effective in treatment in this sense. We think that the reason why this improvement is more significant in Mulligan mobilization is due to the better improvement in pain and functionality in this group.

Evidence today has shown that CH is a multidimensional musculoskeletal disease, but it is controversial in its therapeutic applications (3, 34). Although Racicki (3) reports that methods such as conventional physical therapy and manuel therapy are recommended, there are few studies in the literature regarding the effectiveness of Mulligan mobilization technique in patients (16-18). There are no specific studies on conventional therapy, which is routinely called combined Hotpack, US, TENS, and exercise, in the treatment of musculoskeletal patients. Only Farina et al. (38) on TENS, Ylien (10) on neck isometric, stretching and endurance exercises, McDonnell (26) on neck, scapulothoracic and lumbar exercises, Jull (9) on isometric craniocervical flexion, scapular retraction and stretching exercises in CH emphasized its impact. In addition to all these exercises, they also stated the importance of neck ROM and isometric exercises in the early period to correct cervical retraction and increase neck joint angle. In this study, in accordance with the literature, Mulligan mobilization technique was applied to one group and conventional physical therapy consisting of only hotpack, US, TENS and isomeric-ROM exercises was applied to the other group. Although it was effective in both groups in the treatment of CH, Mulligan mobilization was more effective. However, we think that more studies are needed in the literature on this subject.

The limitations of this study can be summarized as the fact that the treatments were in the wide age range of the study sample, the long-term effects of the study were not investigated, and the home program was not given to the groups. Our study evaluated the efficacy of conventional physical therapy and only Mulligan mobilization for each group and compared the effectiveness of these two methods in CH. We think that further studies should be conducted with in different age groups, longer follow-up periods by giving home programs in order to increase the effectiveness of treatment.

Sources of Support: The study was supported by the Scientific Research Projects Unit of Inonu University (2017/925).

Conflict of Interest: Authors declare that there is no conflict of interest.

Author Contributions: Concept – Research consists of MAD's doctoral thesis; Design – MAD, EK; Supervision – EK, DO; Resources and Financial Support – MAD, EK, ME; Materials – ME, DY; Data Collection and/or Processing – MAD, DY, SO; Analysis and/or Interpretation – MAD, EK, ME, DY; Literature Research – MAD, ME, DY; Writing Manuscript – MAD, SO; Critical Review – EK, DO.

Explanations: None.

Acknowledgements: The study was performed in Malatya Training and Research Hospital in Malatya, Turkey.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)23-31

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Received: *09.06.2021 (Geliş Tarihi)*
Accepted: *09.08.2022 (Kabul Tarihi)*

COVİD-19 PANDEMİ SÜRECİNDE ENGELLİ ÇOCUKLARIN FONKSİYONELLİĞİ İLE EBEVEYNLERİN ETKİLENİMLERİ ARASINDAKİ İLİŞKİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı Covid-19 pandemi sürecinde engelli çocukların fonksiyonelliği ile ebeveynlerin etkilenimleri arasındaki ilişkiyi araştırmaktı.

Yöntem: Çalışmaya 4-12 yaş arasında 84 engelli çocuk ve 84 anne olmak üzere toplam 168 kişi dahil edildi. Engelli çocuklar için Pediatrik Özürlülük Değerlendirmesi Envanteri (PÖDE) ve Kaba Motor Fonksiyon Sınıflandırma Sistemi (KMFSS) kullanıldı. Annelere Zarit Bakım Verme Yükü Ölçeği (ZBVYÖ), Yorgunluk Şiddet Ölçeği (YŞÖ) ve kas-iskelet sistemi rahatsızlıklarını sorgulamak için İskandinav Kas İskelet Sistemi Sorgusu (İKİSS) uygulandı.

Sonuçlar: Bakım yükü puanı ile PÖDE toplam puanı, kendine bakım ve mobilite puanları arasında herhangi bir ilişki görülmedi (p>0,05). Bakım yükü puanı ile sosyal fonksiyon puanı arasında ise orta düzeyde negatif yönde (r=-0,306; p<0,01) anlamlı doğrusal bir ilişki olduğu saptandı. Yorgunluk şiddet puanı ile PÖDE toplam puanı, kendine bakım, mobilite ve sosyal fonksiyon puanları arasında anlamlı doğrusal bir ilişki olmadığı bulundu (p>0,05). Bakım yükü puanı ile yorgunluk şiddet puanı arasında ilişki tespit edilmedi (p>0,05). Ebeveynlerin son 12 ay süresince sadece bel bölgesindeki ağrı olağan işlerini yapmayı engelledi. Son 12 ay süresince kas iskelet sistemi ağrısından yakınan ebeveynlerde en çok ağrıyan vücut bölümleri bel, boyun, omuz, sırt, diz bölgesinde olduğu tespit edildi.

Tartışma: Covid-19 pandemi sürecinde engelli çocukların fonksiyonelliği ile ebeveynlerinin etkilenimleri arasında bir ilişki olmadığı bulundu.

Anahtar Kelimeler: Ebeveyn Etkilenimi, Fonksiyonel Düzey, Özel Gereksinimli Çocuklar, Pandemi, Yorgunluk

THE RELATIONSHIP BETWEEN THE FUNCTIONALITY OF CHILDREN WITH DISABILITIES AND ITS EFFECTS ON PARENTS DURING THE COVID-19 PANDEMIC PROCESS

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this study was to investigate the relationship between the functionality of disabled children and its effects on parents during the Covid-19 pandemic.

Methods: A total of 168 people, including 84 disabled children and 84 mothers, were included in the study. The Pediatric Disability Assessment Inventory (PEDI) and Gross Motor Function Classification System (GMFCS) were used for children with disabilities. The Zarit Burden Scale (ZBS), Fatigue Severity Scale (FSS) and The Nordic Musculoskeletal Questionnaire (NMQ) were applied to the mothers to question musculoskeletal disorders.

Results: There was no correlation between care burden score and PEDI, total score, self-care and mobility scores (p>0.05). A moderately negative (r=-0.306; p<0.01) significant linear relationship was found between care burden score and social function score. There was no significant linear relationship between the fatigue severity score and PEDI total score, self-care, mobility and social function scores (p>0.05). No correlation was found between care burden score and fatigue severity score (p>0.05). For the last 12 months, only the pain in the lumbar region of the parents prevented them from doing their usual work. It was determined that the most aching body parts of the parents who complained of musculoskeletal pain during the last 12 months were in the waist, neck, shoulder, back, and knee regions.

Conclusion: As a result, no relationship was found between the functionality of disabled children and their parents' influences during the Covid-19 pandemic.

Keywords: Impact on Families, Functional Level, Children with Special Needs, Pandemic, Fatigue

GİRİŞ

Covid-19 pandemi süreci, engelli çocuklar ve ebeveynlerinin normalde deneyimlemekte zorlandıkları durumlara yenilerinin eklenmesiyle sürecin daha da zorlaşmasına neden olmuştur (1). Salgın tüm insanlığı etkilemiş fakat engelli bireylerin etkilenimleri çok daha fazla olmuştur (2). Pandemi boyunca evde kalmanın zorunlu tutulması, anne ve babaların ebeveynlik rolünün değişmesinin yanı sıra psikolojik ve fiziksel sağlıkları üzerinde de negatif etkilerin yaşanmasına neden olabileceği belirtilmiştir (3).

Engelli çocukların tedavilerinin sekteye uğraması, uzun vadede olumsuz sonuçlara sebep olabilmektedir. Serebral palsili (SP) çocuklarda düzenli olarak uygulanan fizyoterapi ve rehabilitasyon programının kısa süreli olarak durması, kalça displazisi gibi komplikasyonların oluşmasına sebep olabilmekte ve fonksiyonel becerilerini yerine getirmelerini olumsuz yönde etkileyebilmektedir (4). Alışılagelmiş düzene ihtiyaç duyan zihinsel yetersizliği ve yaygın gelişimsel bozukluğu olan çocuklar için günlük programlarının değişmesi öfke nöbeti geçirmelerine sebep olabilmekte ayrıca çeşitli davranışsal problemlerin gelişmesine, değişikliklere karşı aşırı tepki verme, oluşan yeni değişimlere ayak uyduramama gibi durumlara yol açabilmektedir (5,6).

SP'li çocuklarda ortaya çıkan motor gelişim geriliği, mobilite güçlükleri, epilepsi nöbetleri, görme ve işitme problemleri, dil ve konuşma bozuklukları, öğrenme güçlükleri, zihinsel problemler, çocukların günlük yaşam aktivitelerindeki bağımsızlığı ve fonksiyonel bağımsızlık düzeyini olumsuz şekilde etkilemektedir (7). Mental retardasyonlu (MR) çocukların, sosyal gelişimlerindeki yetersizliklerden dolayı, fiziksel aktivite katılımlarının zayıf olduğu ya da aktivitelere katılmakta güçlük çektikleri ve bu durumdan kaynaklı çocukların motor performans düzeylerinin olumsuz yönde etkilediği belirtilmektedir (8).

Otizm spektrum bozukluğu (OSB) tanısı alan bireylerin de günlük yaşam aktivitelerini gerçekleştirme sırasında daha fazla ipucuna gereksinim duydukları, günlük yaşam becerilerini genellemede sıkıntı yaşadıkları için bu becerileri ev dışı ortamlarda uygun olarak sergileyemedikleri tespit edilmiştir (9).

Engelli çocuklar bedensel ve zihinsel gelişimlerindeki yetersizliklerinden dolayı anne ve babalarına bağımlı şekilde yaşamaktadırlar. Engelli çocuğa bakım verme, çocuğun transferi, rehabilitasyonu sırasında, ebeveynler uyku düzensizliği yaşamakta ve ekstra güç sarf etmektedirler. Engelli çocuğun bakımı, ebeveynler için zor ve uzun bir süreçtir. Bu süreçte ebeveynler çocuklarının bakım ve rehabilitasyonunda aktif rol oynarken çok fazla ayakta kaldıkları için fiziksel sağlıkları kötü etkilenmekte ve genellikle kas iskelet sisteminde ağrılar görülmektedir (10,11).

Covid-19 salgınının yaygın olduğu süreçte, engelli çocukların fonksiyonelliklerinin, ebeveynlerde bakım yükü, yorgunluk ve kas iskelet sistemi etkilenimi üzerine etkisini değerlendirmek ve çocukların fonksiyonelliğinin ebeveynlerdeki bakım yükü ve yorgunluk ile ilişkisini incelemekti.

YÖNTEM

Çalışmada analitik kesitsel çalışma tasarımı kullanıldı. Çalışmanın yapılması için Başkent Üniversitesi Tıp ve Sağlık Bilimleri Araştırma ve Etik Kurulu tarafından (Onay Tarihi:17.03.2021 ve Proje no: KA21/79) onay alındı (Ek 2) ve Başkent Üniversitesi Araştırma Fonunca desteklendi. Çalışmaya başlamadan önce G*Power yazılım programı (G*Power Ver. 3.0.10, Universitat Düsseldorf, Düsseldorf Almanya) ile güç analizi yapıldı. Yapılan güç analizi sonucunda, %85 güç ve %5 yanılma payı ile örneklem büyüklüğü 61 çocuk 61 ebeveyn, toplamda 122 kişi olarak bulundu. Çalışmayı bırakma riski ve çalışmanın gücünü arttırmak amacı ile 84 çocuk ve 84 anne toplam 168 kişi çalışmaya dahil edildi (Şekil 3.1.). Araştırma Covid-19 pandemi sürecinde Ankara ili Yaman Şirinler Özel Eğitim ve Rehabilitasyon merkezlerinde eğitim ve tedavilerine devam eden engelli çocuklar ve ebeveynleri üzerinde gerçekleştirildi.

Uygulama öncesinde çalışmaya katılmaya gönüllü annelere anket formları hakkında bilgilendirme yapıldı ve onay alındı. Anketler yüz yüze olacak şekilde araştırmacı tarafından yapıldı. Ebeveynler kendi anketlerinin yanı sıra çocukların anketinde de katılımcı oldu. Anne ve çocukların sosyodemografik bilgileri kaydedildi.

Özel eğitime devam etmekte olan, sağlık kurul raporu ve Rehberlik Araştırma Merkezi (RAM) ra-

porunda serebral palsi, yaygın gelişimsel bozukluk, hafif mental retardasyon tanısı almış olan 4-12 yaş arası çocuklar ve bu çocukların ebeveynleri, SP'li çocuklar için KMFSS seviyesi I-II olan ve bu çocukların ebeveynleri, tek engelli çocuğa sahip olan ve engelli çocuğun asıl bakımını üstlenen ebeveynler dahil edildi. Anne ve babadan herhangi birinin yaşamını yitirdiği, anne ve babanın ayrı yaşadığı durumlarda, çocuk ve ebeveyni çalışma dışı bırakıldı.

Kaba Motor Fonksiyon Sınıflandırma Sistemi (KMFSS)

SP'li çocukların kaba motor fonksiyonlarının değerlendirilmesinde Kaba Motor Fonksiyon Sınıflandırma Sistemi (KMFSS) kullanıldı. Seviyeler şu şekilde belirtilmektedir;

Seviye I: Kısıtlama olmaksızın yürür.

Seviye II: Kısıtlamalarla yürür.

Seviye III: Elle tutulan harekete yardımcı araç ve gereçleri kullanarak yürür.

Seviye IV: Kendi kendine hareket sınırlanmıştır. Motorlu hareketlilik aracını kullanabilir.

Seviye V: Elle itilen bir tekerlekli sandalyede taşınır.

KMFSS'nin genişletilmiş Türkçe versiyonu El ve ark. tarafından yapılmıştır (12).

Pediatrik Özürlülük Değerlendirme Envanteri (PÖDE)

Engelli çocukların fonksiyonel yeteneği ve performansını değerlendirmek için Pediatrik Özürlülük Değerlendirmesi Envanteri (PÖDE) kullanıldı. Fonksiyonel beceriler, bakıcıların yardımı ve modifikasyonlar olmak üzere üç bölüm den oluşmaktadır. Maddelerden 0 yapamaz, 1 yapabilir olarak puanlandırılıp toplam skor elde edilerek değerlendirilmektedir. Erkin ve ark. tarafından Türkçe geçerlilik ve güvenirlilik çalışması gerçekleştirilmiştir (13). Çalışmamızda pediatrik özürlülük değerlendirme ölçeğinin güvenirlik katsayısı olan cronbach alfa (α) değeri 0,947 olarak bulundu.

Bakım Verme Yükü Ölçeği (BVYÖ)

Bakım yükünü değerlendirmede Bakım Verme Yükü Ölçeği (BVYÖ) kullanıldı. Bakım Verme Yükü Ölçeği 22 maddelik, 0'dan 4'e kadar değişen (0=asla, 1=nadiren, 2=bazen, 3=sık sık, 4=hemen her zaman) likert tipte bir ölçektir. Geçerlik ve güvenirliği İnci tarafından yapılmıştır (14). Çalışmamızda bakım verme yükü ölçeğinin güvenirlik katsayısı olan cronbach alfa (α) değeri 0,913 olarak bulundu.

Yorgunluk Şiddet Ölçeği (YŞÖ)

Ebeveynlerde yorgunluk değerlendirmesi için Yorgunluk Şiddet Ölçeği uygulandı. Toplamda 9 maddeden oluşan bu ölçekte tüm maddeler için verilen puanların toplamıyla elde edilen skora göre yorgunluk düzeyi belirlenir. Bu ölçeğin Türkçe geçerlik ve güvenirlik çalışması Armutlu ve ark. tarafından yapılmıştır (15). Çalışmamızda yorgunluk şiddet ölçeğinin güvenirlik katsayısı olan cronbach alfa (α) değeri 0,825 olarak bulundu.

İskandinav Kas İskelet Sistemi Sorgusu (İKİSS)

Ebeveynlerin kas-iskelet sistemi değerlendirmesi için İskandinav Kas İskelet Sistemi Sorgusu kullanıldı. İKİSS'de amaç; standardize edilmiş sorularla dokuz bölge olan ayaklar-ayak bilekleri, dizler, uyluklar-kalçalar, bilekler-eller, bel, dirsekler, sırt, omuzlar, boyun değerlendirmesi ile kas iskelet şikayetlerinin tespit edilmesidir. Türkçe geçerlilik ve güvenilirlik çalışması Kahraman ve ark. tarafından yapılmıştır (16).

İstatiksel Analiz

Çalışma verileri IBM SPSS Statistics 26 (IBM SPSS Statistics for Windows, Version 26; Armonk,NY) programına aktarılarak analizler tamamlandı. Veriler değerlendirilirken kategorik değişkenler için frekans dağılımları, sayısal değişkenler için tanımlayıcı istatistikler (ort±ss) verildi. Uygulanacak analizlere karar verebilmek için öncelikle tüm puanlara normal dağılım varsayımı için Kolmogorow Smirnov Testi (n>50) uygulandı. Test sonucunda ölçek ve alt boyut puanlarının normal dağılım varsayımını sağladığı görüldü ve bu nedenle karşılaştırmalarında parametrik testler kullanıldı. Sayısal iki değişken arasında nedensel olmayan ilişkilerin derecesinin belirlenmesi için Pearson Korelasyon Katsayısı kullanıldı. Çalışmanın gücü G*Power 3.1.9.2 paket programı ile hesaplandı. Çalışma sonrası hesaplanan güç analizi sonucuna göre 0,05 anlamlılık düzeyi ve 0,396 etki büyüklüğünde çalışmanın gücü %90 olarak bulundu.

SONUÇLAR

Ebeveynlerin Tablo 1'de ve çocukların Tablo 2'de demografik özelliklerinin dağılımları verildi. Araştırmaya katılan ebeveynlerin %31'i 25-34 yaş aralığında, %26,2'si 35-39 yaş aralığında, %42,9'u ise 40 yaş ve üstündeydi. Ebeveynlerin %89,3'ü çalışmamakta, %10,7'si çalışmaktaydı. Ebeveynlerin %22,6'sı çocuğunun bakımına 0-6 saat ayırmakta, %28,6'sı 6-12 saat, %48,8'i ise 12 ve üstünde saat ayırmaktaydı. Ebeveynlerin %23,8'i çocuğunun bakımı için destek almakta, %76,2'si ise destek almamaktaydı. Araştırmaya katılan çocukların %31'i kız, %69'u ise erkek idi. Çocukların %51,2'si 7 yaş ve altında, %48,8'i ise 8 yaş ve üstündeydi. Çocukların %33,3'ü atipik otizmli, %33,3'ü hafif düzey mental retardayonlu, %33,3'ü ise serebral palsiydi.

İskandinav kas iskelet sistemi sorgusunun dağılımları Tablo 3' de yer almaktadır. Araştırmaya katılan ebeveynlerin çoğunluğu son 12 ay süresince boyun (%58,3), omuz (%54,8), sırt (%65,5), bel (%77,4) ve diz (%50,0) bölgelerinde ağrı, acı,

Tablo 1. Ebeveynlerin Demografik Özelliklerinin Dağılımları.

	Kişi Sayısı (n=84)	Yüzde (%)
Yaş Grubu (Ort±SS)	37,85±6,140	
25-34 yaş	26	31,0
35-39 yaş	22	26,2
40 yaş ve üstü	36	42,9
Boy, cm (Ort±SS)	1,64±0,061	
Kilo, kg (Ort±SS)	71,87±11,874	
BKİ, kg/ m² (Ort±SS)	26,93±4,871	
Zayıf	3	3,6
Normal	27	32,1
Fazla Kilolu	35	41,7
Obez	15	17,9
Aşırı Obez	4	4,8
Meslek		
Çalışmıyor	75	89,3
Çalışıyor	9	10,7
Eğitim Durumu		
İlkokul	19	22,6
Ortaokul	16	19,0
Lise	36	42,9
Üniversite	13	15,5
Medeni Durum		
Bekar	0	0,0
Evli	84	100,0
Sahip Olunan Çocuk Sayısı		
1	17	20,2
2	40	47,6
3 ve üzeri	27	32,1
Engelli Olan Çocuk		
1.	36	42,9
2.	23	27,4
3.	18	21,4
4.	2	2,4
İkiz	5	6,0
Çocuğun Bakımına Ayrılan Zaman		
0-6 saat	19	22,6
6-12 saat	24	28,6
12 saat ve üstü	41	48,8

Tablo 1. (Devamı)

	Kişi Sayısı (n=84)	Yüzde (%)
Çocuğun Bakımı İçin Destek Alma Durumu		
Evet	20	23,8
Hayır	64	76,2
Çocuğun Bakımı İçin Yardım Eden Birisinin Olma Durumu		
Var	33	39,3
Yok	51	60,7
Var ise Kim;		
Baba	22	66,7
Anneanne-Dede	7	21,2
Babaanne-Dede	3	9,1
Abla	1	3,0
Kronik Hastalık Olma Durumu		
Var	20	23,8
Yok	64	76,2
Covid-19 Hastalığı Geçirme Durumu		
Evet	12	14,3
Hayır	72	85,7

Ort: Ortalama. SS: Standart Sapma. n: Kişi Sayısı. %: Yüzde, cm: santimetre, m: metre, kg: kilogram.

rahatsızlık hissetmekte iken dirsek (%82,1), el bilekleri/el (%53,6), kalçalar/uyluklar (%72,6), diz (%50,0) ve ayak bileği/ayak (56) bölgelerinde ağrı, acı, rahatsızlık hissetmemekteydi.

Ebeveynlerin çoğunluğunun son 12 ay süresince sadece bel bölgesindeki ağrı (%52,4) günlük işleri yapmayı engellemekteyken, boyun (%75), omuz (%78,6), dirsek (%91,7), el bilekleri/el (%85,7), sırt (%73,8), kalçalar/uyluklar (%90,5), diz (%75,0) ve ayak bileği/ayak (%77,4) bölgelerinde ağrı günlük işleri yapmayı engellememekteydi.

Tablo 4'de ölçek ve alt boyut puanları arasındaki ilişkinin incelendiği korelasyon analizi sonuçları yer almaktadır. Çocukların kendine bakım puanı ile mobilite puanı arasında orta düzeyde pozitif yönde (r=0,547; p=0,000), kendine bakım puanı ile sosyal fonksiyon puanı arasında orta düzeyde pozitif yönde (r=0,414; p=0,000) anlamlı doğrusal bir ilişki olduğu görüldü, çocukların mobilite puanı ile sosyal fonksiyon puanı arasında ise anlamlı doğrusal ilişki olmadığı bulundu (p>0,05).

Ebeveynlerin bakım yükü puanı ile çocukların PÖDE toplam puanı, kendine bakım ve mobilite puanları arasında anlamlı doğrusal bir ilişki olmadığı bulundu (p>0,05), ebeveynlerin bakım yükü puanı ile çocukların sosyal fonksiyon puanı arasında ise orta düzeyde negatif yönde (r=-0,306; p=0,005) anlamlı doğrusal bir ilişki olduğu saptandı.

Ebeveynlerin yorgunluk şiddet puanı ile çocukların PÖDE toplam puanı, kendine bakım, mobilite ve sosyal fonksiyon puanları arasında anlamlı doğrusal bir ilişki olmadığı bulundu (p>0,05).

Ebeveynlerin bakım yükü puanı ile yorgunluk şiddet puanı arasında da anlamlı doğrusal bir ilişki tespit edilmedi (p>0,05).

TARTIŞMA

Covid-19 pandemisi süresince engelli çocukların günlük yaşamlarının değişimi, eğitimlerindeki kısıtlılık, yaşıtlarıyla oyun oynama ve sosyal ilişkiler üzerinde olumsuz etkilerin olabileceğinden yola çıkarak, farklı engel türüne sahip çocukların fonksiyonelliği ile ebeveynlerin etkilenimleri arasındaki ilişkinin incelendiği bir çalışma planlandı. Çalışmamızdan elde ettiğimiz sonuçlar doğrultusunda, engelli çocukların fonksiyonel düzeylerinin ebeveyn etkilenimine yorgunluk parametresi açısından bir etkisi olmadığı bulundu. Ebeveynlerde bakım yükü parametresi ise sadece çocukların sosyal fonksiyon düzeyi ile ilişkili bulundu.

Çocuğun doğduğu andan itibaren 0-6 yaş ara-

Tablo 2. Çocukların Demografik Özelliklerinin Dağılımları.

	Kişi Sayısı (n=84)	Yüzde (%)
Cinsiyet		
Kız	26	31
Erkek	58	69
Yaş Grubu (Ort±SS)	7,86±2,622	
7 yaş ve altı	43	51,2
8 yaş ve üstü	41	48,8
Boy (Ort±SS)	1,27±0,190	
Kilo (Ort±SS)	30,74±14,470	
BKİ (Ort±SS)	18,59±5,115	
Zayıf	50	59,5
Normal	25	29,8
Fazla Kilolu	6	7,1
Obez	3	3,6
Çocuk Hastalığın Tanısı/Rahatsızlık Türü		
Atipik otizm	28	33,3
Hafif düzey mental retardasyon	28	33,3
Serebral palsi	28	33,3
Çocuğa Konulan Engelli Tanı Süresi		
5 yıl ve altı	43	51,2
6 yıl ve üzeri	41	48,8
Okul Durumu		
Okula gitmiyor	16	19,0
Kreş/Anaokulu	20	23,8
İlkokul	32	38,1
Ortaokul	16	19,0
Çocuğun Özel Eğitim ve Rehabilitasyon Merkezinde Tedavi Süresi		
6 aydan az	1	1,2
6 ay-1 yıl	3	3,6
1-2 yıl	17	20,2
3 yıl ve üstü	63	75,0
Covid-19 Hastalığı Geçirme Durumu		
Evet	4	4,8
Hayır	80	95,2

Ort: Ortalama. SS: Standart Sapma. n: Kişi Sayısı. %: Yüzde.

sındaki süreçte bütün ihtiyaçlarının karşılanmasından sorumlu olan kişiler anne ve babalardır. Özellikle bu yaşlarda engelli çocukların günlük yaşam aktivitelerindeki fonksiyonelliğinin desteklenmesi, karşılaştıkları zorluk ve engelleri aşmasında yol gösterici olmaktadır (17). Sarı yaptığı çalışmasında, MR'li çocuğa sahip olan ebeveynlerin daha fazla yıprandığını ve bakım yüklerinin de daha fazla olduğunu tespit etmiştir (18,19). Çalışmamızda ise ebeveynlerin bakım yükü puanı ile çocukların PÖDE toplam puanı, kendine bakım ve mobilite puanları arasında bir ilişki görülmemiştir. Çocukların fonksiyonelliği ile annelerin bakım yükleri arasında anlamlı farklılık çıkmamasının nedenini, farklı engele sahip çocuklar arasında homojenlik oluşturmak amacıyla, ebeveynlerde fiziksel yük oluşturmayan ambule çocukların çalışmaya dahil edilmesi ile ilişkilendirmekteyiz.

Raina ve ark. yaptığı çalışmada, SP'li çocuklarda iletişim becerileri ve sosyal fonksiyonlar etkilendikçe aile özelliklerinin olumsuz yönde etkilendiğini ve bakım yükünü arttığını belirtmiştir (20). Çalışmamızda da benzer olarak ebeveynlerin bakım yükü puanı ile çocukların PÖDE sosyal fonksiyon puanı arasında ilişki saptanmıştır. Engelli

Tablo 3. İskandinav Kas İskelet Sistemi Sorgusunun Dağılımları.

	Son 12 ay süresince herhangi bir zamanda aşağıdaki bölgelerde herhangi bir sorununuz (ağrı, acı, rahatsızlık) oldu mu?				Son 12 ay süresince herhangi bir zamanda ağrınızdan dolayı olağan işinizi (evde ya da ev dışında) yapmanız engellendi mi?				Son 7 gün sürecince herhangi bir zamanda ağrınız oldu mu?			
	Evet		Hayır		Evet		Hayır		Evet		Hayır	
	n	%	n	%	n	%	n	%	n	%	n	%
Boyun	49	58,3	35	41,7	21	25	63	75	31	36,9	53	63,1
Omuzlar	46	54,8	38	45,2	18	21,4	66	78,6	28	33,3	56	66,7
Dirsekler	15	17,9	69	82,1	7	8,3	77	91,7	10	11,9	74	88,1
El bilekleri/eller	39	46,4	45	53,6	12	14,3	72	85,7	19	22,6	65	77,4
Sırt	55	65,5	29	34,5	22	26,2	62	73,8	26	31	58	69
Bel	65	77,4	19	22,6	44	52,4	40	47,6	41	48,8	43	51,2
Kalçalar/uyluklar	23	27,4	61	72,6	8	9,5	76	90,5	17	20,2	67	79,8
Dizler	42	50	42	50	21	25	63	75	26	31	58	69
Ayak bileği/ayaklar	37	44	47	56	19	22,6	65	77,4	22	26,2	62	73,8

Tablo 4. Ölçek Alt Boyut Puanları Arasındaki İlişkinin İncelenmesi.

			Pediatrik Özürlülük Değerlendirme Ölçeği					
			Toplam Puan	Kendine Bakım	Mobilite	Sosyal Fonksiyon	Bakım Yükü	Yorgunluk Şiddet
Pediatrik Özürlülük Değerlendirme Ölçeği	**Toplam Puan**	r	1					
		p						
	Kendine Bakım	r	0,852	1				
		p	<0,001					
	Mobilite	r	0,623	0,547	1			
		p	<0,001	<0,001				
	Sosyal Fonksiyon	r	0,788	0,414	0,185	1		
		p	<0,001*	<0,001	0,091			
	Bakım Yükü	r	-0,150	-0,042	0,143	-0,306	1	
		p	0,173	0,705	0,194	0,005*		
	Yorgunluk Şiddet	r	0,049	-0,004	0,049	0,075	0,185	1
		p	0,655	0,969	0,657	0,498	0,092	

*p<0,01. **p<0,001. R: Pearson Korelasyon Katsayısı. P: Anlamlılık Düzeyi.

çocukların iletişim becerileri azaldıkça ebeveynlerin bakım yükü artmaktadır. Çocukların sosyal becerileri azaldıkça annelerinin destek ve gözlemine ihtiyaç duymaları, bakım yükünün artmasındaki sebep olarak düşünülebilir.

Tezcan ve ark. SP'li çocuklarda etkilenim şiddeti ve motor fonksiyon düzeyinin günlük yaşamdaki bağımsızlığı etkilediğini bildirmiştir. Etkilenim şiddeti arttıkça ve motor fonksiyon düzeyi azaldıkça çocukların mobilite ve iletişim parametrelerinin etkilendiğini, bağımlılığın arttığını gözlemlemişlerdir (21,22). Çalışmamızda benzer olarak, çocukların kendine bakım puanı ile mobilite puanı arasında pozitif yönde, kendine bakım puanı ile sosyal fonksiyon puanı arasında pozitif yönde ilişki olduğu görülmüştür. Engelli çocuklarda görülen sosyal gelişim yetersizliklerinin motor beceriler ile alakalı olduğu ve motor beceri yönünden gelişen çocukların, sosyal beceri düzeylerinin de gelişeceği düşünülebilir.

Engelli çocuğa sahip annelerde, çocuğun bakımıyla ilgili sorumlulukların büyük bir kısmını üstlendikleri için, stres kronik yorgunluk ve çeşitli psikolojik rahatsızlıklar ortaya çıkabilmektedir (23-25). Hwang ve ark. yaptığı çalışmada, SP'li çocuklardaki fonksiyonel seviye değiştikçe ebe-

veynlerin fiziksel sağlıklarının bozulduğu saptanmıştır (26). Çalışmamızda farklı olarak, ebeveynlerin yorgunluk şiddet puanı ile çocukların PÖDE toplam puanı, kendine bakım, mobilite ve sosyal fonksiyon puanları arasında bir ilişki görülmemiştir. Katılımcı ebeveynler, yorgun olsalar dahi, yorgunluklarını hiçe sayıp öncelikli olarak çocuklarının ihtiyaçlarını karşılamak zorunda hissettiklerini ifade etmişlerdir. Bu durumun ebeveynlerin yorgunluk şiddet puanı ile çocukların PÖDE toplam puanı arasında anlamlı bir ilişki bulunmamasının nedeni olarak düşünmekteyiz.

Ebeveynler engelli çocukların bakım ve rehabilitasyonu sırasında fazla efor sarf etmekte, uykusuz kalmakta ve kendilerini yorgun hissetmektedirler. Özellikle çocuğun bakımında daha fazla rol alan annelerin fiziksel sağlıklarının kötü etkilendiği ve genellikle sırt ve bel ağrıları yaşadıkları tespit edilmiştir. Kavlak ve ark., SP'li çocuklar üzerinde yaptığı çalışmada, çocukların fonksiyonel seviyeleri kötüleştikçe, annelerin üst ekstremite, boyun, bel ve sırtta ağrıların oluştuğu, kaygı düzeylerinin arttığı ve annelerin yaşam kalitesini olumsuz yönde etkilediğini belirtmişlerdir (27,28). Yoosefinejad ve ark. yaptığı çalışmada ise, engelli çocuk annelerindeki kas iskelet sistemi rahatsızlıkları prevelansı araştırılmış ve annelerde en çok boyun, omuz ve bel ağrısı prevelansının yüksek olduğunu tespit etmişlerdir (29,30). Literatüre benzer olarak çalışmamızda, kas iskelet sistemi ağrısından yakınan annelerde en çok ağrıyan vücut bölümleri bel, boyun, omuz, sırt, diz bölgesi olduğu belirlenmiştir. Ebeveynlerin daha çok bu bölgelerde ağrı hissetmesinin sebebi, günlük yaşamda yük binen eklemlerin normalden daha fazla kullanılması ve yanlış pozisyonlarda ağırlık aktarmalarından kaynaklı olabilir. Ebeveynlerin sadece bel bölgesindeki ağrı olağan işlerini yapmayı engellemiştir. Bunun sebebi, ebeveynlerin çocuklarının bakımında ve günlük yaşamda ağrı hissetseler bile bu durumla yaşamaya alışkın olduklarını düşündürebilir.

Sonuç olarak bu çalışma, çocuğun sosyal becerileri arttıkça ebeveynlerin bakım yükünün azaldığını göstermiştir. Engelli çocukların daha fazla sosyalleştirilmesi ve fonksiyonel becerilerinin geliştirilmesi, hem ebeveynlerin bakım yükünü azaltmada hem de ebeveynlerde oluşabilecek kronik ağrı, depresyon ve yorgunluğun önüne geçmede etkili olabilir. Bunun bir halk sağlığı sorunu olduğunu ve ebeveynlerin bilinçlendirilmesine yönelik çalışmaların yapılmasına ihtiyaç olduğunu düşünmekteyiz. Fizyoterapistler engelli çocukları değerlendirirken, ebeveynlerin ihtiyaçlarını da göz önünde bulundurarak eğitici programlar önerebilir. Bu programlar çerçevesinde ebeveynler, fiziksel ve zihinsel engelli çocukların bakımı ve rehabilitasyonunda daha aktif, umutlu ve motive şekilde rol oynayabilir. İleride yapılacak çalışmalarda, engelli çocuklara bakım veren ebeveynlerin daha detaylı değerlendirilmesi ve engelli çocuk bakımındaki bilinçlilik durumunun değerlendirilmesi literatüre katkı sağlayacaktır.

Sonuçların yorumlanmasına katkı sağlayabilecek, bakım veren ebeveynlerin psikolojik durumunun değerlendirilmemesi ve çevresel faktörlerin incelenmemesi çalışmanın limitasyonlarındandır.

Destekleyen Kuruluş: Bu çalışma Başkent Üniversitesi araştırma fonunca desteklendi.

Çıkar Çatışması: Yok.

Yazar Katkıları: Yok.

Açıklamalar: Yok.

Teşekkür: Çalışmaya katılmayı kabul eden çocuklar ve ebeveynlerine teşekkür ederiz.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)32-44

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Received: *12.06.2021 (Geliş Tarihi)*
Accepted: *21.07.2022 (Kabul Tarihi)*

SHORT TERM EFFECTS OF CARDIOPULMONARY REHABILITATION AND NEUROMUSCULAR ELECTRICAL STIMULATION ON FUNCTIONAL CAPACITY, MYOCARDIAL TISSUE DOPPLER AFTER CORONARY ARTERY BYPASS GRAFT SURGERY

ORIGINAL ARTICLE

ABSTRACT

Purpose: Exercise capacity is associated with diastolic function. The aim of our study is to investigate the short-term effects of cardiopulmonary rehabilitation and NMES on functional capacity and myocardial tissue doppler (MTD) after coronary artery surgery.

Methods: Forty patients with coronary artery bypass graft were randomly divided into two groups: CPR+NMES and CPR. Functional capacity were analyzed through 2 minutes walk test (2MWT) and sit to stand test (SST), left ventricular (LV) diastolic functions were analyzed with MTD and thoracic expansion was analyzed with chest wall measurement on the 2nd and 7th postoperative days.

Results: Statistically significant difference was identified between the groups in 2MWT distance (CPR+NMES, Zt*p=0.000*), SST (CPR, Zt*p=0.000*), E' (CPR+NMES, Zt*p=0.002*), E (CPR+NMES, Zt*p=0.025*), E/E' (CPR+NMES, Zt*p=0.007*), A (CPR, Zt*p=0.006*) (p<0.05). Statistically significant difference has been observed in group comparisons in E' (CPR+NMES, G*p=0.000*) ve E/E'(CPR+NMES, G*p=0.007* postoperative 2nd day; G*p=0.019* postoperative 7th day) (p<0.05). The temporal changes of 2MWT distance, heart rate, blood pressures, respiratory frequency, saturation and Borg dyspnea-fatigue measurements did not show a statistically significant difference between groups (p>0.05), except for E'(Zg*p=0.000*), E/E' (Zg*p=0.003*) parameters (p<0.05).

Conclusion: It was seen that NMES, which we applied in addition to early cardiopulmonary rehabilitation, made a positive contribution to LV filling pressure and LV filling rate in the CPR+NMES group. Additionally, in the intergroup comparisons of the CPR+NMES group, it was observed that there was a statistically significant increase in the 2 MWT distance on the postoperative 7th day compared to the postoperative 2nd day.

Keywords: Cardiopulmonary Rehabilitation, Coronary Artery Bypass Graft, Functional Capacity, NMES, Tissue Doppler

KORONER ARTER BYPASS GREFT CERRAHİSİ SONRASI KARDİYOPULMONER REHABİLİTASYON VE NÖROMÜSKÜLER ELEKTRİK STİMÜLASYONUN FONKSİYONEL KAPASİTE, MİYOKARDİAL DOKU DOPPLERİ ÜZERİNDEKİ KISA DÖNEM ETKİLERİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Egzersiz kapasitesi diyastolik fonksiyonla ilişkilidir. Çalışmamızın amacı, koroner arter cerrahisi sonrası kardiyopulmoner rehabilitasyon ve NMES'in fonksiyonel kapasite ve miyokard doku doppleri (MDD) üzerine kısa dönem etkilerini araştırmaktır.

Yöntemler: Koroner arter baypas greftli kırk hasta rastgele iki gruba ayrıldı: CPR+NMES ve CPR. Fonksiyonel kapasite 2 dakika yürüme testi (2DYT) ve otur kalk testi (SST), sol ventrikül diyastolik (LV) fonksiyonları MDD ile, göğüs ekspansiyonu göğüs duvarı ölçümü ile postoperatif 2. ve 7. günlerde analiz edildi.

Sonuçlar: Gruplar arasında, 2DYTmesafe (CPR+NMES, Zt*p=0,000*), SST (CPR, Zt*p=0,000*), E' (CPR+NMES, Zt*p=0,002*), E (CPR+NMES, Zt*p=0,025*), E/E' (CPR+NMES, Zt*p=0,007*), A (CPR, Zt*p=0,006*) istatistiksel olarak anlamlı fark tanımlanmıştır (p<0,05). Grup içi karşılaştırmalarda E' (CPR+NMES, G*p=0,000*) ve E/E' (CPR+NMES, G*p=0,007* postoperatif 2. gün; G*p=0,019* postoperatif 7.gün) istatistiksel olarak anlamlı fark gözlenmiştir (p<0,05). E' (Zg*p=0,000*), E/E' (Zg*p=0,003*) parametreleri hariç (p<0,05), 2DYT mesafe, kalp hızı, kan basıncı, solunum frekansı, saturasyon ve Borg dispne-yorgunluk ölçümleri zamana göre gruplar arasında istatistiksel farklılık göstermedi (p>0,05).

Tartışma: Erken dönem kardiyopulmoner rehabilitasyona ek olarak uyguladığımız NMES'in, CPR + NMES grubundaki LV dolum basıncına ve LV dolum hızına olumlu bir katkı yaptığı görülmüştür. Ayrıca CPR + NMES grubunun gruplar arası karşılaştırmalarında, postoperatif 7. günde postoperatif 2. güne kıyasla 2DYT mesafesinde istatistiksel olarak anlamlı bir artış olduğu görülmüştür.

Anahtar Kelimeler: Kardiyopulmoner Rehabilitasyon, Koroner Arter Baypas Greft, Fonksiyonel Kapasite, NMES, Doku Doppleri

INTRODUCTION

After coronary artery bypass graft (CABG) surgery, several problems that negatively influence everyday living and quality of life can occur, including pulmonary problems, dyspnea, exhaustion, decreased functional capacity, loss of muscle strength, emotional changes, sleep disorders, mental and social problems. These issues can be addressed with a physiotherapy and rehabilitation program that is tailored to the patients' metabolic equivalent of task levels. Physiotherapy and rehabilitation practices linked to respiratory physiotherapy, aerobic exercise, electrotherapy, and progressive mobilization can be performed in the postoperative phase of myocardial revascularization, according to the findings of a comprehensive study published in 2019 (1). Neuromuscular electrical stimulation (NMES) has increased popularity as a promising new exercise training tool in cardiovascular rehabilitation in recent years. NMES administration in patients with heart failure has been shown in studies to improve treatment outcomes. When compared to traditional exercises, NMES has a few advantages, such as requiring less patient motivation and being more likely to be performed by patients who are unable to get traditional training (2). The clinical benefits of NMES have been characterized as a considerable increase in maximal workload, oxygen consumption at the anaerobic threshold, and 6-minute walk distance after CABG surgery. These advantages are thought to be linked to an increase in oxidative capacity in the peripheral muscles of heart failure patients (3).

Because it is independent of preload and afterload, tissue doppler imaging is widely employed, particularly in evaluating diastolic left ventricular (LV) functions. The myocardium's high amplitude and low velocity motions, rather than blood flow, are observed using the tissue doppler technique (4,5). Many factors influence LV diastolic filling, including myocardial relaxation, compliance, cardiac rhythm, and pericardial compliance. At rest and during activity, excellent diastolic function requires appropriate filling of the ventricles without creating an excessive increase in diastolic pressures or pulmonary congestion. Myocardial relaxation is the initial diastolic event, and it is an active energy-dependent event that causes the LV pressure to rapidly drop after the contraction ceases (6). The transmitral pressure gradient established by these many elements results in the LVfilling pattern. These parameters are routinely used in clinical echocardiography, such as myocardial systolic velocity (S), early diastolic velocity (E), highest late filling rate with contraction of the atria- late diastolic velocity (A), wave with early diastolic rapid filling (E'), and ratio of mitral flow early diastolic velocity to early diastolic velocity obtained by pulsed wave tissue doppler from the mitral annulus (LVfilling pressure) (E/E') (7). Additionally, The European Association of Cardiovascular Imaging/American Society of Echocardiography (EACVI/ASE) recently issued recommendations in 2016 that recommend four variables for diagnosing diastolic dysfunction: annular e' velocity (LAT E'VEL-lateral e' / SEP E' VEL-septal e' ratio), average E/e' ratio >14, and diastolic e' velocity (LAT E'VEL-lateral e' / septal e' ratio) (8). Before transmitral flow, myocardial relaxation causes movement and the E' wave arrives first, followed by the E wave. The E' wave is somewhat dependent on preload and directly dependent on myocardial relaxation. With increasing age, diastolic dysfunction, and LV hypertrophy, the E' wave decreases. The E wave is a good way to assess diastolic function since it is a good predictor of myocardial relaxation. Ischemia has a strong effect on the E wave. E' instantly decreases as coronary blood flow diminishes (9).

The link between increased LV filling pressure and increased mortality in men following a myocardial infarction emphasizes the significance of adequate treatment for those at risk (10). High-intensity aerobic treadmill exercise has been shown to improve LV early diastolic myocardial relaxation rate and VO2peak in patients with stable coronary artery disease using tissue doppler (11). The ability to exercise is linked to diastolic function (12).

The goal of our research is to see how cardiopulmonary rehabilitation and NMES affect functional capacity and myocardial tissue doppler (MTD) following coronary artery bypass graft surgery in the short term.

METHODS

Participants

The study took place in Zonguldak Bülent Ecevit University Hospital between January 2017-July 2019 with 40 patients who underwent CABG surgery between the ages of 50-75 and employed solely IMA (3 patients), IMA and saphenous vein grafts (37 patients).

Patients with CABG surgery, stable vital signs, no cooperational, orthopedic, or neurological issues, and postoperative atrial fibrillation meet the inclusion criteria. The participants who met the requirements were randomly assigned to one of two groups (cardiopulmoner rehabilitation (CPR group) or cardiopulmoner rehabilitation with NMES ((CPR+NMES group)) using the permutation block randomization approach (Figure 1).

The study was prepared in compliance with the Helsinki Declaration Criteria, and the study's ethical approval was granted on December 6, 2017 by a Zonguldak Bülent Ecevit University ethics committee decision 2017/20 Non-Interventional Clinical Research ethics committee decision. All patients were given written or spoken information regarding the trial, and written informed consent was obtained.

Measurements

The demographic data (gender, age, body mass index, grafts, comorbidities, total hospital stay, etc) and clinical conditions of the patients (2-minute walking test (2MWT) with dyspne-fatigue, thoracal expansiyon (chest wall measurement (CWM)). The cardiologist determined MTD, whereas the physiotherapist determined all other metrics. During the examination and therapy phases, necessary monitoring was carried out. During the preoperative phase, the patients were not evaluated, questioned, or trained. Before the patients are examined on the second postoperative day, they are informed about what should be considered following surgery, what will be done in the cpr program, and the value of the cpr program. All the evaluations were completed on the 2nd and 7th postoperative days.

Myocardial Tissue Doppler

The early diastolic mitral annulus velocity (E') estimated by MTD and the ratio of the transmitral early peak velocity (E) by pulsed wave doppler over (E/E') are the two key parameters for grading diastolic dysfunction (13). We examined the E' parameter, which indicates the LV premature filling rate, and the E/E' parameter, which reflects the LV filling pressure, in order to see the direct effect of the treatment on the left ventricle in the CPR or CPR+NMES groups. Additionally, LAT E'VEL, SEP E' VEL, E, A and E/A ratio were examined. A cardiologist took this assessment without knowing which patients were in which groups.

2 Minutes Walk Test

Butland et al. (14) developed 2MWT as an alternative to the 6-minute walking test, which is utilized in clinical and therapeutic settings where time is limited to assess a person's functional ability, which is a factor in mortality and morbidity. Prior to the test, which takes place in a 30m long hallway, the patient was given ten minutes of rest, sitting somewhere near the start and under the supervision of a physiotherapist. Before, after and rest the test, the level of dyspnea was measured using the Borg Dyspnea Scale (BDS) (0-10 score) and the level of exhaustion was measured using the Borg Fatigue Scale (BFS) (0-10 score).

30 Seconds Sit To Stand Up Test

The patients were seated in the SST with their arms crossed over their shoulders and their backs against the chair. The patient was advised to immediately stand up and sit in a 43cm high standard chair by the physiotherapist. The timer was started for 30 seconds with the "Start" instruction, and it was stopped as soon as the person's pelvis area hit the chair (16). The purpose of this test is to determine the patient's leg strength and endurance.

Chest Wall Measurements

During deep inhalation and maximum expiration, tape measures were used to measure the chest wall from the axillar, epigastric, and subcostal regions, and the difference between inspiration and expiration was recorded in cm. In addition, the type of breathing (abdominal, chest, or mixed type) and drain were recorded. The normal thoracic expansion of the patient is 2-5" (5.08-12.70 cm) (17). All patients had a drain in place for the chest circum-

ference measurements conducted on the second postoperative day, but not for the measurements taken on the seventh postoperative day.

Protocol

The CPR+NMES group (n = 20) received the CPR program (Figure 1) as well as electrical stimulation (NMES) (Cefar Compex® Rehab, Cefar-Compex Medical Ab, Sweden), whereas the CPR group (n = 20) received only the CPR program. The program began on the second postoperative day, once this day, and then twice daily, abouth ten minutes for the next five days.

Active breathing cycle exercises and incentive spirometry are two types of breathing exercises. Patients were told to use the incentive spirometer every hour. Shoulders back, scapular adduction, lowering arms forward sideways and down, and neck ROM exercises are performed by sitting on the second postoperative day and standing on the other days. In-bed joint range of motion exercises, knee flexion extension by sitting on the bed side, walking without moving forward, standing hip hyperextension, and standing hip abduction adduction are among the Phase I-II activities. The intricacies of walking training, stair exercises, and sitting on

Table 1. Demographic Data

Datas	CPR+NMES Group (n=20)		CPR Group (n=20)		x^2	p
	N	%	N	%		
Gender						
Female	3	15	5	25		0.695φ
Male	17	85	15	75		
Diabetes mellitus	11	55	12	60	0.102	0.749
Hypertension	16	80	15	75		1.00φ
Hyperlipidemia	12	60	11	55	0.102	0.749
COPD	12	60	13	65		0.675φ
MI	13	65	14	70	0.114	0.736
Smoking	14	70	14	70		1.00φ
Alchol	7	35	8	40	0.107	0.744
Breathing types					1.074	0.584
Chest	8	40	5	25		
Abdominal	10	50	12	60		
Mix type	2	10	3	15		
Coronary graft					-0.277	0.783
1	2	10	1	5		
2	4	20	5	25		
3	7	35	7	35		
4	5	25	4	20		
5	2	10	3	15		
	CPR+NMES Group (n=20)		**CPR Group (n=20)**		**t/z**	**p**
	Mean ±SD	**Med (min - maks)**	**Mean ±SD**	**Med (min - maks)**		
Age (y)	63 ± 7.75	61 (51 - 75)	59.85 ± 6.76	60 (50 - 73)	t=1.370	0.179
BMI (kg/m²)	27.21 ±4.38	27.34 (21.48 – 37.01)	26.82 ± 3.51	25.54 (21.48 – 33.56)	t=0.313	0.756
EF (%)	48.5 ± 7.63	50 (30 - 60)	47 ± 10.93	47.5 (25 - 60)	z=-0.327	0.749
Intubation time(hours)	8.45±3.54	7.5(4-16)	9.58±3.29	9(5.5-15.5)	z=-1.262	0.211
Cross-clamp time(minutes)	64.7±25.7	60 (27-135)	58±22.12	57.5 (18-98)	t=0.884	0.382
Total perfusion time (minutes)	104.9±45.07	106.5 (37-240)	103.4±22.7	101 (61-157)	t=0.133	0.895
Intensivecare unit time (hours)	29.8±4.58	28.5 (25-42)	32.03±5.05	32 (23-39)	z=-1.497	0.142
Total hospital days	11.2±1.79	10.5(9-16)	11.05±1.23	11 (9-13)	z=-0.139	0.904

*p<0.05 statistically significant; x^2: Chi Square test, φ: Fisher Exact test, t: Independent simple t-test, z: Mann Whitney U testi, COPD: Chronic Obstructive Pulmonary Disease, BMI: Body Mass Index, MI: Myocard ınfarctus, EF: ejection fraction.

a chair were given in Figüre 2. Sitting on a chair was started once the drains were removed and the patient's health had stabilized. Moreover, dyspnea and fatigue were asked in the stair exercises.

The Physo 5 Denervation Mode Muscle Rehabilitation Device-Cefar Compex device was used to apply NMES. On the second postoperative day was began and applied once a day. For 30 minutes, patients were subjected to bilateral quadriceps and gastrosoleus muscle stimulation using a burst type, 25 hertz frequency, and 5/5 second cycle time (18). Single-use stimrodes brand 5x5 wire adhesive electrodes were used to apply NMES current to each patient.

Statistical analysis

The data was analyzed using the SPSS 26 program, with a 95 percent confidence level. The measures' mean (Mean) and standard deviation (SD) data are provided. Independent groups t were employed in the study to compare measures between groups, as well as the postoperative/discharge comparison of measurements. The ANOVA test was applied multiple times. It's a test strategy for comparing a numerical measurement with a two-group variable called independent groups t. One-way ANOVA is a test strategy for determining the change in quantitative dependent measurements over time for different groups (Group*p refers to the comparison between groups). Zt*p: Change in general, Zg*p: Change in the group; p: p-value, Postop -Discharge)

RESULTS

Table 1 summarizes demographic information. The arrangement of groups is homogeneous.

Some of the patients were given dopamine and bronchodilators as needed, but antiaggregants were given to all of them.

Statistically significant difference has been identified between the groups ($p<0.05$) in 2MWT distance (CPR+NMES, Zt*p=0.000*)(Table 3), heart rate (CPR, Zt*p =0.039*), saturation (CPR+NMES, Zt*p=0.040*; CPR, Zt*p=0.001*; CPR+NMES, Zt*p=0.000*), Borg dyspnea (CPR, Zt*p =0.033*) and fatigue (CPR+NMES, Zt*p=0.006*, Zt*p=0.000*; CPR, Zt*p=0.002*) values on the postoperative 7th day, which were assessed after short-term cardiopulmonary rehabilitation program. In group comparisons, 2MWT systolic (G*p=0.033*) and diastolic (G*p= 0.027*) pressures measured were statistically more significant on the postoperative 2nd day in the CPR+NMES group compared to the CPR group ($p<0.05$). The temporal changes of 2MWT distance (Table 3), heart rate, blood pressures, respiratory frequency, saturation and Borg dyspnea-fatigue did not show a statistically significant difference between groups ($p>0.05$) (Table 2).

The variation in the number of SST repetitions between groups was found to be statistically more significant in the CPR group (Zt*p=0.000*) compared to the CPR+NMES group on the postoperative 7th day ($p<0.05$). However, no statistically significant difference has been identified in the number of SST repetitions and in all measurements of chest circumference, both within groups and in temporal changes ($p>0.05$) (Table 3).

E' (G*p=0.000*) and E/E' (G*p=0.007*; G*p=0.019*) parameters were observed in intragroup changes of MTD parameters in the CPR+NMES group were found to be statistically more significant both on the 2nd postoperative day and on the postoperative 7th day ($p<0.05$). In intergroup exchanges, E' (Zt*p=0.002*), E (Zt*p=0.025*) and E/E' (Zt*p=0.007*) parameters in CPR+NMES group, and A (Zt*p=0.006*) parameter is in the CPR group were found to be statistically more significant on the postoperative 7th day ($p<0.05$). When the temporal changes were examined, E' (Zg*p=0.000*) and E/E' (Zg*p=0.003*) parameters were observed to be statistically more significant in the CPR+NMES group ($p<0.05$) (Table 4).

Moreover, there were no side effects associated with the NMES intervention.

DISCUSSION

As a result of our study, it was seen that NMES, which we applied in addition to early cardiopulmonary rehabilitation, made a positive contribution to LV filling pressure and LV filling rate, which are MTD results in the CPR+NMES group. In addition, in the intergroup comparisons of the CPR+NMES group, it was observed that there was a statisti-

Table 2. Hemodynamic Results of 2MWT

Measure		Postoperative	CPR+NMES	CPR	G*p	Zt*p	Zg*p
Heart rate (bpm)	Before	2nd day	94±11.19	93±15.04	0.813	0.575	0.736
		7th day	93.45±8.9	90.8±13.13	0.460		
		MeanΔ	-0.55±12.01	-2.2±18.11	0.736		
	After	2nd day	96.75±10.46	102.75±15.7	0.163	0.039*	0.536
		7th day	93.55±12.9	96.9±13.61	0.429		
		MeanΔ	-3.2±14.31	-5.85±12.43	0.536		
	Rest	2nd day	93.7±12.67	95.6±15.44	0.673	0.498	0.833
		7th day	91.7±9.19	94.55±13.71	0.445		
		MeanΔ	-2±9.98	-1.05±17.28	0.833		
Systolic Blood Pressure (beats/min)	Before	2nd day	128±10.75	124.7±17.58	0.478	0.880	0.848
		7th day	127.9±18.88	125.55±17.95	0.689		
		MeanΔ	-0.1±16.22	0.85±14.92	0.848		
	After	2nd day	142.1±19.3	126.05±25.98	0.033*	0.967	0.415
		7th day	139.3±21.31	129.15±22.3	0.149		
		MeanΔ	-2.8±23.52	3.1±21.73	0.415		
	Rest	2nd day	126.75±19.16	121.65±20.8	0.425	0.837	0.949
		7th day	127.2±19.34	122.5±18.26	0.434		
		MeanΔ	0.45±21.78	0.85±17.59	0.949		
Diastolic Blood Pressure (beats/min)	Before	2nd day	72.2±10.66	69.35±7.93	0.343	0.118	0.767
		7th day	74.6±8.15	72.85±7.95	0.496		
		MeanΔ	2.4±12.48	3.5±10.78	0.767		
	After	2nd day	79.35±11.18	71.75±9.65	0.027*	0.893	0.398
		7th day	78.15±7.99	73.4±8.26	0.072		
		MeanΔ	-1.2±11.9	1.65±9	0.398		
	Rest	2nd day	73.7±9.89	70.75±9.29	0.337	0.682	0.810
		7th day	74±9.18	71.9±8.88	0.467		
		MeanΔ	0.3±11.57	1.15±10.62	0.810		
Respiratory Frequency	Before	2nd day	24.85±5.71	23.7±4.37	0.478	0.534	0.702
		7th day	23.8±4.05	23.45±3	0.758		
		MeanΔ	-1.05±7.24	-0.25±5.78	0.702		
	After	2nd day	26.7±6.11	27.15±3.94	0.783	0.573	0.797
		7th day	26.4±5.54	26.35±4.3	0.975		
		MeanΔ	-0.3±5.87	-0.8±6.35	0.797		
	Rest	2nd day	26.1±6.21	25±3.76	0.502	0.359	0.908
		7th day	25.2±4.65	24.3±3.96	0.514		
		MeanΔ	-0.9±6.66	-0.7±3.85	0.908		
Saturation	Before	2nd day	93.3±4.24	94.15±3.67	0.502	0.040*	0.716
		7th day	95±2.87	95.35±2.21	0.668		
		MeanΔ	1.7±5.19	1.2±3.19	0.716		
	After	2nd day	94.15±4.2	94.4±4.3	0.853	0.001*	0.670
		7th day	96.3±1.89	97.1±1.77	0.176		
		MeanΔ	2.15±4.25	2.7±3.85	0.670		
	Rest	2nd day	91.15±4.5	93.7±5.12	0.103	0.000*	0.178
		7th day	94.95±2.14	95.55±2.11	0.378		
		MeanΔ	3.8±4.63	1.85±4.36	0.178		

*p<0.05 significant difference, p>0.05 no significant difference, t test/Repeat ANOVA test, G*p: comparison between groups, Zt*p: Change in general, Zg*p: Change in the group

cally significant increase in the 2 MWT distance on the postoperative 7th day compared to the postoperative 2nd day.

In our study, it was determined that there are not enough studies in the literature on the effects of cardiopulmonary rehabilitation applied in the early postoperative period on MTD. The need for myocardial protection increases during surgery and in

Table 3. 2 MWT distancewith Fatigue and Dyspnea, SST Repeats and Measurements of CWM

Measurement		Postoperative	CPR+NMES	CPR	G*p	Zt*p	Zg*p
		2nd day	47.2±18.55	42.78±19.42	0.466		
2MWT distance (meter)		7th day	81.14±24.31	76.16±27.64	0.549	0.000*	0.931
		MeanΔ	33.94±20.92	33.38±19.26	0.931		
		2nd day	1.1±1.39	1±1.65	0.837		
	Before	6th day	0.25±0.68	0.35±0.61	0.627	0.006*	0.702
		MeanΔ	-0.85±1.66	-0.65±1.61	0.702		
Borg Fatigue Scale		2nd day	1.38±1.43	1.98±1.93	0.271		
	After	6th day	0.73±0.8	0.98±1.18	0.437	0.002*	0.491
		MeanΔ	-0.65±1.35	-1±1.8	0.491		
		2nd day	1.05±1.34	1.13±1.31	0.859		
	Rest	6th day	0.38±0.72	0.48±0.73	0.667	0.000*	0.942
		MeanΔ	-0.68±1.2	-0.65±0.93	0.942		
		2nd day	0.8±1.29	0.35±1.14	0.249		
	Before	6th day	0.15±0.24	0.25±0.5	0.423	0.033*	0.114
		MeanΔ	-0.65±1.3	-0.1±0.79	0.114		
		2nd day	0.93±1.5	1.33±2.14	0.498		
Borg Dyspnea Scale	**After**	6th day	0.63±1.26	0.68±1.12	0.895	0.057	0.475
		MeanΔ	-0.3±1.24	-0.65±1.78	0.475		
		2nd day	0.68±1.25	0.83±1.5	0.733		
	Rest	6th day	0.43±1.04	0.2±0.7	0.427	0.033*	0.350
		MeanΔ	-0.25±0.95	-0.63±1.49	0.350		
		2nd day	4.2±2.24	3.45±2.52	0.326		
SST repeats		7th day	6.45±1.79	6.2±2.46	0.716	0.000*	0.393
		MeanΔ	2.25±1.48	2.75±2.12	0.393		
		2nd day	1.5±1.05	1.19±0.83	0.299		
CWM Axillar (cm)		7th day	1.54±0.92	1.37±1.68	0.694	0.623	0.740
		MeanΔ	0.04±1.19	0.18±1.54	0.740		
		2nd day	1.46±0.88	1.27±0.88	0.488		
CWM Subcostal (cm)		7th day	1.47±0.77	1.9±1.19	0.177	0.087	0.092
		MeanΔ	0.01±0.97	0.64±1.31	0.092		
		2nd day	1.17±1.01	1.61±1.09	0.193		
CWM Epigastric (cm)		7th day	1.5±1.39	1.38±1.06	0.751	0.760	0.107
		MeanΔ	0.34±0.86	-0.23±1.26	0.107		

*p<0.05 significant difference, p>0.05 no significant difference; t test/Repeat ANOVA test, 2MWT: two minutes walk test, SST:sit to stand test, CWM: chest wall measurement, G*p: comparison between groups, Zt*p: Change in general, Zg*p: Change in the group

the early postoperative period, especially in ventricles with limited energy, limited reserve and dysfunction. Generally, there is a decrease in LV functions due to ischemic areas. As is known, with the opening of the mitral valve, blood flow begins from the left atrium to the left ventricle, which has a lower pressure. In the middle of diastole, LV and left atrial pressures equalize, and blood flow continues at a low rate (19). As the filling pressure increases, the left atrial and LV pressures may equalize more rapidly, resulting in a faster increase in diastolic pressure, which leads to premature cessation of mitral blood flow (20). However, tissue oxygenation is primarily increased in ischemic areas with revascularization that develops after surgery. Cardiopulmonary rehabilitation applied in the early postoperative period also contributes to revascularization (21). In our study, MTD results in the CPR+NMES group caused a decrease in the early period LV diastolic filling pressure and an increase in the LV filling rate in temporal and intergroup changes. Our study can show that NMES causes an increase in oxidative capacity along with muscle training (22). The approach to regulating oxidative stress during NMES treatment may contribute to the creation of effective treatment strategies for coronary failure

Table 4. Myocardial Tissue Doppler Parameters

Parameters	Times	CPR+NMES	CPR(2)	G*p	Zt*p	Zg*p
	2nd day	0.13±0.18	0.18±0.23	0.526		
LAT E'VEL	7th day	0.27±0.3	0.22±0.25	0.545	0.061	0.325
	OrtΔ	0.14±0.26	0.04±0.34	0.325		
	2nd day	0.1±0.14	0.16±0.22	0.332		
SEP E'VEL	7th day	0.19±0.23	0.13±0.18	0.354	0.455	0.104
	OrtΔ	0.09±0.19	-0.03±0.26	0.104		
E' (Lat E' vel/ Sep E' vel ratio) E' vel ratio)	2nd day	0.4±0.29	0.7±0.2	0.000*		
	7th day	0.47±0.31	0.17±0.15	0.000*	0.002*	0.000*
	OrtΔ	0.07±0.55	-0.53±0.27	0.000*		
	2nd day	0.45±0.14	0.41±0.21	0.487		
E (cm/sec)	7th day	0.55±0.21	0.49±0.16	0.331	0.025*	0.807
	OrtΔ	0.1±0.22	0.08±0.26	0.808		
	2nd day	0.52±0.17	0.42±0.23	0.151		
A (cm/sec)	7th day	0.65±0.26	0.58±0.19	0.353	0.006*	0.797
	OrtΔ	0.13±0.33	0.16±0.31	0.801		
	2nd day	1.13±1.4	1.01±0.38	0.694		
E/A	7th day	0.93±0.44	0.86±0.27	0.547	0.339	0.870
	OrtΔ	-0.2±1.55	-0.14±0.42	0.864		
	2nd day	2.94±2.76	0.89±1.46	0.006*		
E/E'	7th day	2.74±2.93	5.1±3.14	0.019*	0.007*	0.003*
	OrtΔ	-0.2±5.04	4.2±3.69	0.003*		

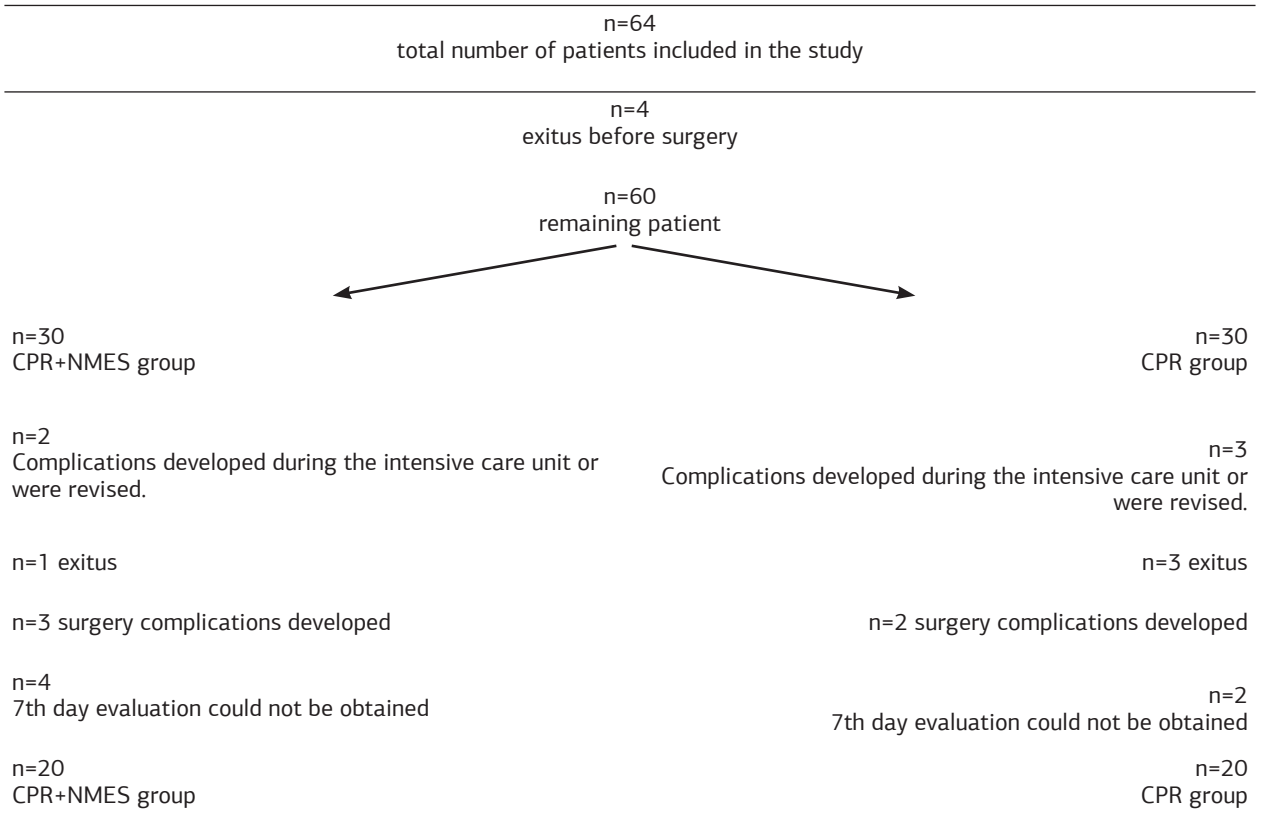
*p<0.05 significant difference, p>0.05 no significant difference; t test/Repeat ANOVA test, LAT E'VEL: lateral annular e' velocity, SEP E' VEL: septal annular e' velocity, E': early diastolic rapid filling, E: early diastolic velocity, A: the atria- late diastolic velocity, E/E' ratio: LVfilling pressure, G*p: comparison between groups, Zt*p: Change in general, Zg*p: Change in the group

(23). In addition, NMES can improve oxygenation in the coronary arteries by increasing the capillary density and oxygen consumption in the muscle fiber (24). Oxygenation that develops in the coronary arteries, in turn, can improve myocardial revascularization by reducing myocardial oxygen consumption.

When we look at the intra-group changes of MTD parameters, on the postoperative 7th day, the LV late filling rate increased in the CPR group, while the early filling rate increased in the CPR+NMES group. When we look at the comparisons between the groups made on the 7th postoperative day, we think that since the heart rate value obtained after 2MWT increased in the CPR group, it may have affected the LV late filling rate (25). However, when we examine the literature, LV early diastolic filling rate and filling pressure are used as determining parameters in LV diastolic functions. LV late filling rate is used more frequently in the examination of left atrial functions (26). In addition, LV filling rate was measured as higher and filling pressure was measured as lower in the CPR group on the 2nd postoperative day. However, on the 7th postoperative day, the LV filling rate was measured as higher and the filling pressure was measured as lower in the intragroup changes of the CPR+NMES group. Exercise training that improves diastolic function can increase exercise capacity considerably (27). Although the same exercises were applied to both groups, this change in diastolic functions observed in the postoperative 7th day CPR group suggests that exercise capacity may have decreased in this group. (28). The reason for this may be that NMES was not applied to this group and therefore their exercise capacity was reduced.

In our study, in comparisons made within the group regarding functional capacity, it was found that there was an increase in walking distance on the postoperative 7th day in the CPR+NMES group. It was aimed to increase the total oxygen consumption in the body with synchronized muscle contraction without causing dyspnea and fatigue by applying NMES in patients who generally have low functional capacity undergoing coronary surgery. NMES increases oxidative aerobic capacity, improves peripheral vasodilation, and ultimately leads to increased vascularization (29). In our study, as

Figure 1. Flow Diagram



supported in the literature, with the increase in the 2MWT walking distance in the CPR+NMES group, functional capacity improved along with peripheral vascularization on postoperative 7th day. Myocardial revascularization expected from surgery after CABG also contributed to this development. In our study, ventricular functions were preserved better in the CPR+NMES group in MTD compared to the CPR group, and no related complications occurred in the cases. There was no statistically significant difference in functional capacity between the groups; however, in accordance with the basic objectives of the phase I program applied in our study, LV diastolic functions were preserved on the 7th postoperative day, as shown in MTD in the CPR+NMES group. We think that if the phase II program had been completed and 2 MWTs had been performed at the end, a difference in functional capacity between the groups might have arisen.

When we examine the comparisons between the groups in our study, the heart rate value obtained after the walking test showed lower decrease in the CPR+NMES group. When we look at the literature, the presence of ischemic areas after CABG surgery, the effects of long-term anesthesia, and high heart rate because of compensation by increasing heart rate instead of increasing stroke volume to increase cardiac output, are expected situations. This may indicate that myocardial oxygen consumption is still high (30).

When we examine the changes within the group in our study, the systolic and diastolic blood pressures measured after the postoperative 2nd day walking test were found to be higher in the CPR+NMES group. This suggests that the pretreatment peripheral vascular resistance or blood viscosity in the CPR+NMES group may be higher compared to the CPR group. There are several reasons for the postsurgery increase in blood pressure in CABG patients, depending on pain, stress or medications. Usually within 4-6 weeks after the surgery, it has been observed that the sympathovagal balance approaches the preoperative values with the restoration of the sympathovagal balance (31). In addition, endothelial dysfunction that develops in coronary artery diseases may have paved the way

Figure 2. Exercise Program

POSTOPERATIVE DAYS	REHABILITATION PROGRAM	DURATION/ FREKANS/ SETS/METERS	PER DAY
2nd postoperative day	Active breathing cycle exercises+incentive spirometry	3-5/1-2	1
	In-bed joint range of motion exercise	3-5/1-2	1
	Knee flexion extension by sitting on the bed side	3-5/1-2	1
	Walking without moving forward.	3-5/1-2	1
	Standing hip hyperextension	3-5/1-2	1
	Standing hip abduction adduction	3-5/1-2	1
	Sitting shoulders back	3-5/1-2	1
	Sitting scapular adduction	3-5/1-2	1
	Sitting, lowering arms forward sideways and down	3-5/1-2	1
	Sitting neck ROM exercises	3-5/1-2	1
	NMES	30 minutes/1	1
	Walking	10-20 meter	1
3th postoperative day	Active breathing cycle exercises+incentive spirometry	3-5/1-2	2
	In-bed joint range of motion exercise	10/1-2	2
	Knee flexion extension by sitting on the bedside	10/1-2	2
	Walking without moving forward	10/1-2	2
	Standing hip hyperextension	10/1-2	2
	standing hip abduction adduction	10/1-2	2
	Standing shoulders back	10/1-2	2
	Standing scapular adduction	10/1-2	2
	Standing, lowering arms forward sideways and down	10/1-2	2
	Neck ROM exercises	10/1-2	2
	NMES	30 minutes/1	2
	Walking	50-100 meter/ 1-2	4
	Sitting on chair	15 minutes	3
	Same exercises(with the exception of in-bed exercises)	10/1-2	2
4th postoperative day	NMES	30 minutes/1	2
	Walking	100-150 meter/ 1-2	4
	Sitting on chair	20-30 minutes	3
	Same exercises(with the exception of in-bed exercises)	10/1-2	2
5th postoperative day	NMES	30 minutes/1-2	2
	Walking	150-200 meter/ 1-2	4
	Stair exercises	5 steps up and down	2
	Sitting on chair	30-45 minutes	3
	Same exercises(with the exception of in-bed exercises)	10/1-2	2
6th postoperative day	NMES	30 minutes/1	2
	Walking	200-300 meter/ 1-2	4
	Stair exercises	10 steps up and down	2
	Sitting on chair	30-45 minutes	3

for this situation (32).

In our study, the comparison between the groups on the 7th postoperative day revealed that the saturation values obtained at the end of 2MWT were higher in the CPR group, and the saturation values at the beginning of the test and at rest were higher in the CPR+NMES group. In the literature, hemodynamic values such as heart rate and saturation have been defined as predictors of recovery after CABG (33). The oxygen saturation of 117 participants was shown to decrease after aerobic exercise in a research (34). Another study indicated that following the 6-minute walk test, oxygen saturation dropped in participants (patients without cystic fibrosis) (35). Acute chronic exercise has been shown to diminish oxygen saturation, and desaturation can occur during exercise (36). During activity, despite the same partial oxygen pressure,

hemoglobin oxygen saturation decreases. In other words, the need for oxygen rises. In our study, the fact that the saturation measured at the end of the postoperative 7th day 2MWT in the CPR group did not decrease under normal conditions and there was an increase in oxygen in the capillaries can be attributed to insufficient oxygen transport to the tissues and insufficient passage through the capillaries in the patients in this group. However, the fact that the saturation level was low at the end of the test in the CPR+NMES group and that it was measured high at the beginning and at rest indicates that NMES may have increased myocardial relaxation and thus facilitated the separation of oxygen from hemoglobin. In addition, we can claim that patients in this group did not enter into oxygen debt at rest after walking. When the temporal changes were examined, there was no superiority between the groups among the mentioned hemodynamic values. The fact that cardiopulmonary rehabilitation could not be applied in the preoperative period and not continued for a long time after surgery may have served to limit its effect on hemodynamic parameters.

In our study, in the comparisons between the groups made on the 7th postoperative day, it was observed that the CPR+NMES group was less tired before the 2MWT and at rest compared to the CPR group, while the CPR group was less tired after walking. In addition, dyspnea levels were observed as lower in the CPR+NMES group before 2MWT and in the resting CPR group. Cebeci and Celik (37) found in their study that 48.1% of patients who underwent CABG experienced lethargy, weakness and fatigue even one month after discharge. We think that the fatigue levels do not show a parallel variation according to the groups due to the fact that our study was conducted in the early phase of phase I CPR, and the patients could not fully rest due to the continuation of myocardial revascularization. The CPR+NMES group, which started the test with a lower level of fatigue and dyspnea, may have completed the test at a faster pace and finished the test with higher fatigue than the other group. Therefore, although dyspnea levels at the end of the test did not differ between the groups, it was observed that the dyspnea level of the resting CPR group was lower than the CPR+NMES group. The reason for the decrease in fatigue in the resting CPR+NMES group can be explained by better LV functions, good myocardial relaxation, comfortable delivery of oxygen to the tissues, and thus better lactic acid tolerance than the other group. Furthermore, it is well understood that increased left ventricule filling pressures and pulmonary capillary wedge pressure cause ventilation perfusion anomalies, which negatively affect the gas exchange response during exercise (38).

The comparison of the number of SST repetitions between the groups on the postoperative 7th day, which is the other evaluation parameter we used to determine functional capacity in our study, showed that there was more change in the CPR group. This test is meant to determine physical capacity and low-limb muscular endurance, and it is a low-risk test that can be performed in clinical practice (39). In addition, in one study, it was reported that the exercise intensity of 2MWT was higher than the intensity of SST (40). In our study, we performed the SST 10 minutes after the 2MWT was finished; this may be due to the higher 2MWT resting dyspnea in the CPR+NMES group and the fact that the initial SST repetition number of the CPR group started from a lower level and reached a value close to the CPR+NMES group. No difference was observed in the temporal change of SST repeat numbers. We think that this is due to the fact that we applied SST in the early phase while the effects of CABG surgery were ongoing, specific lower extremity strengthening exercises were not included in the program as in phase II and phase III studies, and the duration of the program was short.

When CWM were compared, no difference was observed between groups and in terms of temporal changes. Early deep breathing exercises following CABG surgery help to keep pulmonary function in good shape (46). The fact that we used active respiratory cycle exercises and incentive spirometry in both groups, and that exercise applications were performed only for 5 days and in the early period, may be supporting the lack of difference between the groups. In addition, if pulmonary function tests were included in our study, CWM of the groups could be compared in more detail.

In our study, the absence of preoperative evalua-

tions and pulmonary function tests and the short study period can be mentioned among the limitations.

In conclusion, in our early CABG study, LV diastolic functions were preserved after surgery in the CPR+NMES group with the use of NMES, and there was a significant increase in walking distance on the 7th postoperative day according to the comparison between the groups. Further research is needed to evaluate these results by gender, age groups, intensive care parameters and graft types.

Sources of Support: The authors received no institutional and financial support for the research and/or authorship of this article.

Conflict of Interest: Authors declare that there is no conflict of interest.

Author Contributions: All authors have read and approved the paper, they have met the criteria for authorship.

Explanations: None.

Acknowledgements: None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)45-53

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Received: *14.07.2021 (Geliş Tarihi)*
Accepted: *26.05.2022 (Kabul Tarihi)*

GREATER EFFECT OF AUDITORY STIMULI THAN VISUAL STIMULI ON ANTICIPATORY POSTURAL ADJUSTMENTS INCREASE

ORIGINAL ARTICLE

ABSTRACT

Purpose: The role of visual stimuli as the primary stimulus and the effect of auditory stimulus before external perturbation on Anticipatory Postural Adjustments (APAs) releases has been investigated, but which type of stimulus (auditory or visual) before perturbation has a more significant effect on initial APAs release, needs to be investigated. So, this study aimed to investigate the role of visual-auditory contributions before external perturbation on APAs and the effect of stimulus presentation on the release of APAs at different time intervals.

Methods: Participants in this study were fourteen physical education students (Meanage 22.4 ± 2.14 years) exposed to five trials of visual stimulus and five trials of an audible stimulus (80 dB) while standing on the Biodex balance sheet. Then, 1.4 seconds after presenting the stimulus, external perturbation was applied. Electromyography (EMG) activity of the postural muscles was recorded during all trials. APAs were extracted at intervals of -100 to 50 ms (APA1), 50 to 200 ms (APA2), and 200 to 350 ms (APA3). The mixed ANOVA and repeated measures analysis of variance with Bonferroni correction test were used for data analysis.

Results: The results showed that the presentation of visual and auditory stimuli increased the APAs of the postural muscles. According to these results, APA3 was greater than APA2 and APA2 than APA1 ($P \leq 0.05$). Also, the results showed that auditory stimulus increased the APAs of the postural muscles more than the visual stimulus ($P \leq 0.05$).

Conclusion: Generally, the researchers concluded that providing an auditory stimulus before perturbation has a greater effect on APA than a visual stimulus in healthy young girls. Therefore, it is suggested that in order to prevent imbalance or maintain greater balance, auditory stimuli with appropriate intensity can be used. Furthermore, subsequent research on this topic could include comparing APA release under the influence of visual and auditory stimuli in men and women, athletes and non-athletes, and healthy individuals with individuals with mobility impairments.

Keywords: Anticipatory Postural Adjustment, Auditory Stimulus, Electromyography, Muscles, Postural Balance

ANTİSİPATUAR POSTÜRAL DÜZENLEME ARTIŞINDA İŞİTSEL UYARANLARIN GÖRSEL UYARANLARDAN DAHA BÜYÜK ETKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Eksternal perturbasyonlar öncesinde primer uyaran olarak verilen görsel uyarıların ve de işitsel uyarıların Beklenen Postural Düzeltmelerdeki (BPD) salınımlar üzerine etkisi araştırılmış olmakla birlikte hangi tür uyarının (işitsel veya görsel) perturbasyon öncesindeki başlangıç BPD salınımları üzerine etkisinin daha belirgin olduğunun incelenmesi gereklidir. Bu nedenle, bu araştırmada BPD'lerde dış perturbasyon öncesi görsel-işitsel katkıların rolünün ve farklı zaman aralıklarındaki uyaran sununun BPD salınımlarına etkisinin tespit edilmesi amaçlanmıştır.

Yöntem: Bu çalışmanın katılımcıları, Biodex denge zemini üzerinde ayakta dururken beş görsel ve beş işitsel uyaran denemesine (80 dB) maruz bırakılan 14 beden eğitimi öğrencisi idi (ortalama 22,4±2,14 yaş). Uyaran verildikten 1,4 saniye sonra eksternal perturbasyon uygulandı. Tüm uyaran denemeleri sırasında postural kasların elektromyografi (EMG) aktivitesi kaydedildi. BPD'ler -100 ila 50 ms (BPD1), 50 ila 200 ms (BPD2) ve 200 ila 350 ms (BPD3) aralıklarında çıkarılmıştır. Veri analizinde kombine varyans analizi ve tekrarlı ölçümlerde varyans analizi Bonferroni düzeltme testiyle kullanılmıştır.

Sonuçlar: Sonuçlar, görsel ve işitsel uyaranların postural kasların BPD arttırdığını göstermiştir. Bu sonuçlara göre BPD3, BPD2'den ve BPD2, BPD1'den daha büyüktür ($P \leq 0.05$). Ayrıca sonuçlar, işitsel uyaranın görsel uyarana göre postural kasların BPD'lerini daha fazla arttırdığını göstermiştir ($P \leq 0.05$).

Tartışma: Genel olarak araştırmacılar, sağlıklı genç kızlarda perturbasyondan önce işitsel uyaran sağlamanın görsel bir uyarana göre daha büyük bir etkiye sahip olduğu sonucuna varmışlardır. Bu nedenle dengesizliği önlemek veya dengeyi daha fazla korumak için uygun yoğunlukta işitsel uyaranların kullanılması önerilmektedir. Ayrıca, bu konuyla ilgili sonraki araştırmalarda, görsel ve işitsel uyaranların etkisi altındaki BPD salınımı erkek ve kadınlar, sporcu ve sporcu olmayanlar, sağlıklı ve hareket bozukluğu olan bireyler arasında karşılaştırılarak incelenebilir.

Anahtar Kelimeler: Beklenen Postural Düzeltmeler, İşitsel Uyaranlar, Elektromiyografi, Kaslar, Postural Denge.

INTRODUCTION

To maintain the stability of the postural in leg and trunk muscles, the CNS uses two main mechanisms: Compensatory Postural Adjustments (CPAs) and Anticipatory Postural Adjustments (APAs) (1). APAs are an essential mechanism for maintaining the balance that ensures adequate readiness to prevent the occurrence of the disorder before work or dealing with the external environment (2). APAs arise when the perturbation is predictable and controlled by feedforward mechanisms (3). The feedforward mechanisms can be classified into early postural adjustment (EPA) or anticipatory. EPA can be perceived much prior to classical APA, and its goal is to "confirm sufficient mechanical situations" for imminent action. Although EPA and APA are different in quantity and quality in most studies, they are heeded to be one mechanism and are addressed as APA (4).

Previous studies have shown that muscle activation for APAs is related to the primary motor cortex, supplementary motor areas, basal ganglia, and spinal cord (5). Many factors such as the type of perturbation created, the person's level, the static and dynamic conditions, virtual reality, dual cognitive tasks, and attention affect APAs (6-8). On the other hand, research has shown that stimulus-driven attention modulates the onset of APA (2, 6). Furthermore, modulating the activity of sensory areas before presenting the primary stimulus leads to facilitating and inhibiting the processing of sensory information from the sensory stimulus in the presence and absence of attention (6).

The results of previous studies showed that directing attention to the auditory stimulus that was presented 1.4s before the primary visual signal resulted in changes in the release of APAs and their modulation (9). In another study, it was demonstrated that when step initiation is elicited by a "go" sign (for example, in a reaction time task), the presentation of an unpredictable, intense stimulus at the same time or just before the imperative signal was present could trigger early phases of APAs (10).

Also, the effect of differing intensities of auditory stimuli on the release of APAs varied, and higher intensity stimuli led to the production of larger APAs. The initial release of APAs by low or severe stimuli indicates the involvement of different mechanisms in APA initiation (11). It is unclear whether the releasing APAs depends on the attention given to the stimulus or on the stimulus characteristics such as stimulus intensity or type of stimulus presented (9). About comparing the effects of visual and auditory stimuli and their effects on body balance control during a reaction time task, studies have shown that as the complexity of the equilibrium task is greater, the presentation of auditory stimuli than the visual stimulus lead to more interference with the reaction time task. These results suggest that different attentional processes influence the sensory and motor elements of posture control (12).

As observed in previous research the type of stimulus presented is often related to the study of the stimulus auditory and its effect on the initial release of APAs before or at the same time as the main stimulus or external disturbance ('go' command for the subjects). No research, was found on the effect of visual stimuli on the release of primary APAs. It is also unclear whether the timing of stimulus delivery before external perturbation has a different effect on APA emissions. Therefore, the first hypothesis was that auditory and visual stimuli before external perturbation had different effects on the initial release of APAs. Also, the second hypothesis was that auditory and visual stimuli before external perturbation has different effects on APAs at different time intervals.

METHODS

Participants

Fourteen (13) female students of the University of Tehran (22.4±2.14 years) were selected based on inclusion criteria. They participated in the study through a call-up to the physical education and sport sciences faculty. The previous literature about the gender balance differences, examined and since that APA effect on balance, this subject considered (14, 15). The sample size calculated (n=14 people) with G-power software for repeated measure statistical method and considering with 80% power, effect size: 0.4, and α= 0.05.

Participants completed the informed consent form.

This research has been approved by the Department of Learning and Motor Control (local committee) in the form of meeting 27 and is on March 11, 2017. It has been done from December 2018 until the end of January 2019.

Inclusion criteria were that the participants were healthy and had no vision problems, no orthopedic injury, fracture, surgery history and no movement problems. They were in the age range of 22 to 25 years. The criterion for leaving the research was an unwillingness to continue cooperation or creating any inability to perform the test.

The test was performed in a laboratory setting. Other instruments and objects that might have affected the presentation of the visual stimulus were moved to another point in the laboratory, and additional auditory stimuli were controlled by performing a single test without the presence of additional individuals.

Instrument

Biodex Balance System

Biodex Balance System (BBS) (Biodex Medical Systems, Shirley, NY, USA, Model: SW45-30D-E617) is used to evaluate the balance. The person stands on a firm and stable platform, and then, the individual's response to an imbalance in the anterior-posterior and internal-external directions is measured (16). In the present study, the BBS was used to cause external perturbation.

Electromyography Apparatus

The 16-channel surface Electromyography (EMG) apparatus ME 6000 (Mega Electronics Ltd., Kuopio, Finland) was used. The electromyography data were recorded at frequencies of 2000 Hz. It is noteworthy that, in the present study, the band-pass filter with a cut-off frequency of 10 to 500 Hz is used to reject the out-of-band noise.

Software designed by the researcher for providing audio-visual stimuli

The researcher designed this software, which was installed on the laptop (Taban visual-auditory stimulus device, Tehran, Iran). Examiner after entering the desired time of and performance after the chosen time, presented the auditory or visual stimulus (the type of stimulus, its intensity, or the color of the stimulus) through the screen or laptop speakers. Visual stimuli were presented using a horizontal plate of red LED light located 1 m away from the subject's eye, and a speaker provided an 80 dB acoustic stimulus at the same distance (17).

Protocol

The electromyography with electrode installation was used to record the electrical activity of the selected postural muscles containing thighs such as rectus femoris (RF), tibialis anterior (TA), gastrocnemius (GA), vastus intermedius (VI), biceps femoris (BF), and erector spinae (ES). It is noteworthy that these lower limb muscles most frequently have postural stability (18-21). The electrodes were disposable, and their conductivity center diameter was one centimeter. The electrode method was bipolar, and both electrodes' center distance was 20 mm. The European project surface EMG for non-invasive assessment of muscles (SENIAM) was followed to determine the location of electrodes on selected muscles (22).

After installing the electrodes, the subject stood on the BBS without the shoe while his hands were next to his body. Visual (red LED light) or auditory stimuli (80 dB) appeared. In general, 10 trials, including audio stimulus, 5 trials, and 5 with visual stimulus inserted. The order of providing visual and auditory stimuli in the form of counterbalance was considered. It means that the presentation of visual and auditory stimuli was random so that the participants did not know whether the next stimulus was presented visually or auditory. Then, to exert external perturbation, the subject was placed in a state of instability and imbalance by moving the foot platform (platform mode at level 1 was located) (23) 1.4 seconds after the providing stimulus. EMG recording was performed at a frequency of 2000 during all trials.

The APA Calculation

APAs were calculated according to the previous study (1):

The stimulus presentation time was specified as the reference time (T0) on the EMG data. This value was approved by visual scrutiny by an experienced researcher. Data based on T0, in the range from -600 ms (before T0) to +1000 ms (after T0),

were selected for analysis.

The integrals of the muscles' EMG activities (IntEMGi) were calculated over four intervals, each lasting 150 ms. Time windows for 4 epochs based on the study of Kankar and Aruin (24) were Include: a) from -250 ms to -100 ms (APA1), b)-100 ms to + 50 ms (APA2), c) + 50 ms to + 200 ms (compensatory reactions, CPA1) and + d) 200 ms to + 350 ms (CPA2). But given that in this study, external perturbation was 1.4 seconds after stimulus presentation. Therefore, time windows for 3 epochs containing: a) from -100 ms to + 50 ms (APA1), b) + 50 ms to + 200 ms (APA2), and c) + 200 ms to + 350 ms (APA3) were considered.

The IntEMGi of each of these three epochs was modified based on the IntEMGi of baseline activity from -600 ms to-450 ms for T0 as follows:

Formula 1 (25)

$$Int_{EMG_i} = \int_{tw_i} EMG - \int_{-600}^{-450} EMG$$

That IntEMGi is equal to the integral of the EMG activity of each muscle at time intervals from 150 ms (twi, i = 1)

And

$$\int_{-600}^{-450} EMG \quad \textbf{(25)}$$

150 ms of baseline muscle activity that is defined as the integral of EMG activity in the interval of -600 to -400 ms relative to T0. The peak of muscle activity then normalizes the EMG activity integral calculated from formula 1 according to formula 2.

Formula 2 (25)

$$IEMG_{NORM} = \frac{Int_{EMG_i}}{IEMG_{\max}}$$

Statistical Analysis

Shapiro-Wilk test was used to assess the normality of the distribution of the scores, and Levene's test was used for equality variances. 6 (muscles) × 2 (stimulus) mixed ANOVA was used to compare different stimuli at different APA time intervals separately. Also, 6 (muscles) × 2 (stimulus) mixed ANOVA was used for the effect of each stimulus (visual-auditory) on different APAs. Post hoc tests (P≤0.05) were conducted using the Bonferroni correction test. First, EMG data analysis was performed with MATLAB13a software. It should be noted that all of these analyzes were performed with IBM SPSS 21 software.

RESULTS

The information of 14 participants is shown in Table 1.

Table 1. The Information of Participants

	Mean	Standard Deviation
Age (years)	22.4	2.14
Height (cm)	165.3	5.8
Weight (kg)	60.8	6.3

Descriptive information on APA of postural muscles at different time intervals under the influence of visual and auditory stimuli is shown in Table 2. The Effect of Visual Stimuli on APA

The mixed analysis of variance showed that the main effect of the muscles (F (5, 78) = 64.214, P =3×10−2, n2p= 0.805) was significant. Post hoc analysis using Bonferroni correction showed the level of activity of RF (0.377), VI (0.340), BF (0.224), GA (0.24), and TA (0.187) had the highest. Furthermore, ER (0.121) had the lowest activity.

Also, the main effect of time (F (2.156) = 352.963, P =1×10−5, n2p= 0.819) and interaction time * group (F (10, 156) = 14/169, P =1×10−1, n2p= 0.476) were significant. Bonferroni correction for main effect of time showed that the APA3 (0.377 ± 0.008) was greater than APA2 (0.251 ± 0.008; P =41×10−2) and APA1 (0.126 ± 0.006; P =4×10−3) after visual stimulus presentation. Also, the APA2 was significantly greater than the APA1 after the visual stimulus presentation (P =1×10−2). Thus, the effect of visual stimulus presentation on APA released at different intervals and the difference in APA release at different intervals due to visual stimulus presentation in a balance task was significant.

Table 2. APA's descriptive information at different time intervals under visual and auditory stimulus conditions.

Stimulus	Muscle	APA 1 (- 100 to +50 ms)	APA 2 + (50 to 200 ms)	APA 3 + (200 to 350 ms)
		Mean ± SD		
Visual	RF	0.02 ± 0.04	0.24 ± 0.06	0.45 ± 0.06
	TA	0.04 ± 0.06	0.19 ± 0.05	0.32 ± 0.07
	GA	0.28 ± 0.05	0.34 ± 0.07	0.50 ± 0.07
	VI	0.22 ± 0.05	0.31 ± 0.08	0.47 ± 0.06
	BF	0.11 ± 0.05	0.32 ± 0.09	0.30 ± 0.10
	ES	0.07 ± 0.02	0.09 ± 0.04	0.19 ± 0.02
Auditory	RF	0.24 ± 0.06	0.50 ± 0.1	0.57 ± 0.07
	TA	0.19 ± 0.05	0.32 ± 0.06	0.44 ± 0.06
	GA	0.34 ± 0.07	0.47 ± 0.11	0.54 ± 0.07
	VI	0.31 ± 0.08	0.41 ± 0.07	0.52 ± 0.05
	BF	0.32 ± 0.09	0.33 ± 0.09	0.40 ± 0.09
	ES	0.06 ± 0.03	0.21 ± 0.03	0.29 ± 0.06

RF "rectus femoris", TA "tibialis anterior", GA "gastrocnemius", VI "vastus intermedius", BF "biceps femoris" and ES "erector spinae"

The Effect of Auditory Stimuli on APA

The mixed analysis of variance showed that the main effect of the group (F (5, 78) = 43.092, P =4×10−2, n2p= 0.734) was significant. Bonferroni correction test showed RF (0.33), VI (26.26), BF (0.22), GA (0.15), and TA (0.14) muscles had the highest level of activities. However, ES muscle (0.1) had the lowest activity.

Also, the main effect of time (F (2, 156) = 219.869, P =4×10−4, n2p= 0.738) was significant, meaning that the postural muscles' APA was significantly different at different time intervals. The Bonferroni correction showed that APA3 (0.466 ± 0.008) was greater than APA2 (0.378 ± 0.01; P =8×10−1) and APA1 (0.220 ± 0.007; P =1×10−3) after presentation of auditory stimuli. Also, the APA2 was significantly higher than the APA1 (P =3×10−2). Thus, the effect of auditory stimulus presentation on APA release at different intervals and the difference in APA release at different intervals was due to the presentation of an auditory stimulus in a balance task.

Comparison of Visual and Auditory Stimuli in APA1 of Different Postural Muscles

The mixed analysis of variance showed that the main effect of the muscles (F (5, 78) = 56.181, P =1×10−2, n2p= 0.783) was significant. The level of activity of GA (0.307), VI (0.245), ES (0.17), BF (0.122), and TA (0.092) had the highest. However, RF (0.063) had the lowest activity.

Furthermore, the main effect of stimuli (F (1, 78) = 202.257, P =2×10−2, n2p= 0.722) was significant. There was a significant difference between APA1 of postural muscles induced to visual and auditory stimuli. Bonferroni correction showed (Figure 1) that the APA1 of the postural muscles after the presentation of visual stimulus (0.126 ± 0.006) was significantly less than the auditory stimulus (0.204 ± 0.007).

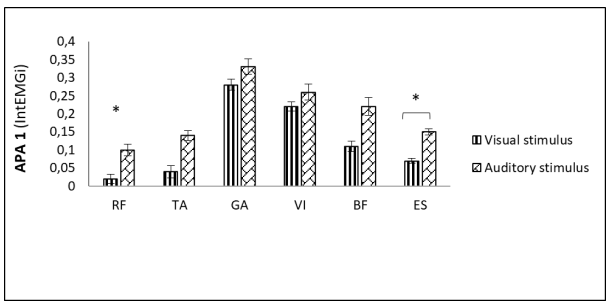

Figure 1. Comparison of visual and auditory stimuli in APA1 of different postural muscles. RF: Rectus Femoris, TA: Tibialis Anterior, GA: Gastrocnemius, VI: Vastus Intermedius, BF: Biceps Femoris, and ES: Erector Spinae. *P<0.05

Comparison of Visual and Auditory Stimuli in APA2 of Different Postural Muscles

The mixed analysis of variance showed that the main effect of the groups was significant (F (5, 78) = 28.134, P =3×10−1, n2P= 0.643). The level of activity of GA (0.409), RF (0.377), VI (0.366), BF (0.325), and TA (0.264), muscles had the highest. Nevertheless, ES (0.155), had the lowest activity.

Also, the main effect of stimuli (F (1, 78) = 150.519, P =6×10−2, n2p= 0.659) was significant, meaning that there was a significant difference between APAs of the postural muscles due to visual and auditory stimuli. The results of the Bonferroni correction showed that the APA2 after visual stimulus presentation (0.225 ± 0.008) compared to auditory stimulus presentation (0.378 ± 0.01;) was significantly less (Figure 2).

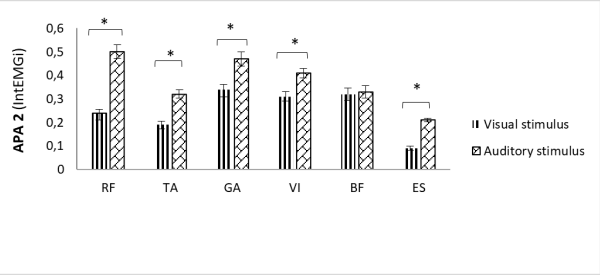

Figure 2. Comparison of visual and auditory stimuli in APA2 of different postural muscles. RF: Rectus Femoris, TA: Tibialis Anterior, GA: Gastrocnemius, VI: Vastus Intermedius, BF: Biceps Femoris, and ES: Erector Spinae. *P<0.05

Comparison of Visual and Auditory Stimuli in APA3 of Different Postural Muscles

The mixed analysis of variance showed that the main effect of the groups (F (5, 78) = 49.216, P =9×10−2, n2p= 0.759) was significant. The level of activity of GA (0.525), RF (0.513), VI (0.501), BF (0.354), TA (0.384), and ES (0.249) muscles had the lowest.

Also, the main effect of stimuli (F (1, 78) = 81.084, P =1×10−1, n2p= 0.510) was significant. In other words, there was a significant difference between APA3 of postural muscles induced to visual and auditory stimuli. Bonferroni correction results showed that the APA3 after visual stimulus presentation (0.377 ± 0.008) compared to auditory stimulus presentation (0.466 ± 0.008) was significantly less (Figure 3).

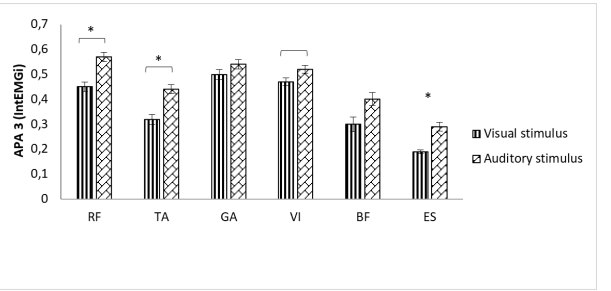

Figure 3. Comparison of visual and auditory stimuli in APA3 of different postural muscles; RF: Rectus Femoris, TA: Tibialis Anterior, GA: Gastrocnemius, VI: Vastus Intermedius, BF: Biceps Femoris, and ES: Erector Spinae. *P<0.05

DISCUSSION

The first finding of the present study showed that visual and auditory stimuli during a balance task increased the APA of the postural muscles. This increase starts simultaneously with the stimulus presentation (from APA1 to APA3) respectively gets bigger after stimulus presentation. These findings are consistent with the findings of research, which specified APAs could be induced by an acoustic stimulus or a visual stimulus. Visual information is usually serious to create effective APAs prior to postural disruption. Preceding studies similarly reported that healthy young adults could be dependent on an auditory cue to produce postural responses to outer perturbation (26). All the researchers stated that when larger APAs were produced for an external postural perturbation, less postural instability was detected. Thus, both visual and auditory cues can help maintain greater balance against perturbation by producing greater APA. Using the contribution of different senses, especially vision, can help a person produce the appropriate APA by providing a perturbation alerting cue. People rely seriously on past experiences to create the expected external perturbation and produce the suitable APA. These experiences are mainly obtained through vision and facilitate the production of APA for external postural perturbations. The important point is that when a move is triggered voluntarily by the person, the individual can optimize the APA. However, when the task is unexpected, APA is not optimized. The same reports have been confirmed for auditory cues, which, as a conditioning stimulus, can trigger APA in healthy individuals against an external perturbation in youth adult (26).

It is also in line with the results of studies that showed attention directed to stimuli moderates the onset of APA (2, 10). Delval et al., (2012) stated that APA is propagated during the preparation period between an alert stimulus to the original "go" initiation stimulus, although the release of APA occurred merely when individuals were told explicitly about the task to be performed. This means that in their research, when people were told to do no task and not respond to stimuli, release APA was not observed, however when they were told the stimuli were within a range of 5 to 10 seconds before the primary signal appeared for the gait, the release of APA is observed (10). Therefore, given that in the present study, similar to the study by Delval et al. (2012), subjects were explicitly told that visual or auditory stimuli appear before external perturbation, it is clear that the presentation of these stimuli would prompt early release postural adjustments before external perturbation.

In addition, study results showed that attention allocation occurs in the prediction of a postural disruption and during initial processing before motor adjustments against the perturbation. These findings are consistent with results by Redfern et al (2017), who compared the effects of visual and auditory stimuli and their effect on body balance control in a reaction time task. They showed that as the complexity of the balance task is greater, the presentation of auditory stimuli than the visual stimulus results in more interference with the reaction time task appeared (12). Recent studies have shown that higher cognitive resources are necessary to maintain balance and integrate functional systems involved in sensory-motor processing, especially in challenging environments. Modifications of sensory information processing related to attention lead to better motor performance involuntary movements in response to visual stimuli. Also, modulation of sensory information processing about attention has been observed for visual, auditory, and tactile information (12).

The second finding of the current study showed that APAs in postural muscles were more affected by auditory stimuli than visual stimuli. The benefits of this type of measurement were investigating of postural stimuli simultaneously and after stimulus presentation. This significant increase between postural adjustments at the concurrent time intervals (APA1) and after the presentation of stimuli (APA2 & APA3) under the influence of auditory stimuli is significant compared to visual stimuli. Hence, it indicates that auditory stimuli can support the balance than visual stimuli. The study results are mainly consistent with Watanabe et al. (2017). They stated that auditory stimuli had a more significant effect on APA than visual stimuli in a choice step reaction. However, investigation of this study is differed from their study. In their research, the APA period was as the interval between the reaction time to foot lift time when moving and they computed the amplitudes of APAs as a percent of body weight from the peak vertical force under the swing foot in the period of APA duration was considered. However, in the present study, APAs were evaluated for lower limb muscle activity. They also stated that when auditory stimuli are present, the amplitude of APA error in mistake attempts increases. Step initiation, in some times to avoid threatening situations, usually occurs under such conditions at which concurrently happening events may call for irreconcilable responses. If APAs are affected by those sensory inputs processed in the brain in negative ways, then it is likely for adverse or unsafe consequences, such as falls, to occur (17). These result repeated in the other study and researchers stated that auditory stimulus might assist a step initiation, credibly by enabling a stimulus identification process and increasing attentional control of stepping behavior, without inducing a decision-making procedure even in a cognitively demanding condition in patients with PD (27).

Thus, it can be said that auditory stimuli may have beneficial effects on APAs, although these effects can be moderated by the duration of stimulus presentation, frequency, and intensity of stimuli. Because, Delval et al (2012) investigated the effect of audible stimulus presentation at different intensities on APA release and observed that different auditory stimulus intensities produced different APAs, and the more intense the stimulus, the greater APA produced (10).

Also noteworthy is the magnitude of the impact of auditory stimuli on wrong responses. In a study, showed that APA error amplitude increases during the presence of auditory stimuli in error attempts.

Thus, auditory stimuli cannot be used to reduce muscle activity latency, especially under threatening conditions without sufficient research, particularly in those at higher risk of falls. For example, in some cases initiating steps to avoid threatening situations usually occur in situations where some concurrent events may require incompatible responses (17). In general, it seems that the mechanism of the auditory cue is different from the visual cue because the auditory cues provides people timing information. Therefore, the participants were able to rely on a new form of sensory information to calculate the postural perturbation and generate appropriate APA (26).

Finally, it can be said given that different perceptual processes can affect the sensory and motor elements of postural control while performing a balance task, APA decrease as a result of auditory stimuli relative to visual can be related to different mechanisms of visual and auditory processing. Because balance is also affected by APA and as a feedforward mechanism helps maintain balance through anticipation, auditory and visual stimulus evaluation in people at risk needs to be investigated.

The main limitations of in this study was to participants were explicitly told that after the stimuli presentation, there will a perturbation in the plate below their feet. So not using a baseline position in this study was one of the limitations of the study. Therefore, this suggest that future researchers consider the use of a baseline position, a position in which individuals are exposed to visual and auditory stimuli without any perturbation in the APA examination. In addition to, the other limitations were the low number of participants, and only young women. It suggests that the researchers in the future studies will be considered the higher number and with individual with the different genders (men). The last suggestion is to consider the combined presentation of visual and auditory cues to see if they will have a greater impact on APA.

Contributors: TABAN SAEEDIAN: concept, design, resources and financial support, materials, data collection and or processing, literature search; MEHDI SHAHBAZI: design, supervision, resources and financial support, materials, g, analysis and or interpretation, writing manuscript, and critical review; SHAHZAD TAHMASEBI BOROUJENI: design, materials, literature search, writing manuscript, and critical review; HOUMAN MINOONEJAD: concept, materials, data processing.

Sources of Support: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflict of Interest: The authors confirm no known conflicts of interest regarding the work described in the current manuscript.

Author Contributions: All authors have read and approved the paper, and they have met the criteria for authorship.

Explanations: None.

Acknowledgments: Data collection for this study was performed in the Motor Behavior Lab of the University of Tehran, and we thank all the participants.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)54-62

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Received: *6.08.2021 (Geliş Tarihi)*
Accepted: *9.03.2022 (Kabul Tarihi)*

THE EFFECTS OF SHOE SUITABILITY ON PLANTAR PRESSURE DISTRIBUTION AND BALANCE PARAMETERS IN CHILDREN WITH HEARING IMPAIRMENT

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this study was to investigate whether the characteristics of the shoes used by the children have an effect on the dynamic and static plantar pressure distribution parameters and balance parameters in hearing impaired children, and to compare the results with those of non-hearing-impaired children.

Methods: The study included 136 children, 68 children with hearing impairment and 68 children without hearing impairment. The Footwear Assessment Score (FAS) was applied to evaluate children's footwears. Flamingo Balance Test (FBT) was used to evaluate the static balance of the children, and the Functional Reach Test (FRT) was used to evaluate the dynamic balance of the children. Static and dynamic plantar pressure distribution measurements of the children were carried out with a sensored walking platform (Footscan® pedobarography system (RsScan-FootScan lab ltd., Ipswich, England)).

Results: In hearing impaired children, a positive relationship was found between FAS and dominant foot total percentage of pressure values. In children without hearing impairment, there was a negative relationship between FAS and dominant hindfoot pressure, and a positive relationship between FAS and anterior non-dominant foot pressure ($p<0.05$). There was no significant relationship of FAS with balance tests, dynamic plantar pressure values, and walking parameters in both groups ($p>0.05$).

Conclusions: The increase in static loading with the footwear suitability on the dominant foot in hearing impaired children may be an indication that children with balance problems load more on the dominant foot in order to feel safer.

Key Words: Balance, Footwear, Hearing Impaired, Plantar Pressure Distribution

İŞİTME ENGELLİ ÇOCUKLARDA AYAKKABI UYGUNLUĞUNUN AYAK TABAN BASINÇ DAĞILIMI, DENGE VE YÜRÜME FONKSİYONU ÜZERİNE ETKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı, işitme engelli çocuklarda çocukların kullanmış olduğu ayakkabılara ait özelliklerin dinamik ve statik plantar basınç dağılım parametreleri ve denge parametreleri üzerine etkisinin olup olmadığını araştırmak ve işitme engeli olmayan çocuklarla karşılaştırmaktı.

Yöntem: Çalışmaya 68 işitme engelli ve 68 sağlıklı olmak üzere toplam 136 çocuk dahil edildi. Çocukların ayakkabılarını değerlendirmek amacıyla Ayakkabı Uygunluğu Değerlendirme Formu (AUDF) uygulandı. Çocukların statik dengesini değerlendirmek için Flamingo Denge Testi (FDT), dinamik dengesini değerlendirmek için Fonksiyonel Uzanma Testi (FUT) kullanıldı. Çocukların statik ve dinamik ayak tabanı basınç dağılım ölçümleri sensörlü yürüyüş platformu (Footscan® pedobarografi sistemi (RsScan-FootScan lab ltd., Ipswich, England)) ile gerçekleştirildi.

Sonuçlar: İşitme engelli çocuklarda dominant ayağa ait AUDF ile toplam yüklenme oranı değerleri arasında pozitif ilişki; sağlıklı çocuklarda ise dominant ayağa ait AUDF ile ayağın arka bölümüne yapılan yüklenme oranı arasında negatif ve non-dominant ayağa ait AUDF ile ayağın ön bölümüne yapılan yüklenme oranı değerleri ile arasında pozitif ilişki olduğu gözlemlendi ($p<0,05$). Her iki grupta AUDF ile denge testleri, dinamik ayak taban basınç değerleri, yürüme parametreleri arasında anlamlı ilişki bulunmadı ($p>0,05$).

Tartışma: İşitme engelli çocuklarda ayakkabı uygunluğunun dominant ayakta statik yüklenme oranı ile artış göstermesi denge problemi olan çocukların kendilerini daha güvende hissetmek için dominant ayağa daha fazla oranda yüklendiklerinin bir göstergesi olabilir.

Anahtar Kelimeler: Denge, Ayakkabı, İşitme Engelli, Taban Basınç Dağılımı.

INTRODUCTION

The hearing system has three main components: outer, middle and inner ear. The outer ear collects sound waves and channels them to the ear canal. The middle ear converts sound waves into mechanical motion, and the inner ear converts this into electrical energy (nerve impulses). Various pathologies may affect one or more of these structures, causing hearing loss (1). Bilateral permanent childhood hearing impairment affects approximately 1 to 1.3 of every 1000 live births (2).

In children with hearing impairment, there is a lack of sensory organization in postural control. Balance and coordination disorders can be seen in hearing impaired individuals due to the impaired sensory feedback mechanisms (3). Balance is the ability to control the body's position in space for stabilization and orientation in a certain direction (4). Human balance is achieved through a multi-sensory process involving the visual, somatosensory, vestibular, and cerebellar systems. The anatomical and functional integrity of the vestibular system in the inner ear is essential for maintaining balance (5). Vestibular receptors receive stimuli regarding the position of the head in space and produce reflexes playing important roles in basic motor responses (6). However, when the information received from one of the sensory systems is limited (e.g., due to hearing loss), the perception of the spatial position of the body part may be affected, which may decrease postural control (7). Vestibular problems affect many areas of children's development, including static and dynamic balance reactions, coordination, and movement speed (8).

The foot provides balance and support while standing and stabilizes the body during walking. It is the only body part functioning on the outer surface (9). Therefore, footwears have been developed to protect the foot. Footwears are primarily used to protect the foot from injuries caused by uneven floor surfaces and excessive impact due to hard floors, and thereby infection and deformity. As civilizations developed, footwears have also become a fashion-determining product. However, footwear components supporting the foot are often overlooked for the sake of fashion. Footwears should protect the foot, increase friction and stability, absorb shocks, and prevent foot deformities. Choosing the most suitable footwears has a long history and especially the selection of children's footwears is very important (10). However, choosing the appropriate footwear remains a challenge for many people (both clinicians and parents) (11). Footwears are very important for hearing impaired individuals as well as for all children. To our knowledge, no study has been found in the literature examining the effect of shoe properties on balance and plantar pressure distribution in hearing impaired individuals.

The study aimed to investigate whether the effects of footwear properties on the plantar pressure distribution, which can be measured statically and dynamically, and balance parameters are different in hearing impaired children compared to those without hearing impairment.

METHODS

Subjects

The study included 136 children aged 6-18 years: 68 children with hearing impairment attending a state school for the hearing impaired in Ankara and 68 children without hearing impairment attending various state schools. The Gpower 3.1 program was used to determine the number of individuals to be included in the study. During the calculation, it was considered that the relationship between shoe fit and plantar pressure distribution would be at least low-medium level, and the correlation value was taken as r=0.350. When the H0 correlation level was taken as r=0 and power analysis was performed, it was determined that the number of cases that should be included in the study should be 61. A loss of approximately 10% that may occur during the study was taken into account, and the study was completed with 68 individuals. An equal number of individuals were also included in the control group (12). This study was designed as a case-control study. The children were recruited from April to May 2019. Children were divided into two groups as hearing impaired children and those without hearing impairment. In order to conduct our study, permission was obtained from the Ethics

Committee of Hacettepe University (GO 19/1081). Prior to the study, an informed consent form was obtained from the children's families, and the children consented verbally that they volunteered to participate in the study.

In our study, hearing impaired and non-hearing-impaired children who were cooperative and did not have an additional disease affecting the foot and ankle were included in the groups.

Outcome Measures

Demographic information (age, gender, dominant extremity, presence of additional disabilities), height, body weight, and body mass index (BMI) of all children participating in the study were recorded. The types of footwears used by the children were inquired, and their footwear fit was evaluated with the Footwear Assessment Score (FAS). The dynamic balance of the children was evaluated with the Functional Reach Test (FRT) and their static balance was evaluated with the Flamingo Balance Test (FBT). Static and dynamic plantar pressure distributions obtained during static stance and walking were assessed using the pedobarographic analysis method.

Evaluation of Footwear Style and Appropriateness

The FAS was used as an objective method for evaluating footwears. The reliability study of the Turkish FAS was conducted by Yakut et al. (13). The FAS is a valid and reliable scale designed to provide a comprehensive assessment of the footwear and can be effectively applied in clinical/research settings. All categorical items of the FAS are recommended for clinical evaluation of footwear in various populations (14). The highest total score for fit footwears is 15. Higher scores indicate that the footwear is suitable, and lower scores indicate that the footwear is not suitable (15).

Evaluation of Dynamic Balance

The Functional Reach Test (FRT), which was developed to assess balance problems rapidly and its reliability was established by Donahoe et al., was used to evaluate the dynamic balance of children (16). Longer reached distance in this test indicates better balance (17).

Evaluation of Static Balance

The Flamingo Balance Test (FBT) is a Eurofit test used in balance assessment with high reliability and validity, and it is simple, low-cost, and suitable for research in large populations. It is used to evaluate the ability to successfully maintain balance on one leg. To perform the test, only a stopwatch and a narrow balance board with a non-slip surface are required. The number of times the child's balance got disturbed during 60 seconds was recorded. If there was more than 15 falls/ balance losses in the first 30 seconds, the test was terminated (18).

Evaluation of Plantar Pressure Distribution

The examination of the foot plantar pressure distribution between the foot and the support surface where the foot touches is defined as pedobarographic analysis (19). The basic principle in pedobarographic analysis is to map the plantar surface pressure, which indirectly indicates significant postural abnormalities (20). Plantar pressure distribution measurements have the potential to objectively evaluate the effects of clinical practices on foot/ankle function (21). In our study, FootScan® (RsScan-FootScan lab ltd., Ipswich, England) sensor, a walking platform with a 1 m length (this was a limitation for our study), was used for pedobarographic measurements. In static measurements the peak pressures of both feet (N/cm^2), the percentage of pressure on each of the dominant and non-dominant foot (%), and the percentage of pressure on the forefoot and hindfoot (%) of both feet were recorded.

During the dynamic measurement, they were asked to look forward, not focus on the ground, and walk on the platform in the same way they normally walk. They walked five times and measurements were recorded. In dynamic measurements: foot axis angles, maximum and minimum subtalar joint angle values, force (N) and the maximum pressure (N/cm^2) under the 1st-5th fingers, 1st-5th metatarsal, midfoot, and heel medial and heel lateral; foot lengths and foot widths (cm); walking speed (m/second); and step length (cm) were recorded.

What kind of changes footwear causes in foot biomechanics/balance was assessed. We evaluated footwears that children wear frequently. A child can

Table 1: Descriptive Statistics of The Individuals' Demographic Characteristics.

Variables	Hearing-Impaired		Non-Hearing-Impaired			
	Minimum – Maximum	Mean±SD	Minimum – Maximum	Mean±SD	t	p
Age (year)	7 – 15	12.00 ± 2.44	7 – 16	12.69 ± 2.22	-1.728	0.091
Height (cm)	110 – 185	142.29 ± 14.85	146 – 180	159.99 ± 8.76	-8.459	0.012*
Body Weight (kg)	17.40 – 74.60	39.79 ± 14.40	30 – 84	51.47 ± 10.90	-5.335	0.010*
BMI (kg/m²)	12.82 – 33.16	19.03 ± 4.12	13.88 – 32.39	20.00 ± 3.47	-1.496	0.139

*p<0.05. BMI: Body Mass Index, SD: The Standard Deviation.

have very different footwears. All pedobarographic evaluations and static and dynamic balance measurements were performed barefoot.

Statistical Analyses

IBM SPSS 21.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. Demographic characteristics are expressed as means, standard deviations, and min-max values.

The data were normally distributed. Therefore, normally distributed continuous variables of the groups were compared with independent samples t-test. The Chi-square test was used for categorical variables. Pearson correlation coefficient was calculated to determine the relationship between FAS total scores and static foot pressure distribution parameters, FBT, and FRT values by groups. A p-value of <0.05 was considered statistically significant.

RESULTS

Descriptive data of all 136 children, 68 children with hearing impairment and 68 children without

Table 2: A Comparison of Right and Left Shoe FAS Sub-Scores in Children with and without Hearing Impairment.

Variables for Right Shoe (Dominant Foot)	n	Hearing-Impaired		Non-Hearing-Impaired		p
		%	n	%		
Material-Upper	**Leather**	38	55.88	26	38.23	0.042*
	Other	30	44.12	42	61.77	
Material-Outsole	**Syntetic/Rubber**	65	95.58	68	100	0.124
	Other	3	4.42	-	-	
Heel to Ball Length	**Fit**	66	97.05	68	100	0.148
	Not Fit	2	2.95	-	-	
Width of The Shoe	**Fit**	67	98.52	68	100	0.321
	Not Fit	1	1.48	-	-	
Available Room in The Toe Box	**Pinchable**	51	75	36	52.94	0.011*
	Not Pinchable	17	25	32	47.06	
Status of Keeping the Feet in Shoes	**Shoes Slide Off**	31	45.58	34	50	0.609
	Shoes Not Slide Off	37	54.42	34	50	
Heel Height	**> 2.5 cm**	28	41.17	38	55.88	0.049*
	< 2.5 cm	40	58.83	30	44.12	
Shoe Style	**Shoes or Slipper**	5	7.35	1	1.47	0.102
	Boot	3	4.41	-	-	
	Shoes or Boots With A Strap or Lace	60	88.24	67	98.53	

Heel Wear	**>5 mm**	7	10.29	4	5.88	0.348
	<5 mm	61	89.71	64	94.12	
The Length Available for Growth	**0 – 5 mm**	48	70.58	37	54.41	
	6 – 11 mm	13	19.11	20	29.41	0.151
	11 – 20 mm	7	10.31	11	16.18	
Variables for Left Shoe (Non-Dominant Foot)		**Hearing-Impaired**		**Non-Hearing-Impaired**		**p**
		n	**%**	**n**	**%**	
Material-Upper	**Leather**	38	55.88	26	38.23	0.042*
	Other	30	44.12	42	61.77	
Material-Outsole	**Syntetic/Rubber**	65	95.58	68	100	0.124
	Other	3	4.42	-	-	
Heel To Ball Length	**Fit**	66	97.05	68	100	0.148
	Not Fit	2	2.95	-	-	
Width of The Shoe	**Fit**	67	98.52	68	100	0.321
	Not Fit	1	1.48	-	-	
Available Room in The Toe Box	**Pinchable**	50	73.52	37	54.42	0.020*
	Not Pinchable	18	26.48	31	45.58	
Status of Keeping The Feet in Shoes	**Shoes Slide Off**	31	45.58	33	48.52	0.733
	Shoes Not Slide Off	37	54.42	35	51.48	
Heel Height	**> 2.5 cm**	28	41.17	38	55.88	0.049*
	< 2.5 cm	40	58.83	30	44.12	
Shoe Style	**Shoes or Slipper**	5	7.35	1	1.47	0.102
	Boot	3	4.41	-	-	
	Shoes or Boots With A Strap or Lace	60	88.24	67	98.53	
Heel Wear	**>5 mm**	7	10.29	4	5.88	0.348
	<5 mm	61	89.71	64	94.12	
The Length Available for Growth	**0 – 5 mm**	47	69.11	35	51.47	
	6 – 11 mm	14	20.58	25	36.76	0.092
	11 – 20 mm	7	10.31	8	11.77	

*p<0.05. MTP: The Metatarsophalangeal Joint.

hearing impairment, are given in Table 1. A comparison of the height (p=0.012) and body weight (p=0.010) of the participants showed a significant difference, but no statistically significant difference was observed in terms of BMI (p=0.139) and age (p=0.091).

In hearing impaired children, 85.2% of those with hearing impairment preferred sports footwears; 2.9% leather-soled footwears; 7.4% rubber-soled footwears; 1.5% boots with thick soles; 1.5% boots with plastic/rubber sole, and 1.5% used other style footwears. Regarding those with non-hearing-impairment, 91.2% preferred sports footwears; 2.9% boots with thick soles; 1.5% boots with plastic/rubber sole, and 4.4% other style footwears.

The comparison results of the FAS sub-scores belonging to the dominant and non-dominant footwears are given in Table 2. In the comparison of both groups, there was a statistically significant difference between the FAS sub-scores of the preferred material upper part (p=0.042), toe box height (dominant p=0.011; non-dominant p=0.020) and heel height (p=0.039) for the dominant and non-dominant footwears. There was no significant relationship between other values (p>0.05).

There was no significant relationship between FAS

Table 3: The Relationship between FAS Total Scores Obtained from Children with and without Hearing Impairment and Peak Pressures and Pressure Percentage Parameters (As Static Foot Pressure Distribution Parameters).

Variables	Hearing-Impaired				Non-Hearing-Impaired			
	FAS Total				FAS Total			
	Dominant		Non-Dominant		Dominant		Non-Dominant	
	r	p	r	p	r	p	r	p
PP Total (%)	0.321	0.014*	-0.301	0.063	-0.231	0.059	0.224	0.073
PP Front (%)	0.998	0.404	-0.187	0.119	-0.104	0.980	0.302	0.011*
PP Back (%)	0.243	0.057	-0.173	0.174	-0.268	0.032*	-0.031	0.807
Peak Pressure (N/cm²)	0.198	0.988	-0.011	0.963	-0.150	0.219	-0.208	0.094

*p<0.05. Peak Pressure: The Maximum Amount of Pressure Measured at the Sole of the Foot, FAS Total: Total Footwear Assessment Score, PP Back: The Percentage of Pressure that Occurs in the Hindfoot, PP Front: The Percentage of Pressure that Occurs in the Forefoot, PP Total: The Percentage of the Total Pressure Occurring in the Dominant/Non-Dominant Foot Sole; N: Newton; cm²: Square Centimeter.

total scores and values of dynamic plantar pressure distribution measurements in both groups (p>0.05). There was a increasing in the percentage of total pressure (PP) in the dominant foot with the increase in footwear suitability in children with hearing impaired (r=0.321, p=0.014). In non-hearing-impaired children, while FAS total score increased, posterior PP values decreased in the dominant foot (r=-0.0268, p=0.032) and while FAS total score increased, anterior PP values increased in the non-dominant foot (r=0.302, p=0.011) (Table 3).

The mean FRT value was measured as 15.62±2.96 cm in those with hearing impairment and 31.62±6.77 cm in those without hearing impairment. The FBT results (numbers of fall) were found to be 8.23±5.02 for hearing impaired children, and 1.97±2.46 for non-hearing-impaired children. While there was a statistically significant difference between the balance test results (p=0.000), in terms of the FAS total scores there was no significant difference between the groups (right p=0.961, left p=0.923) (Table 4). However, there was no statistically significant relationship between FAS total scores and FBT (dominant r=-0.220, p=0.072 in children hearing impaired; dominant r=-0.018, p=0.885 in without hearing impairment) and FRT (dominant r=0.067, p=0.586; non-dominant r=0.074, p=0.547 in children hearing impaired; dominant r=-0.039, p=0.753; non-dominant r=-0.081, p=0.513 in without hearing impaired) values in both groups.

DISCUSSION

It was found that footwear fit had no effect on dynamic plantar pressure distribution, walking speed, stride length, and balance in children with hearing impairment, but there was a significant relationship between footwear fit and pressure percentage, one of the static plantar pressure distribution parameters.

Foot flexibility that children have during their development makes the size, shape, and design of the footwear important. These features support the view that external factors such as the choice of footwear may affect the structural development

Table 4: Comparison of FAS total score, FRT and FBT between groups

		Hearing-Impaired	Non-Hearing-Impaired	t	p
		Mean ± SD	Mean ± SD		
Total Score of FAS	FRT	15.62±2.96	31.62±6.77	-17.853	0.001*
	FBT	8.23±5.02	1.97±2.46	9.231	0.001*
	Right (Dominant Foot)	11.18±1.95	11.19±1.56	-0.049	0.961
	Left (Non-Dominant Foot)	11.18±1.96	11.21±1.53	-0.097	0.923

*p<0.001. FAS Total: Total Footwear Assessment Score, FRT: The Functional Reach Test, FBT: The Flamingo Balance Test.

and function of the foot, and may have an impact on foot health in the long term, but still this theory lacks scientific evidence (22).

In our study, it was observed that the groups were not homogeneously distributed in terms of height and body weight. However, since the groups consisted of subjects with height and body weight suitable for their age, no statistically significant difference was found between BMI values. FAS scores decreased due to the fact that most of the children had low socioeconomic levels, the footwears they used were large, and also because the girls preferred footwears with lower soles just to look good. On the other hand, the children's heels were not worn because they could change footwears frequently due to the ease of access to low-cost footwears, and many children (especially boys) prefer footwears with laces and high soles, such as sports footwears, and these two factors have led to an increase in FAS scores. However, the use of textile as a product material in sports footwears, which are used by individuals because they are trendy, and the fact that this material decreases the toe box height even more were the reasons for low FAS scores. For this reason, when the FAS scores of the groups were compared, a statistically significant difference was found between the material preferred in the upper part of the footwear, toe box height, and heel height sub-scores. On the other hand no statistically significant difference was found between total FAS scores of groups.

Foot plantar pressure distribution analysis allows clinicians and researchers to evaluate foot function; to diagnose children and adolescents with musculoskeletal disorders affecting walking and feet; to assess the severity of the deformity; and, to decide on treatment, and it is a valuable tool in documenting short- and long-term results (23). According to the present results, no relationship was found between footwear fit and dynamic foot plantar pressure in both groups. However, the static plantar pressure values showed that PP on the dominant foot, i.e., the loading amount, increased in children with hearing impairment with better footwear fit. In children without hearing impairment, the footwear fit increases PP in posterior dominant foot and anterior non-dominant foot. According to this result, it can be said that children with hearing impairment have a higher load on the dominant foot due to the feeling of fear and insecurity arising from loss of balance.

It was reported that optimal foot development can be achieved with a better optimal balance control (24). The normal values of FRT scores reported by Deshmukh et al. in children aged 6-12 years ranged from 22.7±3 cm to 37±4.4 cm (25). According to these data in our study, the FRT score was very low in children with hearing impairment. However, the number of children with hearing impairment who failed during FBT was significantly higher than those without hearing impairment. When we look at the norm values of the FBT test for the age group included in our study, it was shown that children without hearing impairment have 95% and those with hearing impairment have 70% balance success rate (26). According to both results, it is possible to say that the balance abilities of children with hearing impairment were worse than those without disabilities. Despite this, no significant relationship was found between footwear fit and balance in both groups.

The footwear is the primary interface between the individual and the surface, and therefore will contribute to how the ground reaction forces produced during walking affect both foot and ankle. In studies conducted on conventional footwears in healthy children, it was stated that footwears are the main external factor affecting the walking of children (27). Current literature shows that footwears affect gait parameters (28,29). However, studies on whether these effects are important in terms of function or how they affect foot health and foot development in the longer term have been conducted (30).

Footwears have made progress not only in protecting the foot, but also in improving walking or motor performance in certain environments, such as outdoor walking or even indoors (24). In our study, all patients were wearing closed toe footwears. Accordingly, based on the evaluation results, there was no statistically significant relationship between footwear fit and walking speed and step length data in both groups.

The impact of the footwear on the biomechanical interaction between the foot and the environment

forms the basis of the hypothesis that footwears can have a long-term effect on foot function. In this context, inappropriate choices have also been reported to have a negative effect on long-term foot development and foot health (22). However, understanding the effect of footwears on foot development is difficult due to the difficulties in identifying the foot as a functional biomechanical unit throughout childhood. In addition, studies on the effects of footwears on children with hearing impairment are lacking in the literature.

Knowing more about the social dimensions of footwears and what they mean for children are important steps towards helping shape footwear designs and also making footwear recommendations meaningful in practice. As a prerequisite for effective practical discussions about footwear choices for children, understanding what factors affect parental purchasing practices is important to help clinicians understand how they affect current choices and determine how best to give age-appropriate footwear advice (30). Considering that there is a wide range of varieties in the footwear industry today and the child wants to choose footwears in accordance with their own taste and fashion as the age of the child grows, it becomes even more important to research which footwears are healthier. Moreover, it should not be overlooked that footwears are a critical factor in providing appropriate sensory input to the foot in children with hearing impairment, in whom an important function, balance, is affected.

According to the results of study, it was concluded that footwear fit had no effect on dynamic plantar pressure distribution, walking speed, stride length, and balance in children with hearing impairment, but there was a significant relationship between footwear fit and pressure percentage, one of the static plantar pressure distribution parameters. This relationship is in the form of an increase in a greater load on the dominant foot with increasing footwear fit. It can be concluded that the increase in the loading rate with appropriate footwears in hearing impaired children may be because fit footwears contribute to self-confidence, which makes them more active. Development of suitable children's footwears can contribute to taking precautions in childhood and thus preventing different problems that may occur not only in childhood but also in advanced ages in hearing impaired children, which may be useful for clinical practices. However, more studies are needed for this. In addition, studies in which the foot pressure distribution is measured in the footwear may help to clarify this issue more.

Sources of Support: This work is supported by Hacettepe University Scientific Research Projects Coordination Unit [Grant number: 18892].

Conflict of Interest: No potential conflict of interest was reported by the author(s).

Author Contributions: Concept – SEÇ, NB, HÖ; Design – SEÇ, NB, HÖ; Supervision – SEÇ, NB, HÖ; Resources and Financial Support – SEÇ, NB, HÖ; Materials – SEÇ, NB, HÖ; Data Collection and/or Processing – SEÇ; Analysis and/or Interpretation – SEÇ, NB, HÖ, HK; Literature Research – SEÇ, NB, HÖ, HK; Writing Manuscript – SEÇ, NB, HÖ, HK; Critical Review- SEÇ, NB, HÖ, HK.

Acknowledgements: Our study is part of the doctoral thesis and the abstract has been presented at a scientific meeting (6. International Gevher Nesibe Health Sciences Conference).

Acknowledgments: None.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)63-69

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Received: *10.08.2021 (Geliş Tarihi)*
Accepted: *24.02.2022 (Kabul Tarihi)*

THE EFFECTS OF ABDOMINAL BRACING MANEUVER ON QUADRICEPS MUSCLE TORQUE, TIME TO PEAK TORQUE AND MUSCLE ACTIVATION LEVELS AT DIFFERENT KNEE FLEXION ANGLES

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of the present study was to investigate the effects of abdominal bracing maneuver (ABM) on quadriceps peak torque (PT), time to peak torque (TTPT) and muscle activation levels during maximal strength testing of the quadriceps muscle in healthy individuals.

Methods: Sixteen healthy individuals (Age: 24.63±1.67 years) participated in the present study. Each participant was taught ABM technique by a physical therapist's guidance. Surface electromyography was used to measure internal oblique/transversus abdominis, vastus medialis, vastus lateralis, and rectus femoris activation levels. Isokinetic dynamometry was used to measure quadriceps PT and TTPT during maximum isometric muscle testing at 60° and 90° of knee flexion angles with and without ABM. Repeated measures of ANOVA was performed for statistical analysis.

Results: There was a significant angle by condition interaction for quadriceps PT ($F(1,15)=5.30$, $p=0.04$). PT decreased when ABM was performed, but the decrease was greater at 60° compared to 90° of knee flexion (60°: $p=0.001$, ES=0.68; 90°: $p=0.008$, ES=0.33). Quadriceps activation levels also decreased during ABM ($p=0.04$) regardless of knee flexion angle.

Conclusion: The present study revealed that ABM may decrease muscle activation levels and peak torque during maximal quadriceps strength testing. Researchers should evaluate compensatory movements of the lumbopelvic region in order to prevent the error of force transfer in test results.

Key Words: Electromyography, Knee joint, Maximal Strength

ABDOMINAL BRACING MANEVRASININ FARKLI DİZ FLEKSİYON AÇILARINDA, KUADRİSEPS ZİRVE TORKU, ZİRVE TORKA ULAŞMA SÜRESİ VE KAS AKTİVASYONU ÜZERİNE ETKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Bu çalışmanın amacı sağlıklı bireylerde abdominal bracing manevrasının (ABM) maksimal kuvvet testi sırasında kuadriseps zirve torku (ZT), zirve torka ulaşma süresi ve kas aktivasyonuna etkisini araştırmaktı.

Yöntem: Bu çalışmaya 16 sağlıklı birey (Yaş: 24,63±1,67 yıl) katılım gösterdi. Her bireye fizyoterapist tarafından ABM tekniği öğretildi. Internal oblik/transversus abdominis, vastus medialis, vastus lateralis ve rektus femoris kaslarının aktivasyonu ölçümünde yüzeysel elektromyografi kullanıldı. Maksimal izometrik test sırasında kuadriseps ZT ve zirve torka ulaşma süresi değerleri 60° ve 90° diz fleksiyon açılarında izokinetik dinamometre ile ölçüldü. İstatistiksel analizde tekrarlı ölçümler ANOVA kullanıldı.

Sonuçlar: Kuadriseps ZT değerinde, duruma göre açı etkileşimi anlamlı bulundu ($F(1,15)=5,30$, $p=0,04$). ZT değerleri her iki diz açısında da ABM ile düştü ancak düşüş 60° diz fleksiyon açısında 90°'ye göre daha fazla idi (60°: $p=0,001$; ES=0,68; 90°: $p=0,008$, ES=0,33). Kuadriseps kas aktivasyonunda da ABM ile düşüş olduğu görüldü ($p=0,04$).

Tartışma: Yapılan çalışma sonuçları maksimal kuadriseps kas testi sırasında hem ZT hem kas aktivasyon seviyelerinin düştüğünü göstermektedir. Araştırmacılar test sonuçlarında kuvvet aktarımının sebep olacağı yanılmayı engellemek için lumbopelvik bölgenin kompansatuar hareketlerini değerlendirmelidir.

Anahtar Kelimeler: Elektromyografi, Diz Eklemi, Maksimal kuvvet

INTRODUCTION

Volitional preemptive abdominal contraction (VPAC) techniques aim to increase abdominal muscle activation voluntarily with different strategies. VPAC is commonly preferred to prevent compensatory lumbopelvic motions during functional activities and/or exercises (1, 2). There is a general thought among clinicians that the exercises are more effective if they are performed with VPAC, since VPAC enhances lumbopelvic control via producing lumbar multifidus co-contraction (3). Previous researches support that idea where the activation levels of the targeted muscles increase with VPAC during both lower and upper extremity exercises in healthy individuals (4-6).

VPAC has been applied with different methods such as abdominal draw-in maneuver (ADM) (or abdominal hollowing) and abdominal bracing maneuver (ABM). The ADM emphasizes the activation of abdominal core muscles including the transversus abdominis (TrA) and internal oblique (IO) muscles (7, 8) while ABM involved the global co-contraction of abdominal wall muscles (9, 10). Compared to ADM, ABM has been shown to be more effective for stabilizing the spine as it increases spinal stiffness (2, 11). Moreover, Haddas et al. (12) suggested that ABM might reduce biomechanical factors associated with anterior cruciate ligament injury since it enhanced pelvic stability and improved lower extremity alignment during landing from jump.

Previous studies found that hip muscle activation levels were greater with increased abdominal muscles' co-activation while performing functional lower extremity exercises (13-15). Similarly, Harput et al. (6) reported that quadriceps activation levels increased with ADM during unilateral lower extremity exercises. However, the previous studies investigated the VPAC effects on muscle activation levels during therapeutic exercises which were performed with body weight. Thus, there is limited knowledge about how ABM affects a targeted muscle during maximal strength testing. Tayashiki et al. (16) reported that ABM increased the hip extension torque by increasing intra-abdominal pressure, which radiates the force to weaker muscles in the lower extremities. In another study about intra-abdominal pressure and its relationship with gluteus maximus and hamstring muscle size and hip extension torque showed that only hip extensor torque was related to intra-abdominal pressure (17). Although there is evidence that showed ABM increased hip extensor maximal strength in the prone position in healthy individuals, there is no study to document the effects of ABM on quadriceps maximal torque and activation in the healthy population.

Therefore, the aim of the present study was to investigate the effects of ABM on the quadriceps peak torque and time to peak torque, and quadriceps activation levels during maximum isometric quadriceps strength testing at different knee flexion angles in healthy individuals. It is hypothesized that quadriceps peak torque and activation levels decreased, while time to peak torque would increase with ABM during maximal isometric knee extension muscle testing.

METHODS

Participants

The sample size was calculated according to study by Barbosa et al. (13) by using the G-POWER software (Version 3.1.5, Franz Faul, Universitat Kiel, Germany). To achieve 0.90 power, considering the effect size of 1.12 and significance level <0.05 between two different conditions in terms of quadriceps EMG amplitudes, a sample size of minimum 11 participants were necessary (with and without abdominal bracing).

Sixteen healthy individuals (8 Male, 8 Female; age: 24.6±1.7 years; BMI: 21.8±2.1 kg/m^2), between 18-30 years of age, participated in this study. Participants were excluded if they had any systemic/neurological problems, had a BMI higher than 25 kg/m^2, had a lower extremity injury in the last year, and had experience in core stability training (Table 1).

Table 1. Demographic Characteristics of the Participants

N=16 (8 Male, 8 Female)	Mean±SD
Age (years)	24.63±1.67
Height (cm)	171.63±10.47
Body mass (kg)	65.94±13.65
Body mass index (kg/m^2)	21.80±2.13

This cross-sectional study was conducted at Hacettepe University Faculty of Physical Therapy and Rehabilitation between March-June of 2020. Ethical approval was given by the Uskudar University Institutional Review Board, and the study was performed according to the Declaration of Helsinki. Written informed consent was obtained from each subject prior to the study.

Testing Procedures

The physical characteristics of the participants were recorded and their dominant limbs were identified. The dominant limb was defined as the leg used to kick a ball (6).

Quadriceps peak torque and time to peak torque, and quadriceps muscle activation levels of the dominant limb were measured during quadriceps maximum voluntary isometric contraction (MVIC) at different knee flexion angles with and without ABM. Internal Oblique/Transversus Abdominis (IO/TA) muscle activation levels during muscle strength testing were measured bilaterally.

Electromyography (EMG)

Electromyographic data processing of the IO/TA, Vastus Medialis Obliquus (VMO), Vastus Lateralis (VL), and Rectus Femoris (RF) muscles during the quadriceps isometric muscle strength testing were accomplished using a surface EMG system (TELEmyo DTS; Noraxon USA, Inc, Scottsdale, AZ, USA). The identified locations for surface electrode placement were shaved, were abraded, and were cleaned using 70% isopropyl alcohol before testing. Bipolar Ag/AgCl surface electrodes were placed at an interelectrode distance of 2 cm (1-cm diameter). The common-mode rejection ratio was greater than 80 Db, and the input impedance was greater than 10 mΩ. The sampling rate for EMG data was 1500 Hz. SENIAM's European Recommendations for Surface EMG was used to make the placement of electrodes for each muscle (18). The electrodes were placed bilaterally for the IO/TA muscles and only on the dominant limb for the VMO, RF, and VL muscles.

Prior to quadriceps isometric muscle strength testing, bilateral IO/TA muscle activation levels were measured during 5-second MVIC and it was used to normalize IO/TA muscle activation levels during quadriceps strength testing with and without ABM. The participant was laid in the supine position with hips and knees flexed 90°, feet were supported, and the trunk was maximally flexed and rotated to the right, for the IO/TA MVIC evaluation. The examiner applied manual resistance at the shoulders by pushing the trunk extension and left rotation directions (19, 20). MVIC testing was repeated three times. Two-minute rest was provided between repetitions.

Isometric quadriceps muscle strength testing

An isokinetic dynamometer (IsoMed®2000 D&R GmbH, Germany) was used to measure the isometric quadriceps PT and TTPT at 60° and 90° of knee flexion. We selected two knee flexion angles for quadriceps isometric muscle strength testing since there is no consensus in the literature for the optimal knee flexion angle for PT of the quadriceps muscle. These two angles were mainly preferred for MVIC testing for quadriceps in previous studies (21).

The participants were seated with their hip at approximately 90° of flexion. To prevent compensatory movements, the trunk, hip, waist, and distal femur were stabilized by straps. The dynamometer's laser was used to align the axis of the dynamometer to the lateral femoral epicondyle. The force arm of the dynamometer was secured two centimeters above the lateral malleolus. The Knee flexion angle was set at 60° and 90° in a randomized order.

To familiarize themselves with the testing procedures the participants were allowed three maximal isometric quadriceps contractions. During the testing, the participants performed three MVICs (each 5-sec duration) with 2-min rest intervals. The participants were instructed to push the lever arm of the dynamometer as strongly as possible. They were not allowed to hold the handgrips along the seat to prevent any additional force and were asked to put the hands just above the shoulder straps with crossed forearms on the chest. Standard verbal encouragements were provided for each individual and also visual feedback which is known to improve the real-time force values was provided throughout the test via a computer monitor (22).

Abdominal Bracing Maneuver

After completing quadriceps isometric testing without ABM, the participants rested 15 minutes and then, they were taught the ABM by a physiotherapist (14, 23). The participants were instructed to co-contract their abdominal muscles, without changing in upper body position and hollowing the lower abdomen (16). Real-time EMG feedback (TELEmyo DTS; Noraxon USA, Inc, Scottsdale, AZ, USA) was used to check the level of the IO/TA activations of the participants. Participants practiced till they reached IO/TA muscle activation to 20% MVIC (15) in their ipsilateral (dominant limb side) side and held that contraction for at least 10 seconds. We only checked IO/TA muscles activations since it is harder to contract these deep muscles compared to rectus abdominis and external oblique muscles. Previous studies demonstrated that IO/TA activation levels were higher during ABM (24, 25). The training took approximately 15-20 minutes until the participants were able to contract their IO/TA muscles easily in the sitting position. Then, the quadriceps isometric strength procedure was repeated while performing ABM.

EMG-Signal Processing

Noraxon Myo-Research XP Master Edition software (Noraxon USA, Inc) was used to accomplish EMG data processing. The EMG signals were rectified, were band-pass filtered (20-450 Hz), and were smoothed using a root-mean-square moving-window function with a time constant of 100 milliseconds. During quadriceps isometric muscle strength testing, maximum EMG signals of VMO, RF, and VL were calculated. The sum of the VMO, RF, and VL activation levels was expressed as the quadriceps activation level.

IO/TA muscle activation levels during isometric quadriceps strength testing were normalized to MVIC values and were expressed as MVIC %. For each of the MVIC trials, the maximum value obtained over the 5-second maximum effort was recorded, and the maximum of three MVIC trials was used for normalization of the IO/TA EMG data.

Statistical analysis

The data obtained in the present study were evaluated using the IBM SPSS 21.0 (IBM Corporation, Armonk, NY, USA). Data were expressed as means and standard deviations for descriptive data. The normality of EMG data was tested with the Shapiro-Wilk Test. A repeated-measures analysis of variance was performed to determine the angle (60° and 90° of knee flexion) by condition [Neutral activation (NA) and ABM] interaction for PT, TTPT, and quadriceps activation levels. If a significant interaction was observed, post hoc t-tests were used. A change in muscle activation level with ABM was reported with effect size. Cohen's d-coefficient was used to calculate the magnitude of effect size for all variables. An effect size greater than 0.80 was considered as large; 0.5 to 0.79 as moderate; 0.49 to 0.20 as small; and 0.19 to 0 as negligible (26). Significance levels were set at $p<0.05$.

With 16 participants, 98% power was achieved in quadriceps activation and peak torque.

RESULTS

Abdominal activation

Angle by condition interaction was significant neither for ipsilateral side ($F(1,15)=5.20$, $p=0.04$) nor for contralateral side ($F(1,15)=0.96$, $p=0.35$) IO/TA muscle activation levels. The IO/TA activation levels of the both sides increased with ABM ($p=0.04$, $p=0.02$). There was a 31.6% increase in contralateral and 18.4% increase in ipsilateral IO/TA activation levels with ABM (Table 2).

Peak torque and time to peak torque

There was a significant angle by condition interaction for quadriceps PT ($F(1,15)=5.30$, $p=0.04$). PT values both decreased by performing ABM, but the decrease was greater at 60° compared to 90° of knee flexion (60°: $p=0.001$, ES=0.68; 90°: $p=0.008$, ES=0.33). At both conditions, PT was greater at 60° than 90° (NA: $p<0.001$, ABM: $p=0.02$) (Table 3).

Angle by condition interaction was not significant for TTPT ($F(1,15)=0.07$, $p=0.79$). The condition main effect was also not significant ($F(1,15)=0.42$, $p=0.53$) (Table 3).

Quadriceps activation

There was no significant angle by condition interaction for quadriceps activation level ($F(1,15)=0.96$,

Table 2. Ipsilateral and Contralateral IO/TA Activation Levels with Neutral Activation and with Abdominal Bracing Maneuver During Isometric Knee Extension Strength Testing at Different Knee Flexion Angles.

Side	Angle	NA (MVIC%) Mean±SD (min-max)	ABM (MVIC%) Mean±SD (min-max)	P value	Cohen's d
Ipsilateral	60	54.98±41.67 (6.68-163.57)	70.26±33.38 (14.04-129.23)	0.112	0.40
	90	51.44±37.38 (10.0-161.43)	72.98±31.98 (11.99-124.29)	0.024*	0.62
Contralateral	60	49.79±32.63 (1.71-130.86)	89.98±68.09 (24.70-247.54)	0.007	0.65
	90	65.39±47.68 (10.0-184.30)	91.89±64.70 (22.11-209.38)	0.018*	0.47

Values are mean ± standard deviation. Abbreviations: NA = Neutral Activation, ABM = Abdominal Bracing Maneuver, MVIC = Maximum Voluntary Isometric Contraction. *p<0.05.

Table 3. Quadriceps Peak Torque, Time to Peak Torque, and Quadriceps Activation Levels with and without Abdominal Bracing Maneuver During Isometric Knee Extension Strength Testing at Different Knee Flexion Angles.

	Angle	NA	ABM	P value	Cohen's d
Quadriceps PT (kg/m^2)	60	2.83±0.65	2.39±0.61	0.001*	0.68
	90	2.28±0.67	2.07±0.57	0.008*	0.33
TTPT (s)	60	3.01±1.14	2.92±1.48	0.846	0.06
	90	2.27±1.42	2.52±1.67	0.482	0.16
Quadriceps activation level (mV)	60	1.34±0.5	1.10±0.5	0.023*	0.48
	90	1.30±0.4	1.10±0.4	0.002*	0.50

Values are mean ± standard deviation. Abbreviations: NA = Neutral Activation, ABM = Abdominal Bracing Maneuver, MVIC = Maximum Voluntary Isometric Contraction, PT = Peak Torque, TTPT = Time to Peak Torque. *p<0.05.

p=0.34). Condition main effect was determined significant for quadriceps activation level (F(1,15)=11.88, p=0.004). Quadriceps activation level decreased with ABM (p=0.04) (Table 3).

DISCUSSION

The findings of the present study demonstrated that performing ABM increased IO / TA levels about 18-31 percent during the maximum isometric quadriceps strength test and decreased quadriceps peak torque and activation levels in healthy individuals. The decrease in quadriceps peak torque was greater at 60° knee flexion than 90° knee flexion. On the other hand, time to peak torque of quadriceps did not change with the ABM.

We planned this study since we observed that individuals performed quadriceps isometric tests with compensatory lumbopelvic motions including increased anterior pelvic tilt and trunk rotation even stabilization straps are used for controlling these motions. ABM was shown to be effective for achieving and maintaining lumbopelvic stability during dynamic movements. Despite the previous findings, we postulated that these compensatory movements could increase quadriceps strength due to force transmission from the trunk to the leg and mask the real quadriceps force.

Vera-Garcia et al. reported that during sudden trunk perturbations, ABM causes less trunk displacement than ADM (2). Moreover, ABM provides global abdominal wall contraction, thus performing ABM increases the stability of the lumbopelvic complex along with antagonist co-contraction (16). Previous studies demonstrated that all the muscles of the abdominal wall participate in spinal stability and every part should work harmoniously for maintaining stabilization (27, 28).

During quadriceps muscle strength testing in a sitting position, seat belts are used to prevent trunk compensatory movements. We observed in our clinics that belts were not able to provide a completely stable trunk while performing maximal knee extension muscle strength testing. The individuals demonstrated increased anterior pelvic tilt and trunk rotation during the test, thus, the force trans-

mission via trunk to lower extremity muscles could mislead the results (29, 30). In the present study, our participants were taught how to perform ABM by a physiotherapist prior to actual testing first in the supine position and then in sitting position. In addition, they practiced ABM several times with resistive knee extension at 60° and 90° of knee flexion. The abdominal activation was also checked during the test whether the participants activating related muscles or not. During maximal isometric knee extension muscle strength testing, the participants activated ipsilateral abdominal core muscles between 51 MVIC% and 55 MVIC% without ABM. With ABM, these values increased from 70 MVIC% to 73 MVIC%. On the other hand, contralateral abdominal core activation increased more than the ipsilateral sides. It increased from 59 MVIC% to 96 MVIC% at 60° of knee flexion and increased from 65 MVIC % to 92 MVIC% at 90° of knee flexion. This finding may support that to prevent pelvis and trunk rotation, contralateral abdominal muscles worked more than the ipsilateral side.

We observed a 15.5% decrease in quadriceps peak torque in 60° knee flexion and a 9.2% decrease at 90° knee flexion. The decrease in quadriceps peak torque might occur due to several reasons. The compensatory movements of the trunk and the pelvis might be prevented by performing ABM during the test. This may decrease the transmission of the force from the trunk to the leg and may result a decrease in quadriceps muscle strength. On the other hand, trying to maintain ABM during the testing might be hard and the participants might not exert their maximal knee force while focusing on the ABM. There is no study in the literature investigating quadriceps strength with VPAC techniques in sitting position. Therefore, it is hard to discuss our findings with the available literature. Tayashiki et al. (16) reported greater hip extension muscle strength by performing ABM in the supine position and they suggested that an increase in intraabdominal pressure via ABM radiates the generated force to weaker muscles in the lower extremities. Hwang et al. (31) also found greater concentric hip extension muscle strength in prone standing position in healthy individuals. Hip extension muscle strength is closely related to pelvic tilt movements and intraabdominal pressure. Consistent with the findings of peak torques, quadriceps muscle activation levels decreased by performing ABM. However, the decrease in muscle activation levels was independent from the knee flexion angles. The present study demonstrated quadriceps muscle activation levels decreased 13.7 MVIC% in 60° knee flexion and 19 MVIC% in 90° knee flexion angles. We expected to see an increase in quadriceps time to peak torque by performing ABM. We postulated that while performing ABM, the knee extension force was exerted in a controlled manner so the time passed for reaching peak torque would be longer. However, we found no change in quadriceps time to peak torque.

The findings of the present study might have beneficial clinical points. Since quadriceps torque decreased by performing ABM during maximal quadriceps muscle strength testing, this method may be used in patients in the early phase of anterior cruciate ligament injury rehabilitation for strengthening quadriceps in a controlled manner. Clinicians might seek to prioritize isometric strengthening by performing ABM in the early phase of the rehabilitation for quadriceps muscle strains to improve force development without overloading the quadriceps muscle. Moreover, abdominal core muscles can also be strengthened since the activation levels were greater than 60% MVIC during maximum quadriceps isometric contractions (32, 33). However, the utility of these methods is yet to be investigated in future studies.

The present study had several limitations. First, the findings of the present study reflected the status of healthy individuals. ABM may result in various quadriceps muscle strength and muscle activation levels during muscle strength measurement in different patient populations. Third, the results of the present study reflected the isometric strength testing of the quadriceps muscle. During dynamic contractions such as concentric and eccentric muscle strength testing, the effects of ABM may be different.

In conclusion, the results of the present study showed that an increase in abdominal core activation resulted in a decrease in quadriceps maximal isometric muscle strength and muscle activation levels during quadriceps isometric muscle testing

at 60° and 90° knee flexion angles in healthy individuals. The compensatory lumbopelvic motions should be examined during maximal knee extension muscle strength testing.

Sources Of Support: The authors received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical Approval: This study was approved by Uskudar University Institutional Review Board (61351342-/2019-101).

Informed Consent: Written informed consent was obtained from each subject.

Peer-Review: Externally peer-reviewed.

Author Contributions: Concept – BS, DCS, DA, GH; Design – BS, SY, ST, GH; Supervision – GH; Resources and Financial Support – BS, DCS, GH; Materials – BS, DCS, DA, SY, ST, GH; Data Collection and or Processing – BS, DCS, DA, SY, ST, GH; Analysis and or Interpretation – BS, DCS, DA, SY, ST, GH; Literature Search – BS, GH; Writing Manuscript – BS, DCS, DA, SY, ST, GH; Critical Review – BS, DCS, DA, SY, ST, GH

Acknowledgments: This study was presented as an oral presentation at the 7th National Physiotherapy and Rehabilitation Congress which was held in Ankara on April 18-20, 2019

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)71-80

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Received: *05.07.2021 (Geliş Tarihi)*
Accepted: *20.06.2022 (Kabul Tarihi)*

WHAT DO PHYSIOTHERAPY AND REHABILITATION STUDENTS THINK ABOUT ONLINE LEARNING DURING THE PANDEMIC?

ORIGINAL ARTICLE

ABSTRACT

Purpose: Online learning is a comprehensive type of education in which the teacher and the student are physically separated. We wanted to know how online learning was evaluated through the view of physiotherapy and rehabilitation students.

Methods: We included 283 students from department of physiotherapy and rehabilitation in the study. A questionnaire that consisted of 45 multiple-choice questions and 2 open-ended questions was applied to the students. The questions involved whether the student has previously participated in any online learning program, has had access to online learning and technical problems experienced during access.

Results: Our study included 210 (74.20%) women and 73 (25.80%) men. We questioned status of having online learning before the pandemic and 49.82% of the students reported that they did not receive online learning before. We found that 21.55% of the students could not motivate themselves. 30.39% of the students thought having insufficient education in the practical courses due to online education. 10.25% of the students stated that they could not access the necessary equipment for online learning. In the question about they received high-quality education with online learning; 21.55% of the students stated that they did not agree at all.

Conclusion: We think that it is more beneficial to give some theoretical courses online and synchronized, and practical courses face to face. Therefore, we think that it will be beneficial to postpone the practical courses that cannot be done face to face due to the pandemic and to give those courses face to face after the pandemic process.

Key Words: Education, Online Learning, Pandemic, Practical Course, Student

PANDEMİDE FİZYOTERAPİ VE REHABİLİTASYON ÖĞRENCİLERİ ONLINE ÖĞRENME HAKKINDA NE DÜŞÜNÜYOR?

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Online öğrenme, öğretmen ve öğrencinin fiziksel olarak ayrı ortamlarda olduğu kapsamlı bir eğitim türüdür. Fizyoterapi ve rehabilitasyon öğrencilerinin gözünden online öğrenmenin nasıl değerlendirildiğini öğrenmek istedik.

Yöntem: Fizyoterapi ve rehabilitasyon bölümünden 283 öğrenci dahil edildi. Öğrencilere 45 çoktan seçmeli soru ve 2 açık uçlu sorudan oluşan bir anket uygulandı. Öğrencinin daha önce herhangi bir online öğrenme programına katılıp katılmadığı, online öğrenmeye erişimi olup olmadığı ve erişim sırasında yaşanan teknik sorunlar ile ilgili sorular soruldu.

Sonuçlar: Çalışmamıza 210 (74,20%) kadın ve 73 (25,80%) erkek dahil edildi. Pandemi öncesi online eğitim alma durumunu sorguladık ve öğrencilerin %49,82'si daha önce online eğitim almadıklarını bildirdi. Öğrencilerin %21,55'inin kendilerini motive edemediğini gördük. Öğrencilerin %30,39'u çevrimiçi eğitim nedeniyle uygulamalı derslerde yetersiz eğitim aldığını düşünmektedir. Öğrencilerin %10,25'i çevrimiçi öğrenme için gerekli donanıma ulaşamadıklarını belirtmiştir. Online eğitim ile kaliteli eğitim aldıklarına ilişkin soruda; Öğrencilerin %21,55'i bu görüşe hiç katılmadığını belirtmiştir.

Tartışma: Bazı uygulamalı olmayan derslerin online ve senkronize, uygulamalı derslerin yüz yüze yapılmasının daha faydalı olduğunu düşünmekteyiz. Bu nedenle pandemi nedeniyle yüz yüze yapılamayan uygulamalı derslerin ertelenmesinin ve pandemi sürecinden sonra bu derslerin yüz yüze verilmesinin faydalı olacağını düşünmekteyiz.

Anahtar Kelimeler: Eğitim, Online Öğrenme, Öğrenci, Pandemi, Pratik Ders

INTRODUCTION

The World Health Organization (WHO) stated that Covid-19, which started to spread from China to the whole world on 30th January 2020, is a serious public health problem and was declared a global pandemic on 11th March 2020 (1,2). In Turkey, the first case and the first death were reported on 11th March and 17th March 2020, respectively. Until 9th September, the total number of people undergoing Covid-19 and who died due to Covid-19 were recorded as 284 943 and 6837, respectively (3). It is recommended to pay attention to social distance and avoid close contact to be protected from Covid-19, which is transmitted by the respiratory tract, spreads rapidly, and has high contagious properties (4). For this reason, public areas such as workplaces, schools, and universities were gradually closed within the scope of various precautions taken, and regions with a high number of patients were quarantined. The closure of universities, including physiotherapy departments, has led to online learning in many countries (5).

Online learning is a comprehensive type of education that includes new technological developments and presentation techniques from a very broad perspective in which the teacher and the student are physically separated (6,7). The student is considered to be the most important factor in achieving success in online education with a teacher (6). A student-based assessment approach is required to determine the effectiveness of any educational method that is applied (8). It is thought that this assessment should be made with evidence-based methods on subjects that may affect the education process and guide teachers such as accessing online learning materials, technical competence required to provide accessing, availability of technology by students and teachers, course design, teacher-student cooperation, student learning outcomes and the satisfaction in the education process (8,9). Although the effects of these changes regarding the teaching method are not fully known, teachers are still trying to get some solutions, especially regarding the efficiency of clinical practice (5,10). In addition to teachers, there are some uncertainties regarding the satisfaction of students studying in health sciences and their access to required technical equipment to follow online courses regularly (11,12).

As one of the precautions in our country due to the Covid-19 pandemic affecting the whole world, our university has switched to an online learning program, and courses have started to be taught online. Although departments that do not have a master-apprentice relationship and do not require direct application could teach their courses with online learning during the pandemic in the spring semester of 2020 successfully, unfortunately applied sciences had a lot of difficulties in this regard. Higher education of Health Sciences has a master-apprentice relationship and it is not possible for the student to learn the examination, treatment, and rehabilitation of the patient without touching. However, we had to complete the practical courses online due to the pandemic, which we were not prepared for (13,14).

In the 2020-2021 academic year, all universities in Turkey implemented the online education process. While some senior students in applied health sciences could do internships in hospitals, some could not. Students could not do internships in cities where the pandemic was intense (13,14). During this period, we observed that students' motivation and learning performance were extremely low. We planned this study because of the necessity to question the thoughts of health sciences students about online education and to plan the next education accordingly. It was thought that many sciences in Turkey will continue online education even after the pandemic. Although the theoretical part of the courses in applied health sciences could be given online, we thought that the practical part of the courses should be given face to face. However, the ratio of this should be adjusted by asking the opinions of students and lecturers. Our aim in this study was to know how online learning was evaluated through the view of physiotherapy and rehabilitation students.

METHODS

The study was carried out between June 2020 and December 2020 in Hatay Mustafa Kemal University, Faculty of Health Sciences, Department of

Physiotherapy and Rehabilitation. 430 students were invited and 283 bachelor's degree and master of science students accepted to participate the study. The study was a descriptive study. Some of questions were likert type, some of them were descriptive. An informed consent form containing information about the study was sent to the students, and consent was taken online (by WhatsApp application) from the students who agreed to participate in the study. Ethics committee permission required for the study was obtained from Hatay Mustafa Kemal University Ethics Committee (Ethical approval number: 04/06/2020-07-14).

A questionnaire that consisted of 45 multiple-choice questions and 2 open-ended questions was applied to the students. We prepared the questionnaire by Google forms and send it to the students by WhatsApp application. The questionnaire was formed from 4 parts such as:

1: Gender and educational status of the participants;

2: Questions related to participation in online learning and providing access to online education;

3: Questioning the quality and adaptation in education, effectiveness of the online learning, model, the motivation for the course, the availability of the required equipment, and the environment and questions about the teacher;

4: Questions related to the lesson processing and ideas about socializing.

The questions were about degree of the student's education, whether the student has previously participated in any online learning program, access problems to online learning, the quality of the online learning process, efficiency of the courses, the attitude of the teacher during online learning, the student-teacher relationship, the impact of online learning on student's social behavior, and the views on the similarities and differences between online learning and traditional education.

At the beginning of the study, all students were informed about the study and their questions about the purpose and method of the study were answered. The questions were recorded in the online system and sent to the students via an internet link to be answered, and the students' answers were recorded in the system.

The questions were created by the researchers since there was no scale developed on this subject at the time we conducted the study. The questions were formed by 5 physiotherapists (two of whom were academicians of at least 8 years) with professional experience ranging from 3 years to 15 years.

Statistical analysis

Statistical Package for Social Sciences (IBM SPSS Statistics for Windows, Version 22.0. Chicago, Illinois, USA) Software was used to analyze the data. Numbers and percentages were used to present the descriptive characteristics and answers of the students. A questionnaire was created and sent to all students belonging to Hatay Mustafa Kemal University physiotherapy and rehabilitation department (bachelor's degree), and health sciences institute physiotherapy and rehabilitation department (master of science), and all of them were invited to participate in the study. Therefore, sample size analysis was not performed when all of the target

Table 1. Gender and Educational Status of the Participants

		n	%
Gender	Female	210	74.20
	Male	73	25.80
Education Degree	Bachelor's Degree Class 1	71	25.09
	Bachelor's Degree Class 2	83	29.33
	Bachelor's Degree Class 3	65	22.97
	Bachelor's Degree Class 4	56	19.79
	Master of Science Course Period	7	2.47
	Master of Science Thesis Period	1	0.35

Table 2. Questions Related to Participation in Online Learning and Providing Access to Online Education

		n	%
Have you attended any online learning program before?	Yes	142	50.18
	No	141	49.82
Do you have a computer in your home?	Yes	182	64.31
	No	101	35.69
On which device do you follow your online learning lessons?	Computer	126	44.52
	Tablet	6	2.12
	Smartphone	151	53.36
Do you have any problems accessing the internet?	Always	24	8.48
	Often	73	25.80
	Sometimes	151	53.36
	Any time	35	12.37
How often do you use the university library's off-campus access service?	Everyday	6	2.12
	3-5 times a week	19	6.71
	1-2 times a week	235	83.04
	Never	23	8.13

population was invited to the study. But we analyzed the rate of the attending students over the total number of the students in the physiotherapy and rehabilitation department when we completed data collection.

RESULTS

The online education in our university was asynchronous. Our study included 210 (74.20%) female and 73 (25.80%) male students. We found that 25.09% of them were first-class, 29.33% of them were second-class, 22.97% of them were third-class, and 19.79% of them were fourth-class students in bachelor's degree. It was determined that 2.82% of the participants were master of science students (Table 1).

We questioned status of having online learning before the pandemic and 49.82% of the students reported that they did not receive online learning before. We found that 35.69% of the students did not have a laptop device to use during the online lessons in education; 53.36% of them followed up lessons with a smartphone; 25.80% of them stated that they often had problems with the internet (Table 2).

We questioned their ideas about online learning as an effective learning model. We found that 21.55% could not motivate themselves, and 29.68% were indecisive about motivation. We found that 10.25% of the students could not access the necessary equipment for online learning, and 44.52% of them stated that they had access. Most of them did not agree with the idea of "If I had online learning alternative in my department, I would prefer online learning" (Table 3).

In the study, 53.71% of the students stated the lecturer was enthusiastic about education and 49.82% agreed with the question that the lecturer informed the student sufficiently about online learning (Table 4).

It was determined that 30.39% of the students agreed with the idea of having insufficient education in the practical courses. There was a high rate of agreeing (I agree 32.51% and 17.67% absolutely agree) with the question that "online learning helps me to understand the subject better than face to face education because I can stop or watch the online learning videos where necessary" (Table 4).

In our study, we found that most of the students agreed that "online learning will prevent students'

Table 3. Questioning the Quality and Adaptation in Education, Effectiveness of the Online Learning, Model, the Motivation for the Course, the Availability of the Required Equipment, and the Environment and Questions About the Teacher

Questioning the Quality and Adaptation in Education, Effectiveness of the Online learning, Model, the Motivation for the Course, the Availability of the Required Equipment, and the Environment	**I do not agree at all**		**I do not agree**		**I am indecisive**		**I agree**		**I absolutely agree**	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Online learning is an effective learning model	45	15.90	73	25.80	98	34.63	58	20.49	9	3.18
I can motivate myself to start the lesson.	28	9.89	61	21.55	84	29.68	97	34.28	13	4.59
I can easily access the minimum necessary equipment for online learning.	29	10.25	54	19.08	48	16.96	126	44.52	26	9.19
I find it difficult to provide the appropriate environment for the lesson (desk, convenient time, noiseless environment, etc.).	38	13.43	86	30.39	41	14.49	76	26.86	42	14.84
If I had an alternative to online learning in my department, I would prefer online learning.	89	31.45	79	27.92	74	26.15	25	8.83	16	5.65
I think the department where I am currently studying is suitable for online learning.	120	42.40	75	26.50	67	23.67	19	6.71	2	0.71
I think online learning affects my eye health negatively.	16	5.65	70	24.73	64	22.61	81	28.62	52	18.37
I think I get a high-quality education with online learning.	61	21.55	87	30.74	92	32.51	39	13.78	4	1.41
I keep detailed notes during the online learning lecture.	20	7.07	56	19.79	66	23.32	111	39.22	30	10.60
I think I have been adapted to the online learning system.	42	14.84	54	19.08	90	31.80	88	31.10	9	3.18
I think my friends are adapting to the online learning system	51	18.02	63	22.26	117	41.34	48	16.96	4	1.41
Online learning is more motivating than a normal classroom environment.	89	31.45	81	28.62	60	21.20	40	14.13	13	4.59
I think one of the advantages of Online learning is that the contents (video, audio, ppt) can be accessed at any time.	11	3.89	9	3.18	42	14.84	150	53.00	71	25.09
I think that online learning is more advantageous than formal education, as more than one access to courses and documents with the same content can be provided at different times.	30	10.60	52	18.37	83	29.33	85	30.04	33	11.66
Questions About the Teacher										
The teacher was enthusiastic about training.	12	4.24	21	7.42	84	29.68	152	53.71	14	4.95
The teacher gave me enough information about online learning.	16	5.65	41	14.49	67	23.67	141	49.82	18	6.36
The presentation style of the teacher caught my attention.	21	7.42	57	20.14	96	33.92	98	34.63	11	3.89
The teacher was friendly towards the students during the lesson.	5	1.77	14	4.95	44	15.55	195	68.90	25	8.83
I can easily communicate with the teacher whenever I want.	24	8.48	48	16.96	84	29.68	106	37.46	21	7.42
In online learning, the teacher cannot effectively control the educational environment.	5	1.77	36	12.72	81	28.62	122	43.11	39	13.78

Table 4. Questions Related to the Lesson Processing and Ideas About Socializing

Questions Related to the Lesson Processing	I do not agree at all		I do not agree		I am indecisive		I agree		I absolutely agree	
	n	%	n	%	n	%	n	%	n	%
I have easy access to the university's online learning website.	15	5.30	47	16.61	55	19.43	132	46.64	34	12.01
Online learning lessons are as efficient as face to face education lessons	86	30.39	82	28.98	70	24.73	37	13.07	8	2.83
With online learning, students' success processes can be followed more easily.	70	24.73	100	35.34	70	24.73	33	11.66	10	3.53
I think that the online learning I received from the same teacher is more efficient than face to face education.	81	28.62	81	28.62	84	29.68	29	10.25	8	2.83
I think I received insufficient education in the practical courses in online learning.	4	1.41	25	8.83	78	27.56	86	30.39	90	31.80
Online learning provides me a better understanding of the subject than face to face training, as I can stop or watch the videos when I want.	19	6.71	34	12.01	88	31.10	92	32.51	50	17.67
In online learning, not being able to communicate with the teacher simultaneously during the lesson decreases my motivation.	10	3.53	47	16.61	66	23.32	110	38.87	50	17.67
Face to face interaction is required for the best training.	4	1.41	21	7.42	61	21.55	111	39.22	86	30.39
Since vocational education requires learning with practical applications, vocational education cannot be given by online learning.	2	0.71	20	7.07	47	16.61	102	36.04	112	39.58
I think that online learning can be used in teaching theoretical lessons after the pandemic.	13	4.59	28	9.89	64	22.61	119	42.05	59	20.85
I think that online learning can be used in practical lessons after the pandemic.	120	42.40	75	26.50	60	21.20	20	7.07	8	2.83
I follow course contents uploaded to the online learning system regularly.	9	3.18	55	19.43	71	25.09	120	42.40	28	9.89
Online learning can be easily applied to all levels of vocational education.	85	30.04	108	38.16	65	22.97	20	7.07	5	1.77
Ideas about Socializing										
Online learning negatively affects the student's life after graduation by preventing the student's participation in group work and taking responsibility.	10	3.53	48	16.96	81	28.62	80	28.27	64	22.61
Online learning prevents students from socializing.	12	4.24	51	18.02	39	13.78	105	37.10	76	26.86
As I communicate less with my friends in online learning, the sincerity between us decreases.	22	7.77	72	25.44	51	18.02	96	33.92	42	14.84
Since the day and time of the lesson are not known in online learning, I have difficulty starting the lesson.	11	3.89	68	24.03	46	16.25	103	36.40	55	19.43
Since online learning lessons are conducted in a shorter time and more intensively than formal education lessons; it contributes to me in terms of efficient use of time	20	7.07	41	14.49	92	32.51	107	37.81	23	8.13
I prefer online learning as there are no necessities required by the classroom environment (clothing, preparation of the class to start the lesson, no obligation to adapt to society, etc.).	37	13.07	58	20.49	77	27.21	79	27.92	32	11.31

participation in group work and taking responsibility and will affect the student's life after graduation negatively" (Table 4).

DISCUSSION

The effectiveness of the education provided in the digital environment was evaluated in our study. We questioned students who took the theoretical and practical courses with online learning for one semester and the results were examined.

Online education is a new practice in our country that comes with the pandemic. Especially in applied health sciences, the idea of online education has not been adopted by both the lecturer and the student. Therefore, in a short time, it was found that students had difficulty in adapting to online education, and both physical and motivational conditions forced students. In health education, even one single person's incomplete learning cannot be accepted. Therefore, even one person who cannot access online education due to inadequacies such as internet and laptop makes the applicability of online education questionable. We think that the students who switch to online education without preparation in the world and in our country may not be able to perform their previous performances because it is an unusual method even if their physical deficiencies are eliminated. Therefore, we think that face to face education should be started at the first opportunity allowed by pandemic conditions and the process of getting used to online education should be carried out during face to face education. As a matter of fact, the theoretical courses of health sciences can be given online, and practical courses can be given face to face.

The study was conducted in a state university. Because the education was asynchronous in most of the state universities in Turkey while foundation universities applied the lessons as synchronous. For synchronized training, students must have instant laptop and internet access. However, during the pandemic period, our students, who reached us by phone, stated that those living in the village went from the village to the city on a certain day of the week and accessed the records of the lessons in the internet café because they did not have laptop and internet at home. State university students have limited financial opportunities compared to foundation university students. It is obvious that synchronized education in public universities creates a disadvantageous situation for students who have to be at their family's house during the pandemic. Therefore, the asynchronous nature of online courses at state universities has created an advantage for disadvantaged students in terms of equality of opportunity. However, in synchronous education, the student-teacher relationship is more lively, and the student is more likely to like and understand the lesson, thanks to their communication. We think that the fact that the courses are given asynchronously in our university affects the results. If in our university lessons had been synchronized, it would have been expected that students who have the necessary equipment would have higher online education satisfaction.

Online learning process; It is based on the realization of learning through the combination of learner, teacher and course contents in different environments and through communication technologies (15). With the emergence of the Covid-19 pandemic in our country and in the world, the online learning process has been started as an urgent plan in order not to interrupt education. It is inevitable that this rapid transition process will bring along disruptions. It is very important to get feedback from students in order to improve the ongoing processes related to online learning.

We found that 35.69% of the students do not have laptop at home. In online learning, the teacher gives homework to the students that they can prepare only by laptop. Smartphones are suitable for watching the lessons but not suitable for preparing project and homework. So, this situation causes students to do insufficient, sloppy homework and sometimes to have others do it. Considering the students who do not have laptops, this situation causes the assessment and evaluation of the students to be insufficient and unhealthy. Most of the students agreed that physiotherapy and rehabilitation department was not suitable for online learning and do not agree with the idea online learning was an effective learning model. 29.33% of the students could not easily access the minimum necessary equipment for online learning. This is an im-

portant rate about which we cannot be insensitive. Physiotherapy and rehabilitation department is a practical, a vital part that deals with human health. Therefore, the education of every student is important. Even one student's graduation with incomplete education means risking the lives of patients. Therefore, the online learning in physiotherapy and rehabilitation department is considered not to be suitable for practical courses.

Students declared that they had motivation problems during the online learning and they do not rely on the education they get by online learning. One advantage of the online learning is that the contents (video, audio, ppt) can be accessed at any time. It is seen that half of the students participating in our study received online learning for the first time. The online learning systems that exist within universities differ. Unfamiliarity with the system can affect the process negatively. We think that the brochures, videos and visuals that will be prepared for students on how to use the system will contribute positively. Another factor that will provide motivation and student participation is the student's ability to access educational materials (16). As a result of our study, it was observed that 55.48% of the students were able to log into the system via tablet and smart phone, and 8.48% of the students always had problems with internet access. In this case, the important point is that there may be documents that they will not be able to access with their tablets and phones or they will not be able to access at all due to internet problems. Choy et al. reported that internet-related problems increase students' anxiety and decrease motivation (17). Lack of access to the course material for which the student is responsible reduces motivation and participation, as well as preventing effective measurement and evaluation.

Our study was carried out with students attending physiotherapy and rehabilitation department. Physiotherapy and rehabilitation department is largely based on skill and attitude teaching, and practical courses are predominant. As a result of the study, most of the students stated that online learning was not an effective method, and physiotherapy and rehabilitation department was not suitable for online learning. In a study published in 2014 on physiotherapy and rehabilitation department education, it was reported that the additional use of web-based learning in clinical learning was useful (18). In our study, students stated that it is not suitable to use as a single method.

When the participants were asked whether their friends adapted to online learning or not, the answer 'I am undecided' came to a great extent. This result shows that socialization has decreased and communication is weakened between students. One of the important factors of learning is peer interaction (19). Students can achieve permanent learning to a large extent by interacting with their peers as well as with tutorials and materials. Even if asynchronous applications are made in online learning, it is thought that giving homework such as projects, e-posters, and presentations that students can do as a team and keeping them in touch with their peers will be beneficial (20). By creating groups such as mail, social media, messaging applications, this process can be carried out more easily by the tutorial. The importance of timely and accurate feedback in order to provide students with the right knowledge and skills and to increase the retention of information has also been emphasized by studies (21,22). It is very important to ensure this by the teacher in asynchronous lessons and timely feedback can be provided with the specified tools. Some students were satisfied about saving time thanks to online learning. Most of them reported that online learning lessons are conducted in a shorter time and more intensively than formal education lessons. In formal education, it takes time and money to dress up and reach the campus. Considering this result, it should be noted that it would be beneficial to process some courses that can be taught online.

The students stated that their teacher tried to give the lessons in the best way and that the teachers were sincere and warm. Like students, teacher had difficulties to adapt due to their first online education, and especially elderly teachers who were far from technology had serious problems in the online education system, video recording, and course upload to the website. Despite this, they tried to motivate the students due to the pandemic and we found this situation was noticed by the students.

We found that most of the students think that on-

line learning lessons are not as efficient as face to face education lessons. Most of them prefer formal face-to face education more than online learning. Students reported that they think they received insufficient education in the practical courses with online learning. We think that it would be more beneficial to conduct practical lessons face to face and to conduct theoretical lessons synchronously online.

Our education system was asynchronous, so when we questioned the students about difficulty starting the lesson because of the day and time of the lesson not known in online learning, they stated that they have problems about this.

Another disadvantage of the online learning is preventing the students from socializing. Most of the students reported that online learning negatively affects the student's life after graduation by preventing the student's participation in group work and taking responsibility and prevents students from socializing. The university is not only an institution where the profession is learned, but also a place where personal development and friendships are provided. So face-to face learning has many advantages. Students think that online learning causes a decrease in the quality and efficiency of education and problems in measurement and evaluation compared to face to face education. It was emphasized that limited student-teacher interaction in online learning reduces motivation for the lesson. Despite these, although it seems disadvantageous, it is an important advantage that it allows the student to access the contents at any time in his / her daily schedule asynchronously. Henaku declared that college students experienced internet connectivity problems (23). We found that 21.91% of the students reported that website of the university was not easy to access. This is our take home message. We are planning to make our website better.

The limitation of our study is the small sample size. We conducted the study only at one state university. Planning future studies to include both foundation and state universities will provide a more detailed explanation of the situation in Turkey. Another limitation of our study is that graduate and undergraduate students were analyzed together. But master's degree courses are more appropriate to online education than bachelor's degree. Master of science student satisfaction might be higher than the other classes.

We have 430 students in the physiotherapy and rehabilitation department. We invited all of them to participate the study. But only 283 students of them accepted to participate (65.81% of the students participated the study). So power of the study is not as high as it should be, it is lower than 80%. So we would like to define because of the low power of our study, results should be interpreted carefully.

As a result, the pandemic process that emerged in our country at the beginning of 2020 and obliged universities to start urgent online learning in education has opened the door to a change in education for us (24). We think that the contribution of these results in the preparation of the educational contents that will be restructured by making more use of technology will be great. The preparation of new contents, taking into account the positive and negative feedback we have emphasized in the results of our study, will play an important role in increasing the quality and efficiency of education. As a result, we think that it is more beneficial to give some theoretical courses online and synchronized, and practical courses face to face. Therefore, we think that it will be beneficial to postpone the practical courses that cannot be done face to face due to the pandemic and to give those courses face to face after the pandemic process.

Contributiors: Concept – EDH; Supervision – EDH, YT; Resources and Financial Support – ÖG; Materials - EDH, SBa; Data Collection and/or Processing - IK, MŞF, BP, FEÇ; Analysis and/or Interpretation – FEÇ, SBe, ÖG, IK; Literature Research – EDH, EL, Sba; Writing Manuscript - EDH, YT, EL; Critical Review – BP, MŞF.

Declaration of interests: There is no conflict of interest to disclose.

Acknowledgements: We thank all the students who participated in this study.

Funding: There is no funding support for the study.

Informed Consent: The students included in the study were informed about the study's methodolo-

gy, and informed consent was obtained for participation in the study.

Ethical Approval: Approval for the study was granted by Hatay Mustafa Kemal University Non-Interventional Clinical Researches Ethics Board (Approval Date: 04.06.2020 and Approval Number: 04/06/2020-07-14).

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)81-88

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Received: *25.08.2021 (Geliş Tarihi)*
Accepted: *10.03.2022 (Kabul Tarihi)*

KARBON TABANLIK KULLANIMININ PES PLANUS VE PES KAVUSU OLAN BİREYLERDE AYAK PLANTAR BASINÇ DAĞILIMINA ETKİSİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çalışmada kişiye özel üretilen karbon tabanlık kullanımının, pes planus veya pes kavusu olan bireylerde dinamik ve statik plantar basınç analizine etkisini değerlendirmek amaçlanmıştır.

Yöntem: Çalışmaya tabanlık kullanması reçete edilen 30 gönüllü birey cinsiyet ayrımı gözetmeksizin dahil edildi. Ağrı değerlendirmesi için Görsel Analog Skala (GAS), dinamik ve statik plantar basınç analizi için sensor medica pedobarografik cihaz ve yaşam kalitesi için Kısa Form-36 Yaşam Kalitesi Anketi kullanıldı. Kişiye özel karbon tabanlık üretilip, katılımcıların 6 ay kullanması istendi. Analizler tekrarlı ölçümlü Anova testi ile başlangıçta, 2. ve 6. ayda yapıldı.

Sonuçlar: Karbon tabanlık kullanımı öncesi ilk ölçüm, 2. ve 6. ayda yapılan GAS değerlendirmelerinde ($p<0,001$), dinamik pedobarografik ölçüm analizlerinde ($p<0,05$) ve sağ ve sol ayağa binen ağırlık yüzdesi dışında diğer statik pedobarografik ölçüm analizlerinde ($p<0,05$) istatistiksel düzeyde anlamlı farklılık elde edildi. Yaşam kalitesinin sosyal fonksiyon hariç tüm diğer alt başlıklarında istatistiksel düzeyde anlamlı değişiklik belirlendi ($p<0,05$).

Tartışma: Pes planus veya pes kavusa sahip bireylerde kişiye özel karbon tabanlık kullanımının ayak ağrısını azalttığı, statik ve dinamik plantar basınç analizi ile yaşam kalitesi üzerinde olumlu etkisi olduğu belirlenmiştir.

Anahtar Kelimeler: Ağrı, Pedobarografi, Pes Kavus, Pes Planus, Tabanlık

THE EFFECT OF CARBON INSOLE USE ON FOOT PLANTAR PRESSURE DISTRIBUTION IN INDIVIDUALS WITH PES PLANUS AND PES CAVUS

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this study was to evaluate the effect of using custom made carbon insoles on dynamic and static plantar pressure analysis in individuals with pes planus or pes cavus.

Methods: Thirty volunteers who were prescribed to use insoles were included in the study, regardless of gender. The Visual Analogue Scale (VAS) was used for pain assessment, and the sensor medica pedobarographic device for dynamic and static plantar pressure analysis and Short Form-36 Quality of Life Questionnaire for quality of life. Personalized carbon insoles were produced and the participants were asked to use it for 6 months. Analyzes were performed with repeated measures Anova test at baseline, at 2 and 6 months.

Results: Before using carbon insoles; In the first measurement, 2nd and 6th month VAS evaluations ($p<0.001$), dynamic pedobarographic measurement analyzes ($p<0.05$), other static pedobarographic measurement analyzes except the percentage of weight on the right and left feet ($p<0.05$) statistically significant difference was obtained. A statistically significant change was found in all subtitles of quality of life except social function ($p<0.05$).

Conclusion: The use of personalized carbon insoles in individuals with pes planus or pes cavus; it has been determined that it reduces foot pain and has a positive effect on quality of life with static and dynamic plantar pressure analysis.

Keywords: Pain, Pedobarography, Pes Cavus, Pes Planus, Insole

GİRİŞ

Ayak, hem duruş pozisyonunda hem de yerle temasta olduğu dinamik aktiviteler sırasında insan vücudunun tüm yükünü taşıyan en önemli unsurdur. Vücuttaki bütün yüzeyin %5'i olan ayak, vücut yapısının %95'ini destekler ve insan vücuduna karşı uygulanan yer reaksiyon kuvvetlerinin şok absorbsiyonu fonksiyonuna sahiptir. Ayak yapılarının desteklenemediği durumlarda ortaya çıkan ayaktaki bozukluklar; kas, tendon, sinir, ligament, eklem ve kemik dokularını kapsayan problemler ile meydana gelerek kişilerin yaşam kalitesi, plantar basıncı ve ağrılarını olumsuz yönde etkilemektedir (1).

Pes kavus (PK), geniş bir anormallik spektrumunu karakterize etmek için kullanılan, tipik olarak normalden yüksek medial longitudinal ark (MLA), başparmağın plantar fleksiyonu, ön ayağın pronasyon ve valgusu, arka ayak varusu ve ön ayak adduksiyonu ile karakterize bir durumdur. PK esnek ya da rijit olabilirken ayak ağrısı olan hastalarda sık görülen bir bulgudur (2). Pronasyon derecesi az olan bireylerde sıklıkla semptom vermezken, pronasyon açısı fazla olan bireyler yorgunluk hisseder ve metatars başlarındaki ağrıdan şikayet eder (3). PK'lu bireylerde normal ayak tipine sahip bireylere göre daha fazla ayak ağrısı olduğu görülmekte ve bu bireylere uygulanan kişiye özel tabanlıkların yürüme sırasında plantar basıncı azalttığı çalışmalarda gösterilmiştir (2- 4).

Pes planus (PP), medial longitudinal arkın düz veya normale göre daha çökük olmasıdır. PP ayağın fonksiyonelliğini bozarak yumuşak dokularda dengesiz yük dağılımına neden olur (4). PP çocuklarda çok yaygın ve genellikle asemptomatiktir (5). Vücut ağırlığına bağlı olarak ayaklar üzerinde oluşan mekanik stres göz önüne alındığında aşırı kilolu olan çocuklar, PP ve kas-iskelet sistemi problemleri için yüksek risk altındadır (6). Yetişkinlerde PP tesadüfi bir bulgu olabilir. Semptomatik hastalarda orta ayak, topuk, alt bacak, diz, kalça ve/veya sırt ağrısı şikayetleri olabilirken, daha ileri değişiklikleri olan hastalar, değişen yürüyüş paterninden şikayet edebilirler (5). PP'lu bireylerde kişiye özel tabanlık kullanımının amacı ayağın doğal biyomekanik dizilimini düzenleyerek MLA'ı destekleyen dokularda oluşan yükleri en aza indirgemektir (7). PP'lu bireylerde kişiye özel tabanlık kullanımının, ağrı şiddetini azaltarak yaşam kalitesini artırdığı gösterilmiştir (8).

Literatürde kişiye özel tabanlık kullanımının, ayak tabanında oluşan basıncı azaltmada etkili olduğu gösterilmiştir (9,10). Gelişen teknoloji ile birlikte kişiye özel yapılan tabanlık materyal seçimleri değişkenlik göstermektedir. Etil Vinil Asetat (EVA) malzemesi hem ekonomik hem de kolay şekil almasından dolayı çok fazla tercih edilmiştir. Karbon grafit materyali ile üretilen tabanlıkların temas alanı ve maksimum kuvvet oluşumunu düzenleyerek plantar basınç dağılımını dengelediği bildirilmiştir. Aynı zamanda plantar yükleme azaldığında ayağın lateral hareketleri sırasında oluşan stresi minimum düzeyde tutarak konservatif tedavinin etkin olmasını sağlamaktadır (11). Fakat literatürde kişiye özel yapılan tabanlıklarda materyal olarak karbon kullanılmasını inceleyen çalışmalar limitlidir. Bu bağlamda çalışmamızda pes planus veya pes kavusu olan bireylerde, kişiye özel üretilen karbon tabanlık kullanımının statik ve dinamik plantar basınç analizi ile yaşam kalitesi ve ağrı üzerine etkisinin incelenmesi amaçlanmıştır.

YÖNTEM

Çalışma, uzman hekim tarafından tabanlık kullanması önerilen 30 gönüllü birey ile ortez-protez yapım ve uygulama merkezinde gerçekleştirildi. Çalışmanın başlangıcında tüm katılımcılara çalışma detayları anlatıldı ve bilgilendirilmiş gönüllü olur formu imzalı olarak alındı. Çalışma 10840098-604.01.01-E61617 numarası ile etik kurul tarafından onaylandı.

Çalışmaya PP veya PK'u olup tabanlık kullanması gereken, herhangi bir nörolojik, romatolojik, ortopedik ya da nöromüsküler patolojiye sahip olmayan, okuma-yazma bilen ve çalışmaya katılmaya gönüllü olan 6-54 yaşları arasındaki bireyler dahil edildi. Alt ekstremite cerrahisi geçiren, pes kavus veya pes planus dışında yaralanma veya hastalık öyküsü olan ve 1 santimetre (cm)'den fazla alt ekstremite boy eşitsizliği olan bireyler çalışmadan dışlandı.

Çalışmaya alınan olguların demografik bilgileri kaydedildikten sonra, bireylerin son bir hafta içinde günlük yaşam aktiviteleri esnasında PP veya PK'u olan ayaklarında hissettikleri ağrı görsel analog

skala (GAS) ile değerlendirildi. GAS, üzerinde 0- 10 arasında numaralardan oluşan öznel bir ağrı ölçüm yöntemidir. 0 ağrı olmadığını, 10 şiddetli ağrı olduğunu belirtmektedir (12).

Yaşam kalitesi değerlendirmesinde Kısa Form-36 (KF-36) kullanıldı. KF-36; fiziksel fonksiyon, vücut ağrısı, fiziksel problemler nedeniyle kısıtlanma, emosyonel problemler nedeniyle kısıtlanma, emosyonel iyilik hali, sosyal fonksiyon, enerji ve genel sağlık olmak üzere 36 soru içeren 8 bölümden oluşmaktadır. Sorulara verilen puanlama 0-100 arasındadır. Düşük puan, düşük yaşam kalitesi seviyesini göstermektedir (13).

Hastaların statik plantar basınç analizleri, yürüyüş analiz cihazı (Sensor medica, İtalya) ile yapıldı. Cihaz, 60x60 cm boyutunda ve tüm yüzeyi basınca duyarlı sensörlerden oluşmaktadır. Statik pedobarografik ölçümde; bireyin demografik bilgi girişi yapıldıktan sonra, bireyden ayakkabı ve çoraplarını çıkararak basınca duyarlı sensörlerden oluşan sensor medica platformuna iki ayağı ile dengede duracak şekilde basması istendi. Bireye statik ölçüm süresince kolları iki yanında doğal salınımda duracak şekilde sabit durması söylendi. Statik pedobarografik ölçüm sırasında bireyin sol-sağ denge dağılımı, ön-arka ayak plantar basınç dağılımı değerlendirildi. Ortalama uygulama süresi bir dakika sürdü ve 3 tekrarlı ölçüm yapılıp sonuçların ortalaması alındı.

Dinamik pedobarografik ölçüm, statik pedobarografik ölçümlerin yapıldığı aynı cihaz ile yapıldı. Bireyden ayakkabı ve çoraplarını çıkarıp basınca duyarlı sensörlerden oluşan sensor medica platformunun yer aldığı 3 metre yürüyüş platformu üzerinde günlük hayatta yürüdüğü gibi doğal yürüyüş paternini gerçekleştirmesi istendi. Katılımcıya en az 3 tur olacak şekilde yürüyüş parkurunu tamamlaması söylendi. Dinamik pedobarografik ölçüm topuk vuruşu, taban teması, orta duruş, itme fazı ve parmak kalkışından oluşan yürümenin duruş fazındaki ön-arka ayaktaki plantar basınç değişimini raporladı. Uygulama yaklaşık 4 dakika sürdü ve sonuçlar ortalama değer olarak kaydedildi.

Katılımcılara statik ve dinamik pedobarografik ölçüm yapıldıktan sonra karbon tabanlık üretimi için, köpük (Ottobock) ile ayaklarının kalıp ölçüsü alınarak negatif model oluşturuldu. Kartonpiyer alçı (ABS) ile ölçüler doldurularak üzerinde işlem yapılacak sertlikte donması beklendi. Yapılan statik ve dinamik ölçümler ile belirlenen bozukluğa göre pozitif model üzerinde modifikasyonlar yaparak kişilerin ayağına göre hazırlandı. Karbon plakalar ayak numarası ölçülerine göre kesildi. Modifikasyondan geçen pozitif modellerin üzerine ayak numarasına göre hazırlanan karbon plakaları şekil alacak kıvamda fırında ısıtılarak press vakum makinesi ile şekil verildi. Karbon materyalin pozitif kalıp şeklini alıp soğuması için 3 saat press vakum makinesinde bekletildi. Son olarak freze ile düzeltmeler yapılarak cilde uyumlu plastazot ile kaplanıp kişilere teslim edildi.

Katılımcıların sağ ve sol olarak her iki ayağına uygulanan karbon tabanlıkları toplam 6 ay boyunca, 1,5-3,5 cm topuk yüksekliği olan spor ayakkabı ile kullanmaları istendi. Karbon tabanlığın kısa süreli ve orta-uzun süreli etkisini değerlendirmek için 2. ve 6. ayda çalışmanın başlangıcında yapılan statik plantar basınç ölçümü, dinamik plantar basınç ölçümü, GAS ve KF-36 yaşam kalitesi değerlendirme anketi ölçümleri tekrarlandı.

İstatistiksel Analiz

Verilerin analizi için IBM SPSS Version 20.0 (Statistical Package for Social Sciences Inc. Chicago, IL, ABD) programı kullanıldı. Sayısal olarak ölçülen veriler yüzde, ortalama, standart sapma, standart hata ortalaması ve etki büyüklüğü (EB) şeklinde ifade edildi. Verilerin normal dağılımına One-Sample Shapiro-Wilk testi ile bakıldı. Tekrarlı Ölçümlü Anova testi ile tabanlık kullanımı öncesi, tabanlık kullanımına başladıktan sonraki 2.ve 6. ay ölçümleri yapıldı. Elde edilen farkların etki büyüklüğünü belirlemede Cohen's d etki büyüklüğü analizi kullanıldı. Etki büyüklüğü değeri 0,30'un altında ise zayıf etki, 0,30- 0,49 arası küçük etki, 0,50-0,79 arası orta etki ve 0,80 üstü büyük etki olarak değerlendirildi. $p<0,05$ olasılık değeri anlamlı kabul edildi. Araştırma sonrasında yapılan G-Power (3.1.9.4) post hoc güç analizine göre, etki büyüklüğü=0,25, $\alpha=0,05$ iken çalışmanın gücü $(1- \beta)=0,84$ olarak hesaplandı.

SONUÇLAR

Çalışmaya dahil edilen, 18 (%60) PK, 12 (%40) PP'lu 30 bireyin; yaşları ortalama 17,73±13,16 yıl, vücut ağırlığı değerleri ortalama 44,40±17,33 kilo, boy

Tablo 1. Katılımcıların Demografik Bilgileri

	Ort±SS	Min-Maks
Yaş	17,73±13,16	6-54
Vücut ağırlığı	44,40±17,33	18-82
Boy uzunluğu	147,36±18,91	1,10-1,83
	n	**Yüzde (%)**
Pes planus	12	% 40
Pes kavus	18	% 60

SS: Standart Sapma, Ort: Ortalama, Min: Minimum, Maks: Maksimum, n:Sayı

uzunluğu değerleri ortalama 147,36±18,91 cm olarak tespit edildi (Tablo 1). Sağ ve sol olarak her iki ayakta karbon tabanlık kullanımı öncesi ilk ölçüm, karbon tabanlık kullanımı sonrası 2. ve 6.ay GAS değerlendirmelerinde ağrının istatistiksel olarak anlamlı düzeyde azaldığı (p<0,001) ve tabanlığın orta düzeyde etki büyüklüğüne sahip olduğu belirlendi (EB:0,615) (Tablo 2).

Katılımcıların dinamik pedobarografik ölçüm analizlerinde; ilk ölçüm ile 2.ay ölçümleri arasında fark yoktu (p>0,05). İlk ölçüm ile 6.ay analizleri arasında sol ön ve arka ayağa binen ağırlık yüzdesinde anlamlı değişiklik elde edilirken (p=0,002), sağ ayakta farklılık belirlenmedi (p>0,05). 2.ay ölçümleri ile 6.ay ölçümleri arasında sağ ve sol ön ve arka ayakta değişim tespit edildi (p<0,05). Katılımcıların ilk ölçüm, 2. ve 6.ay verilerinde sol ön ayağa binen ağırlık yüzdesi (p=0,002), sol arka ayağa binen ağırlık yüzdesi (p=0,002), sağ ön ayağa binen ağırlık yüzdesi (p=0,019) ve sağ arka ayağa binen ağırlık yüzdesinde istatistiksel olarak anlamlı fark elde edildi (p=0,019). Tabanlığın tüm verilere etki büyüklüğü zayıf olarak belirlendi (Tablo 3).

Katılımcıların statik pedobarografik ölçüm analizlerinde; ilk ölçüm ile 2.ay ölçümleri arasında sağ ön ayağa binen ağırlık yüzdesinde anlamlı farklılık vardı (p=0,041). İlk ölçüm ile 6.ay ve 2.ay ile 6.ay ölçümleri arasında sol ve sağ ayağa binen ağırlık yüzdesi dışında diğer tüm parametrelerde değişiklik elde edildi (p<0,05). Katılımcıların ilk ölçüm, 2. ve 6.ay verilerinde sol ön ayağa binen ağırlık yüzdesi (p=0,001), sol arka ayağa binen ağırlık yüzdesi (p=0,001), sağ ön ayağa binen ağırlık yüzdesi (p=0,001) ve sağ arka ayağa binen ağırlık yüzdesinde anlamlı farklılık tespit edildi (p=0,001). Tabanlığın tüm verilere etki büyüklüğü zayıf olarak belirlendi. Sol ayağa binen ağırlık yüzdesi (p=0,070) ile sağ ayağa binen ağırlık yüzdesinin ilk ölçüm, 2. ve 6.ay verileri arasında istatistiksel düzeyde anlamlı bir fark bulunmadı (p=0,072), (Tablo 3).

Yaşam kalitesi analizlerinde; katılımcıların ilk ölçüm ile 2.ay, ilk ölçüm ile 6.ay ölçümleri arasında sosyal fonksiyon hariç tüm alt parametreler anlamlı olarak farklıydı (p<0,05). 2.ay ile 6.ay ölçümleri arasında fiziksel fonksiyon (p=0,032), fiziksel problemler nedeniyle olan kısıtlılık (p=0,043), emosyonel iyilik hali (p<0,001) ve enerji (p=0,043) alt parametrelerinde değişiklik belirlendi (p<0,05). Katılımcıların ilk ölçüm, 2. ve 6.ay fiziksel fonksiyon (p<0,001), vücut ağrısı (p=0,009), fiziksel problemler nedeniyle olan kısıtlılık zamanları (p=0,016), emosyonel problemler nedeniyle olan kısıtlılık (p=0,012), emosyonel iyilik hali (p<0,001), enerji (p=0,001) ve genel sağlık algısı verilerinde istatistiksel olarak anlamlı bir fark elde edildi (p<0,001). KF-36'nın sosyal fonksiyon alt başlığı anlamlı düzeyde farklı değildi (p=0,166). Emosyonel iyilik halinde tabanlığın etki büyüklüğü küçük (EB:0,412) diğer parametrelerde zayıf olarak belirlendi (Tablo 4).

Tablo 2. Görsel Analog Skala ile Ağrı Şiddetinin İlk Ölçüm, 2. ve 6. Ay Karşılaştırılması

	İlk Ölçüm		2.Ay		6.Ay						
	Ort±SS	**Min-Maks**	**Ort±SS**	**Min-Maks**	**Ort±SS**	**Min-Maks**	***p1-2**	***p1-6**	***p2-6**	****p**	**EB**
GAS	2,93±1,83	2,24-3,61	1,56±1,50	1-2,12	0,53±0,93	0,18-0,88	**<0,001**	**<0,001**	**<0,001**	**<0,001**	**0,615**

GAS: Görsel Analog Skala, SS: Standart Sapma, Ort: Ortalama, Min: Minimum, Maks: Maksimum, EB: Etki Büyüklüğü, p1-2: İlk ile 2. ay ölçüm farkı, p1-6: İlk ile 6. ay ölçüm farkı, p2-6: 2. ile 6. ay ölçüm farkı, *p<0,05, ** p<0,05, Tekrarlı Ölçümlü Anova

Tablo 3. Dinamik ve Statik Pedobarografik Analizin İlk, 2. ve 6. Ay Verilerinin Karşılaştırılması

	İlk Ölçüm		2.Ay		6.Ay						
	Ort±SS	Min-Maks	Ort±SS	Min-Maks	Ort±SS	Min-Maks	*p1-2	*p1-6	*p2-6	**p	EB
Dinamik pedobarografik analiz											
Sol ön ayağa binen ağırlık yüzdesi	59,63± 9,47	56-63	58,70± 13,02	53-63	53,00± 10,38	50-55	0,748	**0,002**	**0,009**	**0,002**	**0,143**
Sol arka ayağa binen ağırlık yüzdesi	40,36± 9,47	36-43	41,30± 13,02	36-46	47,00± 7,66	44-49	0,748	**0,002**	**0,009**	**0,002**	**0,143**
Sağ ön ayağa binen ağırlık yüzdesi	57,73± 13,23	52-62	60,93± 10,51	57-64	54,23± 6,81	51-56	0,282	0,156	**<0,001**	**0,019**	**0,127**
Sağ arka ayağa binen ağırlık yüzdesi	42,26± 13,23	37-47	39,06± 10,51	35-42	45,76± 6,81	43-48	0,282	0,156	**<0,001**	**0,019**	**0,127**
Statik pedobarografik analiz											
Sol ön ayağa binen ağırlık yüzdesi	23,90±13,21	18-28	26,33±11,12	22-30	32,20±9,62	28-35	0,265	**0,001**	**0,002**	**0,001**	**0,237**
Sol arka ayağa binen ağırlık yüzdesi	76,03±13,16	71-80	73,66±11,12	69-77	68,13±9,33	64-71	0,278	**0,001**	**0,003**	**0,001**	**0,223**
Sol ayağa binen ağırlık yüzdesi	51,03±8,21	47-54	51,40±8,08	48-54	50,23±3,75	48-51	0,070	0,070	0,070	0,070	0,010
Sağ ön ayağa binen ağırlık yüzdesi	25,90±14,01	20-31	30,60±11,46	26-34	35,20±9,55	31-38	**0,041**	**<0,001**	**0,004**	**0,001**	**0,269**
Sağ arka ayağa binen ağırlık yüzdesi	74,10±14,01	68-79	69,40±9,64	65-73	64,80±9,55	61-68	**0,041**	**<0,001**	**0,004**	**0,001**	**0,269**
Sağ ayağa binen ağırlık yüzdesi	48,96±8,21	45-52	48,60±8,08	45-51	49,73±3,77	48-51	0,072	0,072	0,072	0,072	0,010

SS: Standart Sapma, Ort: Ortalama, Min: Minimum, Maks: Maksimum, EB: Etki Büyüklüğü, *p1-2: İlk ile 2. ay ölçüm farkı, *p1-6: İlk ile 6. ay ölçüm farkı, *p2-6: 2. ile 6. ay ölçüm farkı *p<0,05, ** p<0,05, Tekrarlı Ölçümlü Anova

Tablo 4. KF- 36 Yaşam Kalitesi Ölçeğinin İlk Ölçüm, 2. ve 6. Ay Karşılaştırılması

	İlk Ölçüm		2.Ay		6.Ay						
KF- 36	**Ort±SS**	**Min-Maks**	**Ort±SS**	**Min-Maks**	**Ort±SS**	**Min-Maks**	***p1-2**	***p1-6**	***p2-6**	****p**	**EB**
Fiziksel fonksiyon	88,33± 16,83	82-94	93,33± 16,76	89-97	95,66± 8,58	92-98	0,003	0,002	0,032	<0,001	0,258
Vücut ağrısı	92,33± 15,89	86-98	96,00± 9,41	92-99	97,75± 6,24	95-100	0,043	0,022	0,099	0,009	0,149
Fiziksel problemler	95,00± 12,10	90-99	98,33± 8,29	95-100	98,33± 8,29	95-100	0,043	0,043	0,043	0,016	0,133
Emosyonel problemler	97,40± 4,78	95,6-99,1	98,40± 3,42	97,1-99,6	98,80± 2,95	97,6-99,9	0,019	0,014	0,246	0,012	0,160
Emosyonel iyilik hali	89,06± 10,86	85-93	92,13± 9,59	88-95	96,00± 7,04	93-98	<0,001	<0,001	<0,001	<0,001	0,412
Sosyal fonksiyon	97,08± 9,09	93-100	98,33± 6,34	95-100	98,33± 6,34	95-100	0,166	0,166	0,166	0,166	0,060
Enerji	92,33± 10,40	88-96	94,33± 8,17	91-97	95,66± 6,66	93-98	0,012	0,002	0,043	0,001	0,236
Genel sağlık algısı	90,33± 11,13	86-94	93,00± 9,43	89-96	94,50± 8,44	91-97	0,001	<0,001	0,059	<0,001	0,297

SS: Standart Sapma, Ort: Ortalama, Min: Minimum, Maks: Maksimum, EB: Etki Büyüklüğü, *p1-2: İlk ile 2. ay ölçüm farkı, *p1-6: İlk ile 6. ay ölçüm farkı, *p2-6: 2. ile 6. ay ölçüm farkı *p<0,05, ** p<0,05, Tekrarlı Ölçümlü Anova

TARTIŞMA

Çalışmada; pes planus veya pes kavusu olan bireylerde, kişiye özel karbon tabanlık kullanımının statik ve dinamik plantar basınç analizi, yaşam kalitesi ve ağrı üzerine etkisini değerlendirmek hedeflenmiştir. Karbon tabanlık kullanım öncesi ilk ölçüm, 2. ve 6. ay analizlerde; bireylerin ağrı şiddetinin azaldığı, sosyal fonksiyon hariç yaşam kalitesinin tüm alt parametrelerinin iyileştiği, dinamik ve statik pedobarografik ölçüm analiz sonuçlarında anlamlı farklılık elde edildiği gösterilmiş olup, sol ve sağ ayağa binen ağırlık yüzdeleri arasında anlamlı bir değişiklik belirlenememiştir.

Zammit ve Payne (14), PP'lu 22 hastada 4 haftalık tabanlık uygulaması ile ayak fonksiyonu ve ağrısında pozitif anlamlı değişim belirlemiştir. Amer ve diğ. (15) ayak ağrısı olan 67 bireye, 4 hafta süresince hazır tabanlık uygulaması yapmış ve ağrı şiddetinde anlamlı azalma elde etmiştir. Nogueron ve diğ. (16), ayak ağrısı olan 54 bireye, ayağın orta kısmını destekleyen kişiye özel etin vinil asetat tabanlık uygulamış ve 90 günlük gözlem sonucunda ağrı şiddetinde %90 oranında azalma olduğunu göstermiştir. 24 PP'lu koşucu ile yapılan bir başka çalışmada; 12 kişilik müdahale grubuna medial topuk kamalı tabanlık, kontrol grubuna ise desteksiz standart tabanlık uygulayarak koşucular 60 dakika boyunca koşu bandında koşturulmuş ve alt ekstremite ağrısı kayıt edilmiştir. İki hafta süre ile tekrarlanan ölçümlerde, müdahale grubundaki ağrı şiddetinin kontrol grubuna göre istatistiksel düzeyde anlamlı olarak daha fazla azaldığı bulunmuştur (17). Çalışmamızda 30 kişi ile yapılan ağrı değerlendirmesinde tabanlık kullanımı öncesi ilk ölçüm, tabanlık kullanmaya başladıktan sonraki 2. ve 6.ay ölçümlerinde ağrı şiddetinde anlamlı düzeyde azalma ve orta düzeyde klinik etkisi olduğu belirlenmiştir. Aynı zamanda tabanlık kullanım süresi arttıkça ağrı seviyesinin azaldığı tespit edilmiştir. Çalışmamızda elde edilen sonuçlar literatür ile paralellik göstermektedir. Kişiye özel üretilen karbon tabanlıklar ayağın plantar yüzeyinde basınç dağılımını dengeleyerek ayağın bazı bölgelerinde aşırı yüklenmeyi önlemektedir. Bu bağlamda karbon tabanlığın ayağın plantar yüzeyinde dengeli basınç dağılımı sağlaması ile ağrının azaltıldığı düşünülmektedir.

Chang ve diğ.(18), 42-74 yaş arası metatarsal ağrısı olan 17 bireye, EVA materyali ile kişiye özel tabanlık uygulaması yapmıştır. Çalışmada; dinamik pedobarografik ölçüm pedar-X cihazı ile ağrı görsel analog skala ile değerlendirilmiştir. Yapılan ölçümler sonucunda, kişiye özel tabanlık kullanımının dinamik plantar basınç analizi dağılımının düzeltilmesinde ve ağrıyı azaltmada istatistiksel düzeyde olumlu etkisinin olduğu belirlemiştir. Bir başka çalışmada; idiyopatik PK'u olan 30 kadında kişiye özel tabanlık uygulaması ile ayağın belirli bölgelerinde oluşan dinamik plantar basıncın azaltıldığı bildirilmiştir (4). Najafi ve diğ. (19), PK'u ve buna bağlı ayak ağrısı bulunan 154 katılımcıya, 3 ay boyunca kişiye özel tabanlık uygulamış ve hastaların dinamik pedobarografik ölçüm değerlendirmesinde kişiye özel tabanlığın PK'lu bireylerde plantar basıncın dengeli dağıtılması ve ağrının azalmasında istatistiksel olarak etkili olduğunu göstermiştir. Çalışmamızda dinamik plantar basınç ölçümü sensor medica cihazı ile yapılmış olup kişiye özel karbon tabanlık kullanımı sonucunda istatistiksel olarak anlamlı farklılık görülmüştür. Çalışmamızda literatür ile benzer olarak 6 aylık kişiye özel karbon tabanlık kullanımı dinamik pedobarografik ve görsel analog skala ölçümlerinde anlamlı farklılık bulunmuştur. 2 ay tabanlık kullanımda analizler değişiklik göstermezken 6 ay kullanımı sonuçları olumlu yönde etkilemiştir. Karbon tabanlığın dinamik plantar basınç dağılımına zayıf düzeyde klinik etkisi olduğu belirlenmiştir. Elde edilen bu sonucun karbon tabanlık kullanımının ayak plantar yüzeyinde oluşan dinamik plantar basınç dağılımını dengelemesi sonucu olduğu düşünülmektedir.

Huang ve diğ. (20), PP'u olan 15 kız öğrenci ile gerçekleştirdikleri çalışmada, katılımcılara medial ark destekli tabanlık uygulaması ile statik plantar basınç ölçümü ve yürümenin duruş fazındaki dinamik basınç değişimini incelemiştir. Çalışmanın sonuçlarına göre medial ark destekli tabanlık kullanımı ile plantar yüzeydeki tepe basınç noktalarında istatistiksel olarak anlamlı farklılık bulunmuştur. Chen ve diğ. (21) PP'lu 3-5 yaş aralığındaki okul öncesi çocuklarda 1 sene boyunca tabanlık kullanımının etkinliğini değerlendirmiştir. Çalışma sonucunda kişiye özel tabanlık kullanımının statik plantar basınç değişimini anlamlı olarak etkilediği belirlenmiştir. Çalışmamızda farklı yaş grupları ile çalışılmasına

rağmen sonuçlar literatür ile benzerdir. Çalışmamızda ilk ölçüm ile 2 ay tabanlık kullanımı sonrasındaki analizler farklılık göstermezken 6 ay kullanım sonrasındaki analizlerde anlamlı gelişmeler elde edilmiştir. Karbon tabanlığın statik plantar basınç dağılımına zayıf düzeyde klinik etkisi olduğu belirlenmiştir. Karbon tabanlıkların sert yapılı malzeme olması ile medial ark desteğine maksimum katkı sağlamasının sonuçlarda etkili olduğu belirtilmektedir.

Katılımcıların tabanlık kullanımı öncesi analizlerinde yürüyüş sırasında ön ayağa fazla, arka ayağa az yük verdikleri, statik duruşta ise ön ayağa az, arka ayağa fazla yük verdikleri görülmüştür.

Literatürde kişiye özel tabanlık kullanımının yaşam kalitesini artırdığı birçok çalışmada gösterilmiştir (8,22,23). Wrobel ve diğ. (23) ayak ağrısı bulunan 77 hastayı 3 gruba bölüp, kişiye özel, fabrikasyon ve düz astar olarak 3 farklı tabanlık uygulaması gerçekleştirdiği çalışmasında; EVA materyalinden üretilen kişiye özel tabanlık yapılan hastalarda KF-36 yaşam kalitesi değerlendirme anketinde anlamlı farklılık elde etmiştir. Fabrikasyon ve düz astar tabanlık uygulanan hastalarda KF-36 yaşam kalitesi değerlendirme anketinde olumlu değişim görülmemiştir. Powell ve diğ. (22), 3 ay boyunca kişiye özel tabanlık kullanımı ile KF-36'nın fiziksel fonksiyon, ağrı, fiziksel problemler nedeniyle olan kısıtlılık alt başlıklarında anlamlı farklılık belirlemiştir. Başka bir çalışmada ise metatarsal bölge ve medial ark destekli tabanlık ile KF-36'nın sadece fiziksel fonksiyon alt başlığında anlamlı artış elde edilmiştir (8). Çalışmamızda KF-36'nın sosyal fonksiyon hariç tüm alt başlıklarında tabanlık kullanım süresi ile paralel olarak anlamlı artışlar elde edilmiş ve etki büyüklüğü zayıf olarak belirlenmiştir. Katılımcılara uyguladığımız karbon tabanlık bölgesel yerine tüm ayağa total destek sağladığı için, ağrı azaltılmasında ve plantar basınç analizlerinde değişikliğe sebep olmuş ve böylece KF-36 yaşam kalitesi değerlendirme anketinin birden çok alt başlığında anlamlı artış sağladığı düşünülmektedir. Farklı materyaller kullanılmasına rağmen tabanlığın kişiye özel üretilmesinin sonuçlara olumlu yansıdığı gösterilmiştir.

Ayakta statik duruşta yükün %40'ı ön ayak, %60'ı arka ayağa aktarılır (24). Çalışmamızda 6 ay karbon tabanlık kullanımı bireylerde ön ayağın yüklenmesini arttırarak arka ayağın yüklenmesini azaltmış ve böylece yükün normal sınırlara göre dengeli dağılımını sağlamıştır. Benzer şekilde 6 ay boyunca karbon tabanlık kullanımı ile yürüyüş sırasında ayağın plantar basıncının dengeli dağılımı sağlanmıştır. Dinamik plantar basınç analizinde ön ayağa normalden fazla aktarılan yükün azaldığı ve arka ayağın yüklenmesinin normale yakın sınırlarda arttırıldığı belirlenmiştir. Statik ve dinamik plantar basınç analizlerindeki gelişmeler sonucu bireylerin ağrı seviyelerinin azaldığı ve yaşam kalitelerinin arttığı düşünülmektedir.

Literatürde kişiye özel tabanlık kullanımı ile ilgili birçok çalışma olmasına rağmen tabanlık üretiminde kullanılan materyal farklılığı konusundaki araştırmalar limitlidir. Aynı zamanda çalışmalarda statik plantar basınç ölçümü sıklıkla yapılmasına rağmen, dinamik pedobarografik ölçüm yapan çalışma sayısı yetersizdir ve ulaşılan çalışmalar karbon tabanlığın klinik etki büyüklüğü açısından yeterli veriyi sağlamamaktadır. Ancak katılımcıların çocuk ve yetişkin bireylerden oluşmasına bağlı olarak çalışmamızın yaş aralığının geniş olması, PP veya PK tanılarını destekleyecek herhangi bir ölçüm yapılmaması, bireylerin günlük yaşamlarında tabanlık giydikleri standart bir sürenin olmaması ve takibinin yetersiz kalması, çalışmada güç analizinin yapılmaması çalışmanın limitasyonları olarak gösterilebilir.

Araştırmamızda kişiye özel karbon tabanlık kullanımının statik ve dinamik plantar basınç dağılımı, ayak ağrısı ve yaşam kalitesi üzerinde olumlu etkisi olduğu söylenebilir. İlerde yapılacak çalışmalarda mevcut limitasyonların giderildiği, daha fazla katılımcı ve kontrol grubu ile karşılaştırma yapılarak karbon tabanlığın klinik etkilerinin belirlenmesini önermekteyiz.

Destekleyen Kuruluş: Çalışmayı destekleyen herhangi bir fon ve kuruluş bulunmamaktadır.

Çıkar Çatışması: Çalışmada herhangi bir çıkar çatışması yoktur.

Etik Onay: İstanbul Medipol Üniversitesi, Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu, Onay No: 10840098-604.01.01-E61617.

Aydınlatılmış Onam: Katılımcılardan yazılı aydınlatılmış onam alınmıştır.

Yazar Katkıları: CT (Fikir/kavram, tasarım, kaynaklar ve fon sağlama, materyaller, veri toplama ve/veya işleme, analiz ve/veya yorumlama, literatür taraması, makale yazımı), GAB (Fikir/kavram, tasarım, denetleme/ danışmanlık, analiz ve/veya yorumlama, literatür taraması, makale yazımı, eleştirel inceleme)

Açıklamalar: Herhangi bir toplantıda sunulmamıştır.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)89-97

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Received: *24.11.2021 (Geliş Tarihi)*
Accepted: *20.09.2022 (Kabul Tarihi)*

A COMPARISON OF MANUAL THERAPY AND SPLINT THERAPY IN PATIENTS DIAGNOSED WITH MYOFASCIAL TEMPOROMANDIBULAR DYSFUNCTION WITH SLEEP BRUXISM

ORIGINAL ARTICLE

ABSTRACT

Purpose: The aim of this study was to investigate the effect of manual therapy on temporomandibular pain, range of motion, functionality level of the jaw, sleep quality, and patient satisfaction, and to compare the efficacy with splint therapy among female patients with myofascial temporomandibular dysfunction (M-TMD) accompanied by sleep bruxism (SB).

Methods: A total of 29 female patients, aged 18-50 years, diagnosed with M-TMD were separated into two groups using a simple random sampling method as the manual therapy group (MT; n:15) and the splint therapy group (ST; n:14). All the patients were informed about bruxism and its effects and were given home exercises. The patients in the ST group were instructed to use a static splint for one month. The MT group patients received a total of 8 sessions, 45 minutes twice a week of treatment, including joint and soft tissue mobilizations to the temporomandibular joint (TMJ) and cervical region. Pain severity, symptoms, TMJ range of motion, jaw functionality, sleep quality, and patient satisfaction were evaluated. The evaluations were repeated after 4 weeks and compared with baseline values.

Results: A statistically significant difference was determined in both groups in pain, TMJ range of motion, and sleep quality ($p<0.05$). In the comparison between the groups after treatment, the pain, TMJ range of motion values, and sleep quality were seen to be statistically significantly better in the MT group ($p<0.05$). The patient satisfaction measurements of mean general satisfaction, interpersonal attitude, mean healthcare services score, and general satisfaction total points were found to be statistically significant in the MT group ($p<0.05$).

Conclusion: The applications of both MT and ST were seen to be effective in patients with M-TMD with bruxism. In the comparisons between the groups, the MT method was seen to be more effective than ST. It can be thought that the application of stabilization splint therapy together with manual therapy would significantly increase the treatment efficacy in patients with M-TMD.

Key Words: Bruxism, Manual Therapy, Pain, Splint, Temporomandibular Dysfunction

UYKU BRUKSİZMİ OLAN MİYOFASYAL TEMPOROMANDİBULAR DİSFONKSİYON TANILI HASTALARDA MANUEL TEDAVİ İLE SPLİNT TEDAVİSİNİN KARŞILAŞTIRILMASI

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Çalışmada, uyku bruksizmin (UB) eşlik ettiği miyofasyal temporomandibular disfonksiyonu (M-TMD) olan kadın hastalarda, manuel tedavinin temporomandibular ağrı, eklem açıklığı, çenenin fonksiyonellik düzeyi, uyku kalitesi ve hasta memnuniyeti üzerine etkisini incelemek ve splint tedavisi ile etkinliğini karşılaştırmak amaçlandı.

Yöntem: M-TMD tanılı, 18-50 yaş arası 29 kadın hasta, basit rastgele örnekleme yöntemi ile Manuel Tedavi (MT; n:15) ve Splint Tedavi (ST; n:14) olarak iki gruba ayrıldı. Tüm hastalara bruksizm ve etkileri üzerine eğitim ve ev egzersizi verildi. ST grubundaki bireylerden stabilizasyon splintini bir ay süre ile kullanmaları istendi. MT grubuna, temporomandibular eklem (TME) ve servikal bölgeye eklem ve yumuşak doku mobilizasyonlarını içeren haftada 2 seans 45 dk süreyle, toplam 8 seans tedavi uygulandı. Ağrı şiddeti, semptomlar, TME açıklığı, çene fonksiyonellik düzeyi, uyku kalitesi ve hasta memnuniyeti değerlendirildi. Değerlendirmeler 4 hafta sonunda tekrarlandı ve tedavi öncesi bulgular ile karşılaştırıldı.

Sonuçlar: Her iki grupta kendi içinde ağrı, TME hareket açıklığı ve uyku kalitesinde istatistiksel olarak anlamlı fark bulundu ($p<0,05$). Grupların karşılaştırılmasında ağrı, TME hareket açıklığı değerleri ile uyku kalitesinde MT grubu lehine anlamlı sonuçlar alındı ($p<0,05$). Hasta memnuniyet ölçümlerinde; genel memnuniyet, kişilerarası tutum, sağlık hizmetleri skor ortalaması ile genel memnuniyet total puanı MT grubu bireylerinde anlamlı olarak daha yüksek bulundu ($p<0,05$).

Tartışma: MT ve ST uygulamaları bruksizmin eşlik ettiği M-TMD'si olan hastalarda etkili bulundu, ancak grupların karşılaştırılmasında MT yönteminin ST'ye göre daha etkili olduğu tespit edildi. M-TMD'u olan hastalarda splint tedavisi ile manuel tedavinin birlikte uygulanması tedavi etkinliğini önemli ölçüde arttırabilir.

Anahtar Kelimeler: Bruksizm, Manuel Terapi, Ağrı, Splint, Temporomandibular Disfonksiyon

INTRODUCTION

The most commonly encountered disorder of the temporomandibular joint (TMJ) is myofascial temporomandibular dysfunction (M-TMD), which is a syndrome characterized by findings such as headache, fatigue, stiffness, limited normal joint movement, muscle spasms, and pain with trigger points occurring in all soft tissue including muscles and fascia (1).

Previous epidemiological research has shown that M-TMD is extremely widespread in the general population and is seen more often in females at a mean 4-fold more than in males (2).

There is no specific etiological factor for TMD, but risk factors affecting the dynamic balance of the chewing system have been determined. These risk factors are separated as traumatic, anatomic, physiopathological, and psychosocial (2,3). Psychosocial reasons include stress factors seen together with bruxism. The clenching and grinding of teeth defined as bruxism can be in the form of sleep bruxism (SB) or daytime bruxism (DB) (3). In SB, which is seen more than DB, patients usually awake in the morning with pain in the chewing muscles, fatigue, and headache. As a result of clenching or grinding the teeth, a mechanical load is placed on the muscles and joints, and this can cause M-TMD. Evaluations of the prevalence of bruxism have reported rates varying from 8% to 31% (2,3). These differences in prevalence rates are accepted due to the use of different measurement methods in the diagnosis of bruxism (3).

Different treatment approaches for TMD and bruxism have been recommended in the literature. The current approach to TMJ problems favors the application of non-invasive treatments rather than invasive. Treatments included various approaches such as pharmacological agents, oral splints, cognitive-behavioral programs, physical therapy agents (laser, ultrasound, TENS, biofeedback), manual therapy (MT), osteopathy, relaxation, and meditation (4,5).

From a scan of literature related to this subject, it can be seen that an increasing number of studies have been conducted in recent years related to the efficacy of MT in TMD treatment (6-9). In the majority of studies, the treatment has been weighted towards TMJ and soft tissue mobilization methods. Only one study could be found, which included the TMJ, soft tissues, and cervical segments in M-TMD accompanied by bruxism and that compared splint therapy with MT approaches (9). However, the effect of these approaches on sleep quality, functionality level, and patient satisfaction has not been examined. Therefore, the aim of this study was to compare the efficacy of occlusal splint treatment and manual therapy in patients diagnosed with myofascial temporomandibular dysfunction associated with bruxism and present the evidence for the MT preference. The hypothesis of the study was that manual therapy in M-TMD accompanied by bruxism would be more effective than splint therapy in reducing pain and improving sleep quality.

METHODS

This study was conducted on female patients, aged 18-50 years, who were diagnosed with M-TMD accompanied by bruxism in the Dentistry Faculty of Kahramanmaraş Sütçü Imam University and Kahramanmaraş Türkoğlu Dr. Kemal Beyazıt State Hospital. The study was conducted between January 2019 and February 2020.

Approval for this randomized controlled trial was granted by the Human Research Ethics Committee of Hasan Kalyoncu University (decision no: 2019-67: 14.06.2019). All study procedures conform to the provisions of the World Medical Association Declaration of Helsinki. Written and oral consent was obtained from all participants.

The study included female patients, aged 18-50 years, who were diagnosed with myofascial TMD according to the diagnostic criteria for temporomandibular disorders (DC/TMD) and probable SB according to clinical evaluation and a questionnaire-based assessment (3), with pain severity of VAS ≥3, pain in the jaw, face, temporal region, or ear for at least 6 months, and pain determined in the chewing muscles with palpation.

Patients were excluded from the study if they had TMD other than myofascial according to the research DC/TMD (1), a history of surgery associated

with cervical and/or TMJ problems, a proven specific pathological condition such as cervical and/or TMJ malignancy, fracture, or systemic rheumatoid disease, a history of facial paralysis, a diagnosed psychiatric disease, regular drug use, if they were undergoing orthodontic treatment, had received physiotherapy within the last 3 months, or could not be co-operative.

Power analysis to calculate the sample size was applied using G-power 3.19 software. A moderate effect size (effect size=0.5) was set based on Cohen's d, the significance level was set to a=0.05, and power=0.8, resulting in a minimum of 15 subjects per group required. A total of 56 patients were evaluated, of which 20 were excluded; 7 did not wish to participate in the study, 2 did not meet the criteria, and 11 for other reasons. Thus, 36 patients met the inclusion criteria and were willing to participate in the study. The patients were randomly separated into two groups using the method of single- and double-digit numbers written on paper in a sealed envelope. Those who selected a double-digit number were assigned to the manual therapy (MT) group (n:18) and those with a single-digit number to the splint therapy (ST) group (n:18). After the further exclusion of 7 patients during the treatment period, the final evaluations were compared of 29 patients (15 MT and 14 ST) who completed the 4-week treatment process (Figure 1, Flow Diagram). The opening of the TMJ was measured with calipers in cm. Patient satisfaction was evaluated with the Patient Satisfaction Questionnaire (PSQ-18) (10).

Pain severity was measured with a Visual Analog Scale (VAS), marked from 0 to 10, where 0 indicates no pain and 10 indicates intolerable pain. The patients were instructed to mark the scale corresponding to the severity of pain felt (11).

The level of TMJ functionality was evaluated with the Jaw Functionality Limitation Scale-20 (JFLS-20). The JFLS is a scale with clinical validity and reliability, which evaluates the disability conditions in an individual with temporomandibular dysfunction. The total points range from 0-to 20, with higher points indicating a higher level of disability (12).

The sleep quality of patients was analyzed with the Pittsburgh Sleep Quality Index (PSQI). The PSQI includes 24 items related to both daytime and nocturnal sleep. The responses are scored from 0-3, as 7 sub-scores to give a global score of total points in the range of 0-21. A score of ≥5 indicates poor sleep quality (13).

Treatment Protocol

At the beginning of the treatment, patient education directed at parafunctional behaviors was given, and an exercise program was taught to both groups, with all the patients instructed to perform these exercises at home.

In the patient education, how to protect the jaw joints was explained in detail to the patients. Information was given about avoiding chewing hard foods, not chewing on one side, and paying attention to head posture during the day and when lying down at night. All the patients were also informed about sleep hygiene within the scope of patient education.

The home exercise program included diaphragmatic breathing exercises, mouth opening, and closing while the tongue is in contact with the superior-anterior palate, chin-tuck exercises, mouth opening, and mandibular lateral shift resistance exercises, chewing, and pectoral and neck muscle stretching exercises (8). The patients were instructed to perform the exercises as 3 sets of 10 repetitions per day. The patients were followed up in respect of the home exercise program and splint use with weekly telephone calls.

MT Group

In addition to the patient education and home exercises, the MT group received a manual therapy program applied as 2 sessions of 45 mins each week for 4 weeks (total 8 sessions) by a physiotherapist (SDÖ). Each patient received the therapy at the same time on the same days each week. Soft tissue and joint mobilizations were applied to the TMJ and surrounding structures and to cervical segments, trigger point treatment was applied to trigger points, and myofascial loosening was performed (14). Under caudal traction of the mediolateral and anterior gliding mobilizations, post-isometric relaxation (PIR), suboccipital loosening, and fascia mandibularis myofascial release were applied (4-8). Patients were instructed to perform the

Table 1. Demographic Data of Patients

		MT Group (n=15) X ±SD	ST Group (n=14) X ±SD	z	p
Age (years)		29±9.57	27.79±7.60	-0.197	0.844
Education level (year)		13.33±2.55	11.86±3.06	-1.370	0.171
		N (%)	**N (%)**		
	No education	0 (0%)	0 (0%)		
	Primary school	1 (6.6%)	4 (28.5%)		
	High school	5 (33.3%)	4 (28.5%)		
	Further Education	0 (0%)	0 (0%)		
	University	8 (53.3%)	6 (40%)		
Marital status	**Married**	6 (40%)	8 (57.14%)		
	Single	9 (60%)	6 (42.85%)		
	Divorced	0 (0%)	0 (0%)		
GIS problems	**Present**	9 (60%)	11 (78.57%)		
	Absent	6 (40%)	3 (21.42%)		
Allergy	**Present**	9 (60%)	7 (50%)		
	Absent	6 (40%)	7 (50%)		
Systemic Problems (DM, HT)	**Present**	1 (6.66%)	1 (7.14%)		
	Absent	14(93.33%)	13 (92.85%)		

p*<0.05; X: Mean, SD: Standard deviation, p: Mann-Whitney U test, GIS: Gastrointestinal System, DM: Diabetus Mellitus, HT: Hypertension, MT: Manual Therapy, ST: Splint Therapy

exercises learned in the home exercise program in 3 sets of 10 repetitions every day.

Splint Group

The patients in the ST group were given a static occlusal splint, and adjustments were made as necessary (15,16). All the patients in this group were instructed to use the splint when sleeping for a period of one month. Follow-up of the application was checked in weekly telephone calls.

Statistical Analysis

Differences in general characteristics (age, height, weight, education) between the two groups were analyzed using Fisher's exact test. The Mann-Whitney U test was applied to analyze the differences from baseline to post-treatment mean scores between the two groups. Within the groups, the baseline mean values were compared with the mean values after the treatment using the Wilcoxon test. All statistical analysis was performed using SPSS ver. 21.0 software (SPSS Inc., Chicago, IL, USA). Statistical significance was defined as a p-value <0.05.

RESULTS

The demographic and clinical characteristics of the patients in the MT and ST groups are shown in Table 1. The evaluation was made of 29 patients with a mean age of 28.41±8.58 years (range, 18-47 years).

Symptoms decreased in both groups after treatment, with a greater improvement observed in the MT group. Before treatment, the pain severity values of both groups were similar (p>0.05). After treatment, the VAS values of both the MT and the ST group were determined to decrease significantly (p<0.05), with a significant decrease in the MT group than in the ST group (p<0.05) (Table 2).

In comparing the pre-and post-treatment TMJ ROM values, an increase was seen in all the measurements in both groups (p<0.05). Before treatment, the ROM measurements in both groups were similar (p>0.05). After treatment, a difference was seen between the groups, and the increase in the MT group was determined to be more significant (p<0.05). In the comparisons between the groups of the pre-and post-treatment JFLS and PSQI val-

Table 2. Comparison of the Pain Values pre and post Treatment and Between the Groups

VAS (0-10 cm)	Groups	Pre-treatment X ± SD	Post-treatment X ± SD	p^a	p^b
Jaw pain on waking in the morning	**MT**	4.87 ±1.60	1.40 ±1.18	0.001*	0.000*
	ST	5.43 ±1.60	3.79 ±1.12	0.001*	
Jaw pain when eating	**MT**	5.07 ±1.44	1.33 ±0.90	0.001*	0.000*
	ST	4.64 ±1.01	3.50 ±0.76	0.003*	
Jaw pain after eating	**MT**	4.71 ±0.99	1.00 ±1.07	0.001*	0.000*
	ST	4.00 ±1.11	3.50 ±1.09	0.038*	
Jaw pain at night	**MT**	4.27 ±1.71	0.80 ±0.94	0.001*	0.000*
	ST	3.71 ±1.82	3.07 ±1.44	0.007*	
Headache on waking in the morning	**MT**	5.64 ±1.22	1.60 ±1.24	0.001*	0.000*
	ST	5.14 ±1.29	4.64 ±1.22	0.020*	

p*<0.05, X: Mean, SD: Standard Deviation, MT: Manual Therapy, ST: Splint Therapy, p^a: Within-group differences; p^b: Inter-group differences

ues, there was seen to be a significant decrease in the scores of both scales (p<0.05). After treatment, the decrease in the scores of both scales was determined to be significant in the MT group (p<0.05) (Table 3).

At the end of the treatment period, the level of satisfaction of the patients with the treatment applied was evaluated with the patient satisfaction questionnaire. There was determined to be a significant difference between the groups in respect of the mean general satisfaction, interpersonal attitude, healthcare services, and general satisfaction total points (p<0.05), and the difference was due to the higher scores of the MT group patients compared to the ST group (Table 4).

Table 3. Comparison of the Range of Motion, Jaw Functionality and Sleep Quality Values pre and post-Treatment and Between the Groups

	Group	Pre-treatment X ± SD	Post-treatment X ± SD	p^a	p^b
TMJ ROM Maximal mouth opening (cm)	**MT**	3.47±0.33	4.85±0.39	0.001*	0.000*
	ST	3.64±0.54	3.89±0.48	0.001*	
Right lateralisation (cm)	**MT**	1.03±0.39	1.55±0.40	0.001*	0.006*
	ST	1.11±0.33	1.01±0.31	0.002*	
Left lateralisation (cm)	**MT**	0.96±0.35	1.40±0.40	0.001*	0.009*
	ST	0.98±0.35	0.98±0.35	0.001*	
Protrusion (cm)	**MT**	0.47±0.23	0.83±0.29	0.001*	0.023*
	ST	0.49±0.27	0.59±0.27	0.020*	
JFLS	**MT**	49.47±20.60	20.00±14.20	0.001*	0.001*
	ST	65.57±27.64	55.50±27.96	0.001*	0.001*
PSQI	**MT**	7.93±2.25	5.20±1.57	0.001*	0.001*
	ST	7.07±1.94	6.43±1.83	0.014*	0.040*

p*<0.05, X: Mean, SD: Standard Deviation, MT: Manual Therapy, ST: Splint Therapy, TMJ: Temporomandibular Joint, JFLS: Jaw Functional Limitation Scale, PSKI: Pittsburgh Sleep Quality Index, p^a: Within-group differences; p^b: Inter-group differences

Table 4. Comparison Between the Groups of the Patient Satisfaction Questionnaire Results

PATIENT SATİSFACTION QUESTIONNAIRE	MT Group (n=15) (X±SD)	ST Group (n=14) (X±SD)	z	p
General satisfaction	4.63±0.23	3.61±0.49	-4.550	0.000*
Technical quality	4.50±0.50	4.30±0.52	-1.292	0.196
Interpersonal attitude	4.90±0.28	4.64±0.36	-2.288	0.022*
Communication	4.63±0.35	4.43±0.33	-1.578	0.115
Financial dimensions	4.35±0.72	4.32±0.72	-0.138	0.890
Healthcare services	4.47±0.35	3.89±0.68	-2.550	0.011*
Accessibility and comfort	3.83±0.51	3.82±0.70	-0.404	0.686
General total	80.07±4.82	74.07±6.56	-2.536	0.011*

p*<0.05, X: Mean, SD: Standard Deviation, p: Mann Whitney U test, MT: Manual Therapy, ST: Splint Therapy

DISCUSSION

In this study of female patients diagnosed with M-TMD accompanied by bruxism, the effect was evaluated of the administration of a comprehensive MT program including jaw joint and cervical region joint and soft tissue mobilizations together with patient education and a home exercise program, on parameters such as pain, TMJ ROM, jaw function, sleep quality, and patient satisfaction. The improvements in both groups after treatment compared to pre-treatment were found to be significant. In the comparisons between the groups, the difference was seen to be statistically significant in favor of the MT group. The hypothesis of this study was that manual therapy in myofascial TMD accompanied by bruxism would be effective on pain and sleep quality. When the pre-and post-treatment values were compared, this hypothesis was confirmed.

Although the prevalence of bruxism in the general population varies, the frequency and severity of its accompanying TMD are seen more in females than males. There is a greater tendency for females to seek treatment compared to males (17-19). In our study, the highest incidence of bruxism is seen between the ages of 20-50 years, after which this parafunctional habit gradually decreases (3). All the patients who presented at the clinic and met the study inclusion criteria were female. Patients were selected in the age range of 18-50 years, and the mean age of the 29 study subjects was 28.41 years. In this context, the current study is in parallel with the literature in respect of age and gender.

The most evident clinical symptom in TMD patients is pain in the TMJ region or the chewing muscles, or both, followed by joint limitation when opening the mouth (1). Moreover, cervical region structures are often associated with TMD because of direct or indirect anatomical, biomechanical, and neurophysiological links, and they affect each other (20-23). Previous studies have agreed on the subject that symptoms arising from cervical segments can be directed to the stomatognathic region through the trigeminocervical core pathway (20,21).

Occlusal splints are generally often preferred by dentists for the treatment of patients with bruxism and TMD (24-26). With increased parafunctional activity with oral splints, it is aimed to achieve muscle relaxation, and break teeth clenching habits while protecting the teeth and jaws, to normalize periodontal ligament proprioception using a splint to spread the forces applied to the individual teeth, especially when clenching and grinding can lead to damage, and reposition jaws and condyles within a central relationship. However, in the results of current literature, the debate continues between dentists on the subject of the efficacy of oral splints, the effect mechanism, and whether or not they are appropriate in the treatment of painful TMD. There has not been shown to be any beneficial effect in short-term or long-term follow-up (24,25).

Kraus et al. (23) examined the characteristics of

511 patients referred to physiotherapy for the determination of diagnostic sub-clusters of TMD and to assist in the clinical decision-making in the management of TMD. The study emphasized that oral splinting is the primary conservative method presented by dentists for cases with pain originating from the chewing muscles and the TMJ. The study concluded that it would be more appropriate for dentists to consult a physiotherapist when there is no clear indication for oral splint therapy in patients with suspected cervical spine disorder and to postpone the use of splinting until a response is obtained from physical therapy (23). In our study, patients in the ST group showed resistance to regular use of splints. Despite telephone calls every week and emphasizing the need to use the splint regularly, some patients did not wish to use the splint and terminated the treatment.

In a recent systematic review, insufficient evidence was found to confirm the use of occlusal splints in the treatment of bruxism (16). That systematic examination showed that the data were insufficient to confirm the efficacy of occlusal splints in the treatment of bruxism compared with an untreated group, the use of other intra-oral devices, TENS, cognitive-behavioral treatment, or pharmacological treatments.

There are very few studies in the literature that have compared exercise therapy and splint therapy. In a study by Michelotti et al., the short-term effects were evaluated patient education versus occlusal splint in the treatment of myofascial pain of the TMJ, and it was reported that the use of the splint together with patient education was more effective in reducing pain than the splint without education (27). In another study, the effects of splinting and conservative physiotherapy on pain and joint ROM were examined in TMD cases, with a splint used by the control group and muscle stretching exercises applied twice a week for 6 weeks to the study group. From the results of the study, it was reported that conservative physiotherapy could be a better initial treatment than splinting for reducing pain and increasing joint ROM in myogenic TMD cases (28).

Only one study could be found in the literature that has compared splint therapy with MT. Espi-Lopez et al. separated 16 patients with TMD into two groups, applying MT and ST to one group and ST only to the other. At the end of 4 weeks, the clinical improvement and decrease in pain were found to be significantly greater in the study group with combined therapies (9). This was similar to the current study, but in this case, the MT and ST were compared in isolation, and pain evaluated at 5 different times showed a decrease after treatment in both groups. The decrease in the pain severity values was seen to be significant in the MT group than in the ST group. When considering what would be a clinically meaningful reduction in pain, Farrar et al. (29) determined that a 30% decrease in pain would make a clinically relevant difference in patients with chronic pain. At all the 5 time points in the current study, a clinically significant difference was determined in the VAS values of the MT group.

Dias et al. evaluated the degenerative changes in the TMJ of patients with sleep bruxism, and to investigate the relationship between these and sleep quality, and the PSQI was applied. There was reported to be a significant drop in the sleep quality of the patients (30). In the current study, the sleep quality was evaluated with the PSQI, and consistent with the literature, a large proportion of the patients were seen to have sleep problems. A decrease in the PSQI scores was determined after treatment in both groups, and when the groups were compared, the decrease was significantly greater in the MT group.

After completion of the treatment in the current study, patient satisfaction was measured with the PSQ-18. The results demonstrated that the mean general satisfaction, interpersonal attitude, healthcare services, and general satisfaction total points were significantly higher in the MT group. The reason for this could have been that the physiotherapist spent more time face-to-face with the patients in the MT group, and because the nature of manual treatment requires touching the patient, the patient can comfortably express their problems throughout the session and feels valued by the allocation of time, which increases the level of satisfaction and is thought to have a psychological effect on the reduction of pain. According to the statements of the patients in the ST group, the score was seen to be affected by factors such as

the use of the splint was not practical, there was a fear of swallowing it during the night, and the healthcare personnel only spent a short time with them.

There were some limitations to this study. The planned number of patients could not be reached in the splint group as some patients did not want to use the splint for reasons such as fear of swallowing it, jaw fatigue, and difficulty sleeping at night, and therefore requested to leave the study before completion of the treatment period. The lack of a blind evaluator is another limitation. Other limitations were that regular use of the splint was based only on patient statements, only short-term results were examined as both treatments were only applied for 4 weeks, and therefore the long-term effects could not be evaluated. There is a need for the further blind, long-term studies, and comparisons.

CONCLUSION

In conclusion, both treatments applied in this study to patients with M-TMD accompanied by bruxism were seen to be effective. In the comparisons between the groups, manual therapy was determined to be significantly motre effective than splint therapy in decreasing the severity of pain, increasing TMJ ROM and jaw functionality, and improving sleep quality. The patient satisfaction values of the MT group were also determined to be higher. Splints may help to prevent dental damage in patients with M-TMD accompanied by bruxism. Therefore, it can be considered that the application of splints at the same time as manual therapy and exercises could increase the treatment efficacy, and this combination can be recommended.

Sources of Support: The authors received no financial support for the research and authorship of this article.

Conflict of Interest: The authors report no conflict of interest.

Ethical Approval: Approval for the study was granted by the Human Research Ethics Committee of Hasan Kalyoncu University (Approval Date: 14.06.2019 and Approval Number: 2019-67)

Informed Consent: A written informed consent form was obtained from all participants.

Peer-Review: Externally peer-reviewed.

Authors' contributions: Concept – SDÖ, AT, EN; Design – SDÖ, AT; Supervision – AT, EN; Resources and Financial Support -SDÖ, EN, AT; Materials – SDÖ, AT; Data Collection and or Processing – SDÖ, EN; Analysis and or Interpretation – SDÖ, AT; Literature Search – SDÖ, AT, EN; Writing Manuscript – SDÖ, AT, EN; Critical Review – AT, EN.

Acknowledgments: This study was presented as an oral presentation at the Necmettin Erbakan University International Dentistry Congress, Online, on October 2-3 2021.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)98-105

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Received: *9.10.2021 (Geliş Tarihi)*
Accepted: *9.05.2022 (Kabul Tarihi)*

INVESTIGATION OF THE REASONS FOR THE EMPLOYEE TURNOVER OF PARKINSON'S PATIENTS

ORIGINAL ARTICLE

ABSTRACT

Purpose: It is known that early retirement has been increasing for patients with Parkinson's disease. The data on the factors that cause early retirement in this patient population is limited. The objective of this study is to analyze the effects of Parkinson's disease that cause early retirement.

Methods: Seventy-five patients with Parkinson's disease (mean age: 59.10±9.20 years) participated in this study. Data were collected through face-to-face interviews with patients within the framework of 29 questions determined by the researchers by examining the literature and similar studies.

Results: Participants have been analyzed into groups: Retirement types and reasons for retirement. Patients that quit their jobs because of Parkinson's disease stated that bradykinesia in motor symptoms, somnipathy, and depression in non-motor symptoms came first in their reasons for retirement. It has been determined that 90% of participants that quit their jobs because of Parkinson's disease were not supported by the institutions they worked for, 77.55% couldn't receive physiotherapy treatment and 61.22% couldn't receive psychological therapy. In addition, it has been determined that 55.1% of the participants would like to work if they find a suitable job.

Conclusion: For patients to stay in the workforce longer, patients with Parkinson's disease, their caregivers, and employers should be informed about the health problems associated with Parkinson's disease, their possible consequences, as well as strategies and treatment techniques developed for motor and non-motor symptoms.

Keywords: Early-Retirement, Employee Turnover, Motor Symptoms, Non-Motor Symptoms, Parkinson's Disease

PARKİNSON HASTALARININ İŞ BIRAKMA NEDENLERİNİN İNCELENMESİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Parkinson hastalarındaki erken emeklilik oranının giderek arttığı bilinmektedir. Bu hasta popülasyonunda erken emekliliğe neden olan faktörler arasında kısıtlı sayıda veri vardır. Çalışmadaki amacımız Parkinson hastalığının erken emekliliğe neden olan etkilerini incelemektir.

Yöntem: Çalışmaya 75 Parkinson hastası (ortalama yaş: 59,10±9,20 yıl) dâhil edildi. Literatür ve benzer çalışmalar incelenerek araştırmacılar tarafından belirlenen 29 soru çerçevesinde hastalar ile yüz yüze görüşülerek veri toplandı.

Sonuçlar: Katılımcılar emeklilik türlerine ve emekli olma nedenlerine göre iki farklı şekilde gruplanarak incelendi. Parkinson hastalığı nedeniyle işten ayrılan hastalar tarafından motor semptomlar içinde bradikinezi, non-motor semptomlar içerisinde ise uyku bozukluğu ve depresyon emeklilik nedeni olarak ilk sırada gösterildi. Parkinson hastalığı nedeniyle işten ayrılan katılımcıların %90'ının çalıştıkları kurum tarafından desteklenmediği; %77,55'inin fizyoterapi tedavisi, %61,22'sinin ise psikolojik tedavi almadığı belirlendi. Ayrıca katılımcıların %55,10'inin uygun bir iş bulması halinde çalışmak istediği belirlendi.

Tartışma: Hastaların iş hayatını daha uzun süre devam ettirebilmeleri için Parkinson hastalarının, bakım verenlerinin ve işverenlerinin Parkinson hastalığı ile ilgili sağlık sorunları, bunların olası sonuçları, ayrıca motor ve non-motor semptomlara yönelik geliştirilen stratejiler ve tedavi teknikleri hakkında bilgilendirilmeleri gerekmektedir.

Anahtar Kelimeler: Erken Emeklilik, İşten Ayrılma, Motor Semptomlar, Non-Motor Semptomlar, Parkinson Hastalığı.

INTRODUCTION

Parkinson's disease (PD) is a progressive neurodegenerative disease characterized pathologically by the degeneration of dopaminergic neurons in the substantia nigra and the development of Lewy bodies in the remaining dopaminergic neurons (1). Characterized by both motor and non-motor symptoms, patients with PD typically display rest tremor, rigidity, and bradykinesia as motor symptoms (2). Among the motor problems such as breathing, speech, swallowing, walking, and balance problems occur over time (3). Non-motor symptoms of PD include neurobehavioral disorders, cognitive impairment, and autonomic dysfunction.

Although PD is generally associated with an older patient population, 5% of patients are diagnosed before age 50 and 30% before age 65 (4). Based on this information, we can say that many Parkinson's patients are diagnosed while they are still active in the workplace. It still takes a long time for these individuals to obtain the right to retirement. Psychological (non-motor) symptoms such as depression, anxiety, and sleep disorders observed in the early stages of PD may reduce the working capacity of the patients. In the later stages when progression is observed, the motor effects in addition to the existing symptoms can further increase the negativity in the work-life of the people. Cognitive problems and fatigue also gain importance in this period (5). Although levodopa and dopamine agonists used in the treatment of PD successfully reduce symptoms, their effectiveness decreases over time, and their effect on axial motor symptoms (such as postural instability, dysarthria, palilalia, dysphagia, flexor posture, freezing) and tremor is limited, and unfortunately, it is also associated with undesirable side effects such as motor fluctuations and dyskinesias. Although levodopa and dopamine agonists, as a gold standard, used in the treatment of PD successfully reduce symptoms, their effectiveness decreases over time, and their effect on axial motor symptoms and tremors is limited. In addition, levodopa has side effects such as dizziness, somnolence, headache, dyskinesia, dystonia, etc. Such side effects of pharmacological treatment can also cause a decrease in the working ability of patients, as well as Parkinson's symptoms (6).

Only a few studies have been conducted on the working ability of patients with PD. These few studies have shown that unemployment and early retirement rates in Parkinson's patients are gradually increasing (5, 7). In these individuals, turnover occurs 0-25 years after PD is diagnosed (7, 8). It was observed that the full-time working capacity of the patients decreased by up to 80%, and they quit work earlier than the general population (5). Disability such as bradykinesia, rigidity, tremor, sleep disturbances, cognitive impairment, and sensory disturbances associated with PD is thought to be a factor in the turnover of these employees (9). However, the reasons for early retirement are not fully known, and more information is needed about the specific problems of PD for patients to continue their professional life and stay in the workforce for longer. There are a few studies on this topic that have not been conducted in Turkey. Turkey has an industrial capacity shaped by its unique cultural and economic characteristics. Therefore, we thought that the reasons for the early retirement of patients with PD in Turkey should be investigated. Our aim in this study is to examine the factors that cause the early retirement of individuals with PD and to contribute to occupational health and human resources data about this situation in Turkey.

METHOD

This study was conducted in Istanbul University – Cerrahpaşa, Cerrahpaşa Medical Faculty, Neurology Department, Movement Disorders Unit, Parkinson's Disease Clinic, between May and October 2018. Approval for the study was obtained from Marmara University Institute of Health Sciences Ethics Committee with protocol number 132, dated 07.05.2018, and the study was carried out following the Declaration of Helsinki. All participants were made to sign a written informed consent form before the study. The clinical trial number is NCT03779880.

Participants

Seventy-five volunteer patients with PD participated in the study. Inclusion criteria in the study were

to be diagnosed with PD according to the United Kingdom Brain Bank criteria [10] to be in the 30-85 years old range, and to have ongoing PD treatment; the exclusion criteria from the study were determined as dementia and the presence of severe cognitive impairment.

The sample size was calculated using single group proportional data (population was 150000, the incidence was 5% [7], and the confidence interval was 95%) and the minimum required sample size is 73 participants. Therefore, 75 participants were included in the study.

Outcome Measures

The demographic information of the participants was recorded, the Hoehn & Yahr Staging Scale (H&Y) was applied, and an interview was conducted with the participants. H&Y is used to measure how Parkinson's symptoms progress and the level of disability and classifies the disease into five stages. Stage 1 refers to a patient with unilateral involvement, and stage 5 refers to a wheelchair or bed-bound patient [11]. In our study, the H&Y stage of the participants was assessed by a neurologist.

The interviews with the patients were conducted face to face by a physiotherapist. The 29 questions asked to the patients during the interview were determined by the researchers in advance by examining similar studies in the literature (Appendix).

Twenty-three of the questions are retrospective and are about the conditions of the patients during their retirement or when they leave the workforce. It includes questions about why the participants were retired, how and to what extent they felt the effects of the disease in the work environment, and how they perceived employer support. The last question of the questionnaire requires that the effect of PD on retirement or leaving the workforce is scored between 0-10 points by the patient. 10 points given indicate that PD has the highest effect on leaving the workforce and retirement. 6 prospective questions assess the participants' current desire to work, their working status, and what type of job they continue to work.

Statistical Analysis

Statistical Package for Social Sciences (SPSS), version 25 (Chicago, IL, USA) was used for statistical analysis. After evaluating the normal distribution of the obtained data, Mann Whitney U test was used to compare differences between groups, and the Pearson correlation coefficient was used for correlation analysis. Cohen correlation classification was used for correlation severity. A p-value less than 0.05 is set as statistically significant.

RESULTS

Seventy-five patients with PD (mean age: 59.10±9.20 years) were evaluated. Bradykinesia in 23 patients, tremor in 45 patients, and both tremor and bradykinesia in 7 patients have been observed as initial symptoms. The average retirement age of participants is 49.75±6.30 years; the average age of starting working life is 19.46±4.58 years. Demographic information of participants with PD is shown in Table 1.

Table 1. Demographic Information of the Participants (n=75)

Data	n (%)
Gender	
Female	9 (12%)
Male	66 (88%)
Education	
Uneducated (n, %)	1 (1.33%)
Primary School (n, %)	25 (33.33%)
Secondary School (n, %)	13 (17.33%)
High School	19 (25.33%)
University	17 (22.67%)
Duration of Disease (in years)	
0-5	26 (34.67%)
6-10	22 (29.33%)
10+	27 (36%)
H & Y Stage	
1	28 (37.33%)
2	20 (26.67%)
3	21 (28%)
4	6 (8%)
Retirement Type	
Disability pension	23 (30.66%)
Standard (old age) pension	52 (69.37%)

H & Y: Hoehn & Yahr

The reasons for leaving the work the patients were asked by giving 3 options: "reasons due to illness", "reasons related to the workplace but not related to the health problem" and "different personal reasons apart from disease". Participants were allowed to select more than one option. According to the answers given, the participants have grouped

into two; a total of 49 patients (65.33%) (Group 1) whose reasons are due to disease and a total of 26 patients (34.67%) (Group 2) whose diseases did not affect their retirement. 15 patients in Group 1 reported both disease-related and institutional reasons as reasons for retirement (Table 2).

Identification of Groups

H&Y stage of the participants in Group 1 was 2.50±0.89; the average age was 57.34±9.38 years; the duration to quit work was 6.02±4.52 years after diagnosis. The rate of quitting work was calculated in the first 5 years as 57.17%; between 5-10 years as 28.57%; after 10 years as 14.28%. H&Y stage of the participants in Group 2 was 1.40±0.57; the average age was 60.08±5.95 years. Since 26 of our participants did not consider PD as a reason for quitting work, the analysis of the results was continued with Group 1, consisting of 49 patients.

Table 2. Grouping of Patients Based on Their Retirement Type

Group 1 (n=49)	Group 2 (n=26)
Those who retired on disability due to PD diagnosis (n=23) Those who wanted to work after retirement but had to quit due to PD (n=26)	Those who normally retired (of old age) and do not want to continue working of their own accord (n=21) Those who continue to work of their own accord after retirement (n=5)

PD: Parkinson's disease

Evaluation of Motor and Non-Motor Symptoms (n=49)

When examining which of the motor and non-motor symptoms of PD is/are mentioned in retirement tests, bradykinesia among the motor symptoms with a rate of 34.75%; sleep disorder and pessimistic mood among non-motor symptoms with a rate of 20.65% take the first place that causes retirement the most (Figure 1 a-b). In addition, in the correlation analysis conducted to evaluate the relationship between disease progression and duration of work, a moderate negative correlation (p= 0.010, r= -0.377) was reached between the H&Y stage and the duration of work after PD.

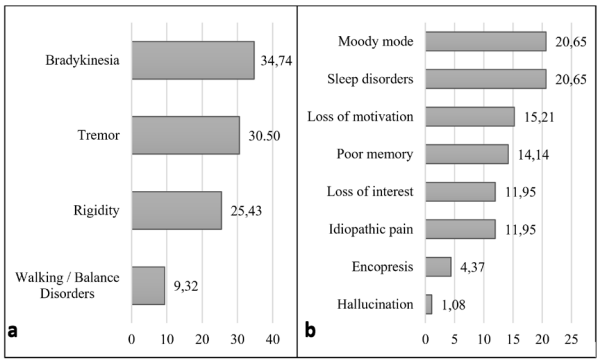

Figure 1: a: Motor symptoms that are among the causes of retirement (%) **b:** Non-motor symptoms that are among the causes of retirement (%)

Opinions of the participants about the effect of the workplace of employment on early retirement (n=49)

All the participants in Group 1 were working in the private sector. 73.46% only because of the symptoms of PD; 26.54% of them stated that they had to quit working life due to the institution they worked for in addition to PD symptoms. While 13 (26.53%) of the participants in Group 1 stated that the institution they work for supported them to continue their working life after the diagnosis, 32 (65.31%) stated that they could not find any support. Only 4 (8.16%) of 49 patients reported that they received a sufficient level of support from the institution they were working at.

The status of individuals receiving physiotherapy and rehabilitation and psychological support (n=49)

All the participants in Group 1 reported both motor and non-motor symptoms as the reason for leaving/retiring from the workforce. Despite this, it was determined that 77.55% (n=38) of the participants did not receive physiotherapy treatment and 61.22% (n=30) did not receive any psychological treatment in the period just before quitting the job. The longest regular treatment period was determined as only 1 year in patients who stated that they received physiotherapy treatment.

Expectations of individuals for the continuation of working life (n = 49)

When asked if participants in group 1 would like to work again in the future, 55.1% stated that they

would like to work if there is a suitable job, and 55.1% stated that they would like to work if there is a suitable job. When questioned about the suitable job description the most common responses are "work that is desk jobs, less tiring/less stressful and has shorter working hours". After these participants were grouped by their educational backgrounds and when their will to work was compared, it was observed that the will to work of the participants with 8+ years of education was statistically significantly higher (p=0.010).

DISCUSSION

It is known that PD has a negative effect on working capacity, and patients with PD leave the workforce at an earlier age than normal employees (6). The objective of our study is to determine the factors that cause the patients with PD to retire early, detect specific problems of patients with PD regarding their working life, and generate data specifically for Turkey.

According to the results of our study, we determined that approximately 65% of the participants had difficulty in continuing their working life after being diagnosed with PD, and 30% retired with a disability report. These rates were considered higher when compared with the results of studies conducted in various countries. While it was detected that an early retirement rate of 20-27% in the conducted studies (12,13), the higher early retirement rate in our study might have various reasons. Differences in the number of participants in the studies, the age and educational background of the participants, the H&Y stages of the patients, the differences in the occupations and working conditions between countries, the employers' perspective on diseases, and the policies of the health-related units may also affect these results.

Martikainen et al. stated that according to the data received from 529 patients who knew the exact date of their retirement says that retirement rate is the highest in the first three years of PD (5), on the other hand, for Murphy et al., it is the highest in the fifth year (14). In our study, we determined that, in line with the literature, the participants quit their jobs on average in the sixth year after the diagnosis of PD. While the rate of quitting the job was approximately 57.17% in the first five years after diagnosis, 14.28% of the participants continued to work for ten years or more. At the same time, as the H&Y stages of the participants increased, it was expected that the duration of work after diagnosis would decrease and there would be a higher degree of correlation between the two data while a negative moderate correlation was found according to our results. These results show that the differences between individuals also play a role in retirement. Martikainen et al. interpreted this in a way that while some patients prefer to continue working despite their symptoms, some patients prefer to quit their job notwithstanding their low stage of H&Y (5). The fact that only motor symptoms are considered in H&Y staging may also be one of the reasons for the negative correlation. Because the non-motor symptoms of PD starting many years ago may cause the person to be affected more emotionally over the years, even if the H&Y stage is in the early stage. The tolerance level of patients may have decreased against situations such as stress management, workload, and hierarchy in work life. Although motor symptoms were mentioned more frequently by study participants as a reason for early retirement, considering the variety of non-motor symptoms, they probably have a higher impact on early retirement.

It is known that both motor and non-motor symptoms have a negative effect on the ability to work. According to our results, bradykinesia is the most common motor symptom that causes retirement. Since various problems such as hypometria, hypophonia, aprosodia, micrography, hypomimia, and shortened stride length are sub-headings of bradykinesia, these complaints were classified as bradykinesia in our study. Because of these sub-headings, bradykinesia may be shown more prominent as a reason for early retirement by the participants compared to other cardinal symptoms (15), as it will lead to a more comprehensive disability in daily life activities and working life. Among the non-motor symptoms, insomnia and depressive mood were the most common causes of early retirement cited by our participants. Depression can increase people's sense of pain and make it difficult for them to cope with chronic illnesses (16). In addition, the

loss of motivation and decrease in energy level caused by depression can affect working life and decrease working capacity. Cognitive impairment, which is one of the consequences of depression, can also impact patients' perception levels, business management processes, and adaptations. Sleep problems, which are common in patients with PD, are likely to cause difficulties in adapting to the job because of not being able to maintain regular sleep during the night, fatigue, and sleepiness at work caused by insomnia. Therefore, working patients may experience a decrease in their working efficiency during the day. There are many studies in the literature reporting a relationship between sleep disorder and depression (14,16,17). This may help explain why our participants cited both depression and sleep disturbance at the same rates as the cause of early retirement. At the same time, as the deterioration of one of the symptoms will affect the other, the negative effects in working life may also be parallel to each other.

According to the results of our study, it was observed that employers and institutions also play an important role in early retirement besides PD symptoms. Only 10% (n=4) of the participants who retired early due to PD reported that they received sufficient support from their institution. Studies have shown that workplace regulations have a positive effect on the working processes of patients with PD (5). It has been reported that it would be beneficial for working patients to be freer in determining the regulation to be made in the type of work and working hours (8). Similarly, our participants defined fewer working hours or part-time work, and positions that require less responsibility as opportunities to work for them. Though there is no specific research on the problems encountered by patients with PD in Turkey, studies point out that people with disability generally face their employers' negative attitudes. Reasons such as unsuitability of workplace physical conditions, transportation difficulties, slowing down work, inefficient work, capriciousness, and being aggressive are among the reasons that prevent disabled employment by employers (18).

The severity of PD should be evaluated not only according to motor problems but also complete well-being by considering the psychological and social conditions of the patients. Therefore, it is of great importance that patients receive both physiotherapy and rehabilitation treatment and psychological treatment during PD. Considering the results of our study, although each of the 49 participants who left their jobs due to PD stated the presence of both motor and non-motor symptoms at the time they decided to quit, 77.55% did not receive physiotherapy treatment and 61.22% did not receive psychological treatment. After their work will to work was questioned, it is seen that 55.1% of them want to work if they find a suitable job. In the light of this data, we think that if the participants are regularly supported with physiotherapy and psychological treatment after they are diagnosed with PD, their work capacity and productivity may increase, and they may be working actively in the current situation. It might be suggested that if treatment methods such as physiotherapy, and psychotherapy, which have a high level of evidence, are applied intensively and programmatically from the early stage of the disease, symptoms of the patients will be controlled, so early retirement will be prevented.

Both motor and non-motor symptoms may cause early retirement in patients with PD. While early retirement is associated with high costs at the social level, it is also associated with a loss of income at a young age at the individual level. Loss of income often requires additional costs, such as treatment costs and daily living expenses, which must be borne by the patient's family or relatives. This situation may cause psychological stress in patients by causing patients to feel more responsible toward their families.

The inability of patients to continue their work-life may cause a loss of income, as well as cause them to be disconnected from social life and to be alone with the disease for a longer period. Financial inadequacy brings with it a decrease in the patient's sense of self and self-worth. Since PD is also directly related to non-motor symptoms such as depression and stress, such feelings can negatively affect the quality of life of patients, and lead to severe mental problems and even suicide. For this reason, it is important for patients to stay as long as they can in working life in terms of both their financial and mental well-being.

Our study has some limitations: (1) Findings were not collected prospectively but through the recall of patients. This situation may cause changes in data such as date, age, and term of employment due to remembering wrong. (2) Since there is no objective measurement method that can evaluate the effect of PD on working life, the data were collected through an interview done by the researchers (3) the number of participants was limited, and the data were collected from a single center.

Some adjustments may be required in the workplace so that patients with PD can stay working for a longer period. We believe that patients could work in workplaces with a part-time or shift system more comfortably. In addition, the patients we interviewed reported that night shifts were challenging frequently, therefore, working hours should include daylight hours. In patients with PD, work that takes a lot of effort and concentration can lead to injuries, exhaustion, and stress. It is important for the patients' health that the work was chosen to be desk jobs that do not entail a lot of responsibility. Furthermore, longer, and adequate rest intervals and more rights to paid vacation might benefit provide an advantage for these patients.

As a result, to enable patients to stay in the workforce for a longer period, patients with PD, their caregivers, and employers (1) need to be informed about the health problems associated with PD and their possible consequences, and (2) the strategies and techniques developed to counter motor and non-motor symptoms. This field needs to be studied further in detail to identify occupational challenges, necessary regulations, and support for patients with PD.

Sources of Support: There is no source of support.

Conflict of Interest: There is no conflict of interest.

Author Contributions: GEU: idea/concept literature review, design, data collection, analysis, article writing. SO: idea/concept, design, supervision/consulting, article writing, critical review. MGP: critical review SE: recruitment of patients, performing neurologic assessments. All authors contributed to the final version of the manuscript and approved it to be published.

Explanations: The article has been presented in the form of an abstract at the 4th International Health Science and Family Medicine Congress, Izmir / Turkey, February 2019.

Acknowledgement: We would like to thank Assoc. Prof. Aysel Yıldız Özer for her support of our study.

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Appendix: Interview Guide

1. When were you first diagnosed with Parkinson's disease?
2. What was your first symptom of Parkinson's disease, and where did this symptom first appear in your body?
3. When did you start your working life?
4. When did you retire?
5. Select the type of retirement: a. Standard pension b. Disability pension
6. Whom did you live with when you retired?
7. Did you have any dependents when you retired? If yes, what was your degree of affinity?
8. Why did you retire?
9. Which of the following is/are among the reasons for your retirement?
   a. Disease-related causes
   b. Reasons based on the institution I work for
   c. No reason, of my own accord
10. Did you decide to leave after learning about the disease when there was no problem in keeping your job?
    a. Yes b. No
11. Had you lost your commitment to your job before you were diagnosed with the disease?
    a. Yes b. No
12. Which of the following motor symptoms were among the reasons for your retirement? (You can tick more than one option.)
    a. Hand tremor
    b. Difficulty starting or transitioning between movements, slowing of movements
    c. The resistance felt during movement or the stiffness felt in the muscles
    d. Freezing during gait, loss of balance
13. Which of the following non-motor symptoms were among the reasons for your retirement? (You can tick more than one option.)
    a. Loss of interest in events around you
    b. Difficulty falling asleep and staying asleep at night
    c. Feeling sad, moody
    d. Forgetfulness
    e. Loss of motivation
    f. Unexplained pain
    g. Seeing or hearing things that you know are not or have been told that they are not
    h. Incontinence or difficulty defecating
14. Did the institution you work for the support you to continue your job after you were diagnosed with Parkinson's disease?
    a. Yes b. No (If "no", go to question 16.)
15. Do you think the support provided by the institution you work for was sufficient?
    a. Yes b. No
16. Are you still working? (If "no", go to question 20.)
    a. Yes b. No
17. What job are you doing now?
18. Specify the type of your work (desk job, in the field, etc.)
19. Is your current job different from your previous job? Please explain.
20. Would you like to continue working with your current health condition?
    a. Yes b. No
21. What kind of job would you like to work in if given the opportunity?
22. Did you have any other illnesses when you retired? (If "no", go to question 24.)
    a. Yes b. No
23. Which are illnesses?
24. Did you receive physical therapy for Parkinson's treatment when you retired? (If "no", go to question 27).
    a. Yes b. No
25. How long / how many sessions of physical therapy did you receive?
26. Do you continue your exercises?
    a. Yes b. No
27. Did you receive psychiatric therapy for Parkinson's treatment when you retired?
    a. Yes b. No
28. If you were to describe your psychological state in a few sentences when you retired, which sentences would you use?
29. What do you think Parkinson's part is in your retirement? (0: none at all, 10: All due to Parkinson's)
    0 1 2 3 4 5 6 7 8 9 10

ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)106-113

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Received: *08.06.2021 (Geliş Tarihi)*
Accepted: *12.06.2022 (Kabul Tarihi)*

KRONİK BOYUN AĞRISI OLAN BİREYLERDE AĞRI, FONKSİYONEL DURUM VE BOYUN FARKINDALIĞI ARASINDAKİ İLİŞKİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Ağrı şiddeti ve fonksiyonel durum birbiriyle ilişkilidir fakat bu ilişkinin doğrudan olmadığı öne sürülmektedir. Bu çalışmanın amacı, kronik boyun ağrılı bireylerde ağrı, fonksiyonel durum ve boyun farkındalığı arasındaki ilişkiyi ve fonksiyonel durum ile ağrı şiddeti ilişkisine boyun farkındalığının katkısını araştırmaktır.

Yöntem: Kronik boyun ağrısı olan 766 birey [509 (%66,4) kadın, 257 (%33,6) erkek] çalışmaya dahil edildi. Boyun ağrısı şiddeti, fonksiyonel durum ve boyun farkındalığı sırası ile Görsel Analog Skala (GAS), Bournemouth Boyun Ağrı Anketi (BBAA) ve Fremantle Boyun Farkındalık Anketi (FBFA) ile değerlendirildi.

Sonuçlar: Kronik boyun ağrılı bireylerin yaş ortalaması 39,47±13,93 yıldı. Çok değişkenli regresyon analizine göre, fonksiyonel duruma esas etkisi olan değişkenler GAS skoru (20-39 yaş grubu: ß=0,918, p<0,001, 40-60 yaş grubu: ß=0,909, p<0,001) ve FBFA skoru (20-39 yaş grubu: ß=0,008, p=0,035, 40-60 yaş grubu: ß=0,124, p<0,001) idi. İlk aşama hiyerarşik analizde GAS skorunun açıklayıcılık oranı 20-39 yaş grubunda %91, 40-60 yaş grubunda %89,7 idi. İkinci adımda FBFA skorunun eklenmesi bu orana 20-39 yaş grubunda %0,6, 40-60 yaş grubunda %1,5 katkı sağladı.

Tartışma: Çalışmamız sonucunda kronik boyun ağrısı olan bireylerde fonksiyonel duruma esas etki eden faktörlerin ağrı şiddeti ve boyun farkındalığı olduğu tespit edildi.

Anahtar Kelimeler: Ağrı Şiddeti, Doğrusal Regresyon, Farkındalık, Fonksiyonel Durum, Kronik Boyun Ağrısı

THE RELATION BETWEEN PAIN, FUNCTIONAL STATUS, AND NECK AWARENESS IN INDIVIDUALS WITH CHRONIC NECK PAIN

ORIGINAL ARTICLE

ABSTRACT

Purpose: Pain intensity and functional status are interrelated, but it is suggested that this relationship is not direct. The aim of this study was to investigate the relationship between pain, functional status, and neck awareness in individuals with chronic neck pain, and the contribution of neck awareness to the relationship between functional status and pain intensity.

Methods: Seven hundred and sixty-six individuals (509 (%66.4) females; 257 (%33.6) males) with chronic neck pain were included in the study. Neck pain intensity, functional status, and neck awareness were evaluated with the Visual Analog Scale (VAS), Bournemouth Neck Pain Questionnaire (BNPQ), and Fremantle Neck Awareness Questionnaire (FNAQ), respectively.

Results: The mean age of individuals with chronic neck pain was 39.47 ± 13.93 years. According to multivariate regression analysis, the variables that had the main effect on functional status were VAS score (20-39 age group: ß=0.918, p<0.001, 40-60 age group: ß=0.909, p<0.001) and FNAQ score (20-39 age group: ß=0.008, p=0.035, 40-60 age group: ß=0.124, p<0.001). In the first stage of the hierarchical analysis, the explanatory rate of the VAS score was 91% in the 20-39 age group and 89.7% in the 40-60 age group. Adding the FNAQ score in the second step contributed to this ratio by 0.6% in the 20-39 age group and 1.5% in the 40-60 age group.

Discussion: As a result of our study, it was determined that the main factors affecting the functional status of individuals with chronic neck pain were pain intensity and neck awareness.

Keywords: Awareness, Chronic Neck Pain, Functional Status, Linear Regression, Pain Intensity

GİRİŞ

Genel popülasyonda sık görülen boyun ağrısı, yetişkinlerde yaklaşık olarak %20,3'lük bir prevalansa sahiptir (1). Boyun ağrısının yaşa göre standartlaştırılmış küresel prevalansı ise 100,000'de 3551,1'dir (2). Avrupa popülasyonunda boyun ağrısı yaşayan bireylerin yaklaşık %15-19'unda problemlerin tam olarak çözülmemesi nedeniyle sorunların kronikleştiği görülmüştür (3). Boyun ağrısı en yaygın görülen dört kronik ağrı içerisinde (Baş ağrısı, sırt, boyun ağrısı ve orofasiyal ağrı) hastaların sağlık hizmetine başvurmasının birincil nedenidir (4).

Geçmişte kronik boyun ağrılı bireylerin sinir-kas ve kas-iskelet sistemi özellikleri (örneğin propriosepsiyon, kuvvet, esneklik ve duruş) incelenmiş ve boyun ağrısının propriyosepsiyonu etkileyebileceği bildirilmiştir (5). Ayrıca propriyosepsiyon eğitimi ile boyun ağrısının tekrarının önlenebileceği ve kronikleşme riskinin de azaltılabileceği savunulmuştur (6). Bir yandan kronik non-spesifik boyun ağrılı hastalarda servikal propriosepsiyon eğitiminin ağrı şiddetini azaltabileceği bildirilirken, diğer yandan ağrısı olmayan bireylerle kıyaslandığında kronik boyun ağrılı bireylerde kas endurans ve dayanıklılığının azalmasına rağmen boyun propriosepsiyonunun değişmediği görülmüştür (7,8). Kronik boyun ağrılı bireylerde ağrı şiddeti, fonksiyonel durum ve boyun farkındalığı ilişkisinin netleştirilmesine ihtiyaç vardır.

Boyun ağrısı ile ilgili çalışmalarda ağrı ve fonksiyonel durum arasındaki ilişkinin orta düzeyde olduğu saptanmıştır (10,11). Fejel ve diğ., ağrı şiddeti ve ağrı durasyonu ile fonksiyonel durum arasındaki ilişkiyi incelerken, Hwang ve Mun, boyun ve omuz ağrısı şiddeti ile fonksiyonel durum arasındaki ilişkiyi vurgulamışlardır. Bilgimiz dahilinde literatürde boyun ağrısı, fonksiyonel durum ve farkındalık arasındaki ilişkinin incelendiği çalışmaya rastlanmamıştır. Ağrı ve fonksiyonel durumun öznel ölçüler olması ve bu nedenle de fizyolojik, psikososyal ve çevresel faktörlerden etkilenebileceği düşüncesi, ağrı ile fonksiyonel durum arasındaki ilişkinin doğrudan olmadığı hipotezinin doğmasına neden olmuştur (11). Klinik müdahaleleri optimize etmek ve gelecekte yapılacak olan epidemiyolojik araştırmaları geliştirmek için ağrı ve fonksiyonel durum arasındaki ilişkiye etki eden faktörlerin netleştirilmesine ihtiyaç vardır. Bu çalışmadaki hipotezimiz; doğrudan olmadığı öne sürülen bu ilişkiye boyun farkındalığının katkıda bulunabileceğidir.

Bu çalışmanın amacı, kronik boyun ağrılı bireylerde ağrı, fonksiyonel durum ve boyun farkındalığı arasındaki ilişkiyi ve fonksiyonel durum ile ağrı şiddeti ilişkisine boyun farkındalığının katkısını araştırmaktı.

YÖNTEM

Kesitsel olarak planlanan bu çalışmaya Ağustos 2020-Haziran 2021 tarihleri arasında Denizli Devlet Hastanesi Fizik Tedavi ve Rehabilitasyon Polikliniğine başvurup fizik tedavi ve rehabilitasyon uzman hekimi tarafından Kronik Boyun Ağrısı tanısı koyulan katılımcılar dahil edildi. Çalışmanın yürütülebilmesi için Pamukkale Üniversitesi Girişimsel olmayan Klinik Araştırmalar Etik Kurulu'ndan 07.07.2020 tarih ve 13 sayılı karar numarası ile etik onay alındı. Çalışma Helsinki Bildirgesinde tanımlanan ilkelere uygun şekilde yürütüldü. Çalışmaya dahil edilmeden önce katılımcılara çalışmanın amacı, çalışmaya katılmanın gönüllülük esasına dayandığı, istedikleri zaman çalışmadan ayrılabilecekleri, verdikleri bilgilerin araştırma dışında başka bir yerde kullanılmayacağı gibi konular hakkında açıklamalar yapıldı. Çalışma öncesi katılımları konusunda tüm katılımcıların aydınlatılmış yazılı onamları alındı.

Çalışmamıza 20-60 yaş aralığında, travma veya cerrahi operasyon öyküsü olmayan, osteoartrit ve romatoid artrit gibi romatizmal hastalığı olmayan, boyun kırığı veya dislokasyon öyküsü olmayan, skolyoz gibi kas iskelet sistemi deformitesi olmayan ve nörolojik herhangi bir defisiti olmayan katılımcılar dahil edildi. Üç aydan kısa süreli boyun ağrısı öyküsü olan ve dahil edilme kriterlerimize uymayan katılımcılar çalışma dışı bırakıldı. Dahil edilme kriterlerimize uyan ve çalışmaya katılmayı kabul eden katılımcılar evrenimizi oluşturdu. Çalışmamızda Denizli Devlet Hastanesi Fizik Tedavi ve Rehabilitasyon Polikliniğine başvuran kronik boyun ağrılı tüm hastalara ulaşılması hedeflendi.

Katılımcıların demografik bilgileri demografik bilgi formuna kaydedildi. Boyun ağrısı şiddeti Görsel Analog Skala (GAS) ile, fonksiyonel durum Bourne-

mouth Boyun Ağrısı Anketi (BBAA) ile boyun farkındalığı ise Fremantle Boyun Farkındalık Anketi (FBFA) ile değerlendirildi.

Sosyo-Demografik Bilgi Formu: Araştırmaya dahil edilen katılımcıların yaş, cinsiyet, boy uzunluğu, vücut ağırlığı ile egzersiz alışkanlıkları (....kez/hafta) sorgulandı. Katılımcıların Beden Kitle İndeksi (BKI) kg/m2 formülü ile hesaplandı. Son 3 ay içerisinde haftada en az 3 kez yarım saat boyunca orta şiddetli egzersiz yapan katılımcılar (Hızlı yürümek, düşük tempolu koşular, dans etmek, ip atlamak, yüzmek, masa tenisi oynamak, yavaş tempoda bisiklet sürmek vb.) egzersiz alışkanlığı var olarak kabul edildi (12).

Ağrı şiddeti ve ağrı durasyonu: Katılımcılardan 10 santimetrelik (cm) yatay bir çizgi üzerinde hissettikleri ağrı şiddetini işaretlemeleri istendi. 0 (sıfır) ağrı olmadığını, 10 ise dayanılmayacak ağrıyı ifade ettiği açıklandı. Çizgi üzerinde işaretlenen nokta cetvel ile ölçülerek GAS değeri cm cinsinden kaydedildi (13). Ağrı durasyonu ise 'ağrılı ay sayısı' sorgulanarak kaydedildi.

Fonksiyonel Durum: BBAA ile değerlendirildi. Toplamda 7 sorudan oluşan anket 2002 yılında İngiltere'de biyopsikososyal model esas alınarak geliştirilmiştir. Anket ağrı ve engellilik ile ilgili sorulara ek olarak psikososyal konularla ilgili soruları içerir (14). Her soru 0 ve 10 arasında puan almaktadır. En yüksek skor 70 olmakla birlikte yüksek skor özür seviyesinin yüksek olduğunu göstermektedir. Anketin içeriği ağrı şiddeti, ağrının günlük yaşam aktiviteleri ve sosyal yaşam üzerine etkisi, kaygı-depresyon seviyesi, kinezyofobi ve ağrı ile baş edebilme gibi boyun ağrılı bireyler için mutlaka sorgulanması gereken değişkenlerden oluşmaktadır. Anketin Türkçe versiyon çalışması Telci ve diğ. tarafından yapılmıştır (15).

Boyun Farkındalığı: FBFA ile değerlendirildi. Bu anket bel ağrılı hastalar için 2016 yılında Wand ve arkadaşları tarafından Avusturalya'da geliştirilmiştir (16). Anketin Türkçe adaptasyon çalışması yapılırken anket Prof. Dr. Benedith Wand tarafından boyun bölgesi için uyarlanmıştır. FBFA bireye özgü değişmiş algılamayı değerlendiren likert tipi (0 = Asla/Hiç böyle hissetmiyorum, 1= Nadiren böyle hissediyorum, 2 = Bazen, ya da bazı zamanlar böyle hissediyorum, 3 = Sıklıkla böyle hissediyorum, 4 = Her zaman ya da çoğu zaman böyle hissediyorum) bir ankettir. Anket bireylere boynunu vücuduna göre nasıl algıladığı, vücut pozisyonunu nasıl algıladığı gibi 9 soru sorar. Toplam skor 0-36 arasında değişir. Yüksek skor kötü prognoza işarettir. Anketin Türkçe versiyon, geçerlik ve güvenirliği Onan ve arkadaşları tarafından yapılmıştır (17).

Tablo 1. Demografik ve Klinik Veriler

Değişkenler		**Ort ± SS**	**Min-Max**
Yaş (yıl)		39,47 ± 13,93	20-60
BKI (kg/m²)		25,61 ± 4,81	16,26-50,78
Ağrı Şiddeti (cm)		5,75 ± 2,08	0-10
Ağrı Durasyonu (ay)		29,58 ± 15,64	4-124
BBAA		32,75 ± 8,75	12-57
FBFA		11,16 ± 6,27	0-31
		n (%)	
Yaş	**20-39**	363 (4,70)	
	40-60	403 (52,60)	
Cinsiyet	**Kadın**	509 (66,40)	
	Erkek	257 (33,60)	
Medeni Durum	**Evli**	504 (65,80)	
	Bekar	262 (34,20)	
Egzersiz Alışkanlığı	**Var**	113 (14,80)	
	Yok	653 (85,20)	

Ort: Ortalama; SS: Standart Sapma; BBAA: Bournemouth Boyun Ağrısı Anketi; FBFA: Fremantle Boyun Farkındalık Anketi; n: Sayı; %: Yüzde

Tablo 2. Değişkenlerin Yaşa Göre İncelenmesi

Değişkenler	20-39 yaş Ort ± SS	40-60 yaş Ort ± SS	p
Ağrı Şiddeti (GAS)	5,35±2,10	6,11±1,99	**<0,001***
Ağrı durasyonu (ay)	27,70±15,26	31,27±15,79	**<0,001***
BKI	23,23±3,79	27,77±4,62	**<0,001***
BBAA	30,95±8,77	34,38±8,42	**<0,001***
FBFA	10,38±6,33	11,87±6,13	**0.001***
	n (%)	**n (%)**	
Egzersiz alışkanlığı			
Var	315 (86,80)	338 (83,90)	0,387**
Yok	48 (13,20)	65 (16,10)	

Ort: Ortalama; SS: Standart Sapma; GAS; Görsel Analog Skala; BBAA: Bournemouth Boyun Ağrısı Anketi; FBFA: Fremantle Boyun Farkındalık Anketi; n: Sayı; %: Yüzde; *:Mann Whitney U Testi; **: Pearson ki-kare testi; p<0,05

İstatistiksel Analiz

Örneklem genişliği, referans olarak incelenen çalışmada elde edilen korelasyon katsayıları incelenerek (11) G*Power paket programı ile (G*Power 3.1.9.7 for Windows, 2020) (18) hesaplandı. Çalışmada elde edilen korelasyon katsayılarının en küçüğü olan r=0,12 değerine göre yapılan güç analizi sonucunda çalışmaya en az 540 kişi dahil edildiğinde %95 güven düzeyinde %80 güce ulaşılabileceği hesaplanmıştır. Çalışmamız kesitsel bir çalışma olduğundan Ağustos 2020-Haziran 2021 tarihleri arasında Denizli Devlet Hastanesi Fizik Tedavi ve Rehabilitasyon Polikliniğine başvurup fizik tedavi ve rehabilitasyon uzman hekimi tarafından Kronik Boyun Ağrısı tanısı koyulan katılımcılar dahil edildi. Çalışmamız 766 kişi ile tamamlandı.

Veriler SPSS 25.0 (IBM SPSS Statistics 25 software (Armonk, NY: IBM Corp.) paket programıyla analiz edildi. Sürekli değişkenler ortalama ± standart sapma ve kategorik değişkenler sayı ve yüzde olarak ifade edildi. Verilerin normal dağılıma uygunluğu Kolmogorov Smirnov testi ile incelendi.

Ağrı şiddeti, ağrı durasyonu, BKI, FBFA, BBAA skor ortalamalarının yaş gruplarına göre incelenmesinde Mann Whitney U testi ve egzersiz alışkanlığının incelenmesinde Pearson ki-kare testi kullanıldı. Ağrı şiddeti, ağrı durasyonu ve boyun farkındalığı arasındaki ilişkinin incelenmesinde Spearman korelasyon analizi kullanıldı. Korelasyon katsayısı <0,2 ise çok zayıf; 0,2-0,4 arasında ise zayıf; 0,4-0,6 arasında ise orta; 0,6-0,8 arasında ise yüksek; >0,8 ise çok yüksek düzeyde ilişki olduğu kabul edildi (19). Bağımlı değişken (BBAA skoru) üzerinde etkisi olduğu düşünülen bağımsız değişkenlerin (yaş, BKI, egzersiz alışkanlığı, ağrı şiddeti, ağrı durasyonu, FBFA) incelenmesinde doğrusal regresyon analizi kullanıldı. BBAA skoru ile ağrı şiddeti arasındaki ilişkiye FBFA skorunun katkısını araştırmak için hiyerarşik regresyon analizi yapıldı. Katkı değerleri R2 ile yorumlandı. Tüm analizlerde p<0,05 istatistiksel olarak anlamlı kabul edildi.

SONUÇLAR

Çalışma kapsamında Denizli Devlet Hastanesi fizik tedavi polikliniğine başvuran kronik boyun ağrısı tanısı alan 1073 birey tarandı. Bu katılımcılardan

Tablo 3. Farklı Yaş Gruplarında Ağrı, Fonksiyonel Durum ve Boyun Farkındalığı Arasındaki İlişki

Değişkenler		20-39 yaş		40-60 yaş	
		BBAA	**FBFA**	**BBAA**	**FBFA**
Ağrı Şiddeti (cm)	r	0,953	0,366	0,941	0,290
	p*	<0,001	<0,001	<0,001	<0,001
Ağrı Durasyonu (ay)	r	0,522	0,929	0,527	0,893
	p*	<0,001	<0,001	<0,001	<0,001

BBAA: Bournemouth Boyun Ağrısı Anketi; FBFA: Fremantle Boyun Farkındalık Anketi; *: Spearman Korelasyon Analizi; p<0,05

Tablo 4. 20-39, 40-60 Yaş Grubu Katılımcıların Regresyon Analizi Sonuçları

Bağımlı değişken: BBAA		20-39 Yaş						40-60 Yaş					
		Std. Beta	t	p	%95 G.A. Alt Sınır	%95 G.A. Üst Sınır	Düzeltilmiş R^2 (%)	Std. Beta	t	p	%95 G.A. Alt Sınır	%95 G.A. Üst Sınır	Düzeltilmiş R^2 (%)
Tek değişkenli	Yaş	0,174	3,356	0,001	0,102	0,389	2,8	0,066	1,323	0,187	-0,042	0,216	0,2
	BKI	0,165	3,187	0,002	0,147	0,619	2,5	0,088	1,773	0,077	-0,017	0,339	0,5
	Egzersiz alışkanlığı	-0,228	-0,523	0,601	-3,384	1,962	-0,2	0,007	0,139	0,89	-2,087	2,404	-0,2
	Ağrı Şiddeti	0,954	60,358	<0,001	3,846	4,105	91	0,947	59,04	<0,001	3,874	4,141	89.7
	Ağrı durasyonu	0,461	9,867	<0,001	0,212	0,317	21	0,444	9,924	<0,001	0,19	0,284	19,5
	FBFA	0,419	8,765	<0,001	0,45	0,711	17,3	0,394	8,595	<0,001	0,418	0,666	15,3
Çok değişkenli	Yaş	-0,002	-0,126	0,9	-0,049	0,043	91,6	-	-	-	-	-	91,1
	BKI	0,022	1,339	0,181	-0,024	0,126		-	-	-	-	-	
	Ağrı şiddeti	0,918	53,907	0	3,688	3,968		0.909	56.928	<0,001	3,712	3,977	
	Ağrı durasyonu	0,009	0,242	0,809	-0,038	0,049		0,006	0,214	0,831	-0.027	0,034	
	FBFA	0,08	2,114	0,035	0,008	0,214		0,124	4,345	<0,001	0,093	0,247	
Hiyerarşik Aşama 1	Ağrı şiddeti	0,954	60,358	<0,001	3,846	4,105	91	0,947	59,04	<0,001	3,874	4,141	89,7
Hiyerarşik Aşama 2	Ağrı şiddeti	0,922	82,57	<0,001	3,709	3,976	91,6	0,909	58,667	<0,001	3,719	3,977	91,2
	FBFA	0,089	9,871	<0,001	0,079	0,168		0,129	8,33	<0,001	0,136	0,219	

BBAA: Bournemouth Boyun Ağrısı Anketi; FBFA: Fremantle Boyun Farkındalık Anketi; Std beta: Standartlaştırılmış beta değeri; G.A.: Güven Aralığı; p<0,05

dahil edilme kriterlerimize uymayan 157, katılmak istemeyen 150 birey çalışma dışı bırakıldı. Çalışmaya yaşları 20-60 arasında değişen ve yaş ortalaması 39,47 ± 13,93 olan 766 kronik boyun ağrılı birey dahil edildi. Katılımcıların demografik verileri ve klinik özellikleri Tablo 1'de gösterildi.

Kazeminasab ve diğ. (2) boyun ağrısı nokta prevalansının erkeklerde 45-49, kadınlarda 50-54 yaş aralığında daha yüksek olduğunu göstermiştir. Yaşın yüksek risk faktörü olduğu yaş aralığındaki bireyler ile riskin daha az olduğu yaş aralığındaki bireyleri kıyaslamak için yaş aralığı 20-39 yaş ve 40-60 yaş olarak kategorize edildi. Yaş kategorize edilerek değişkenler incelendiğinde, 40-60 yaş grubu katılımcıların ağrı şiddeti (p<0,001), ağrı durasyonu (p<0,001), BKI (p<0,001), BBAA (p<0,001) ve FBFA skorları (p=0,001) 20-39 yaş grubu katılımcılardan yüksek iken katılımcıların egzersiz alışkanlıkları benzerdi (p=0,387) (Tablo 2).

20-39 yaş grubu kronik ağrılı bireylerde GAS skoru, BBAA skoru ile pozitif yönde çok yüksek düzeyde ilişki (r=0,953, p<0,001) gösterirken, FBFA skoru ile pozitif yönde zayıf düzeyde (r=0,366, p<0,001), ilişkili olduğu saptandı. Ağrı durasyonu ile BBAA skoru pozitif yönde orta düzeyde (r=0,522, p<0,001) ilişki gösterirken, FBFA skorunun pozitif yönde çok yüksek düzeyde (r=0,929, p<0,001) ilişkili olduğu saptandı. 40-60 yaş grubu kronik ağrılı bireylerde GAS skoru, BBAA skoru ile pozitif yönde çok yüksek düzeyde ilişki (r=0,941, p<0,001) gösterirken, FBFA skoru ile pozitif yönde zayıf düzeyde (r=0,290, p<0,001) ilişkili olduğu saptandı. Ağrı durasyonu ile BBAA skoru pozitif yönde orta düzeyde (r=0,527, p<0,001) ilişki gösterirken, FBFA skorunun pozitif yönde çok yüksek düzeyde (r=0,893, p<0,001) ilişkili olduğu saptandı. (Tablo 3).

Tek değişkenli doğrusal regresyon analizleri sonucunda 20-39 yaş grubu katılımcılarda yaş (ß=0,174, p=0,001), BKI (ß=0,165, p=0,002), ağrı durasyonu (ß=0,461, p<0,001), FBFA (ß=0,419, p<0,001) ve ağrı şiddeti (ß=0,954, p<0,001) skorlarının fonksiyonel durum üzerinde istatistiksel olarak anlamlı etkiye sahip olduğu, egzersiz alışkanlığının fonksiyonel durumu etkilemediği görüldü (p=0,601). 40-60 yaş grubu katılımcılarda ağrı şiddeti (ß=0,947, p<0,001), ağrı durasyonunun (ß=0,444, p<0,001) ve FBFA skorunun (ß=0,394, p<0,001) fonksiyonel durum üzerinde istatistiksel olarak anlamlı etkiye sahip olduğu, yaş (p= 0,187), BKI (p=0,077) ve eg-

zersiz alışkanlığının (p=0,89) fonksiyonel durumu etkilemediği görüldü (Tablo 4). Tek değişkenli modellerde anlamlı çıkan değişkenlerle kurulan çok değişkenli model sonucunda ise, 20-39 yaş grubu katılımcılarda fonksiyonel durum üzerinde esas etkisi olan değişkenlerin ağrı şiddeti (ß=0,918, p<0,001) ve FBFA skoru (0,008, p=0,035) olduğu tespit edildi. 40-60 yaş grubu katılımcılarda fonksiyonel durum üzerinde esas etkisi olan değişkenlerin ağrı şiddeti (ß=0,909, p<0,001) ve FBFA skoru (ß=0,124, p<0,001) olduğu tespit edildi (Tablo 4).

Hiyerarşik regresyon analizine göre, 20-39 yaş grubu katılımcılarda ilk aşamada ağrı şiddetinin (R2= 91) fonksiyonel durumu %91 oranında açıklayabildiği, ikinci aşamada modele FBFA skoru eklendiğinde açıklayıcılık oranının sadece %0,6 oranında arttığı tespit edildi. 40-60 yaş grubu katılımcılarda ilk aşamada ağrı şiddetinin (R2= 89,7) fonksiyonel durumu %89,7 oranında açıklayabildiği, ikinci aşamada modele FBFA skoru eklendiğinde açıklayıcılık oranının sadece %1,5 oranında arttığı tespit edildi (Tablo 4). Bu sebeple fonksiyonel durum üzerinde en yüksek etkiye sahip olan değişkenin ağrı şiddeti olduğu belirlendi.

TARTIŞMA

Bu çalışmanın amacı, kronik boyun ağrılı bireylerde ağrı, fonksiyonel durum ve boyun farkındalığı arasındaki ilişkiyi ve fonksiyonel durum ile ağrı şiddeti ilişkisine boyun farkındalığının katkısını araştırmaktı. Çalışmamız sonucunda ağrı şiddeti, ağrı durasyonu, fonksiyonel durum ve boyun farkındalığının ilişkili olduğu tespit edildi. Çok değişkenli regresyon analizi sonucunda, fonksiyonel duruma esas etkisi olan değişkenlerin ağrı şiddeti ve boyun farkındalığı olduğu görüldü.

Bu çalışmaya kronik boyun ağrısı olan ve üretken çağda olan tüm katılımcıların dahil edilmesi planlandı bu nedenle yaş aralığımız oldukça genişti. İstatistiksel analiz yapılırken tüm değişkenler farklı yaş kategorizasyonlarında incelendi. Regresyon analizi sonucunda ise 20-39 yaş grubunda ağrı şiddeti ve boyun farkındalığına ek olarak BKI ve yaşın da fonksiyonel durumu etkilediği gözlenirken, 40-60 yaş grubunda yaş ve BKI'dan bağımsız olarak ağrı şiddeti ve boyun farkındalığının fonksiyonel durum üzerinde etkili olduğu görüldü. Bu bulgu bize fonksiyonel duruma asıl etki eden değişkenlerin ağrı şiddeti ve boyun farkındalığı olduğunu gösterdi. Ağrı durasyonu, yaş ve BKI'nın etkisini yitirmesi fonksiyonel durumu etkileyen faktörlerin biyomedikal mekanizmalardan çok nörofizyolojik mekanizmalar ile açıklanabileceğini göstermiştir.

Boyun ağrısı, günlük yaşam aktivitelerini kısıtlamanın yanı sıra, yetişkinler arasında azalmış fonksiyonel durum ve iş kaybının önde gelen nedenidir (20). Boyun ağrısı ile fonksiyonel durum arasındaki ilişkinin incelendiği bir çalışmada boyun ağrısının yaygın olduğu ve fakat büyük bir özre neden olmadığı bildirilmiştir (11). Literatürde boyun ağrısı ile fonksiyonel durum arasındaki orta düzeyde ve yüksek düzeyde ilişki olduğunu gösteren çalışmalara rastlanmıştır (11,21). Çalışmamızda ağrı şiddeti ile fonksiyonel durum arasında çok yüksek ilişki tespit ettik. Fejel ve Hartvigsen (11) katılımcıların ortalama ağrı şiddetinin sayısal derecelendirme ölçeğine göre düşük, özür düzeyinin boyun özür indeksine göre hafif düzeyde olduğunu bildirmiş ve bu nedenle ilişkinin orta düzeyde olabileceğini öne sürmüştür. Mevcut çalışmada katılımcılarımızın ağrı şiddeti ortalaması GAS'a göre orta şiddette idi. Fonksiyonel durum BBAA ile değerlendirildi. Bu anketin kesme puanının olmaması nedeni ile fonksiyonel durum seviyesinin belirlenmesi söz konusu olmadı ve benzer bir çıkarımda bulunamadık. Fakat ağrı şiddeti ve özür düzeyinin subjektif ölçümler olduğu ve fizyolojik, psikolojik ve çevresel faktörlerin de bu değişkenlere etkisi düşünüldüğünde çalışmalar arasında farklı sonuçlar elde edilmesi olasıdır. Bu konuda daha geniş popülasyonda boyun ağrısının tüm yönleriyle değerlendirildiği çok merkezli çalışmalara ihtiyaç vardır.

Anatomik yapılarda meydana gelen dejenerasyonun uzun bir süreç olduğu düşünüldüğünde ilk ağrı deneyiminden bu yana geçirilen zamanın sorgulanmasının ağrı durasyonunu yansıtabileceğini düşündük ve ilk boyun ağrısı yaşandığı zamandan itibaren ağrı ile geçirilen ay sayısını sorgulayarak ağrı durasyonunu kaydettik. Çalışmamızda fonksiyonel durum ve ağrı durasyonu arasında pozitif yönde orta düzeyde ilişki gözledik. Bu bulgu bize kişilerin ağrı ile geçirdikleri süre arttıkça fonksiyonel durumun kötüleştiğini göstermektedir. Fejel ve Hartvigsen ağrı durasyonunu son bir yıl içerisindeki ağrılı gün

sayısını sorgulayarak kaydetmişler ve zayıf ilişki tespit etmişlerdir. Sorgulama parametrelerindeki farklılık nedeniyle çalışmalarda farklı ilişki katsayıları elde edilmiş olabilir.

Diş hekimlerinde boyun ağrısı şiddeti ve fonksiyonel durumun BKİ ve egzersiz alışkanlığı ile ilişkili olduğu belirtilmiştir (22). İlgili çalışmada egzersiz alışkanlığı var/yok şeklinde değerlendirilmiş ve katılımcıların egzersiz alışkanlığı konusundaki ifadesi esas alınarak değerlendirme yapılmıştır. Çalışmamızın bulgularına göre, yaş ve BKI fonksiyonel durum ile ilişkili iken egzersiz alışkanlığı ilişkili değildir. Biz çalışmamızda egzersiz alışkanlığını var kabul etmek için son 3 ay içerisinde haftada en az 3 kez yarım saatlik egzersiz yapma koşulunu esas aldık ve katılımcılarımızın çoğunun (%85,2) egzersiz alışkanlığının olmadığını gördük. Fonksiyonel durum ile anlamlı ilişki bulunmamasının nedeni bu olabilir.

Çalışmamızda boyun ağrısı ile azalmış boyun farkındalığı arasında pozitif yönde zayıf düzeyde bir ilişki olduğunu gördük. Moreira ve diğ., (23), boyun ağrısı olan katılımcıların boyun ve omuzlarını vücut diagramında daha az simetrik çizdiklerini aynı zamanda asemptomatik kontrol grubuna kıyasla daha kısa veya daha büyük çizdiklerini rapor etmiştir. Ayrıca postüral farkındalık için uygulanan zihin-beden programı sonucu postüral farkındalık arttıkça ağrı şiddeti azalmıştır (24,25). Literatürde boyun farkındalığı ile ağrı şiddet arasındaki ilişkiyi inceleyen çalışmaya rastlanmadığı için ilişkinin kuvveti ve yönü literatür ışığında tartışılamamıştır.

Çalışmamızda boyun farkındalığının fonksiyonel durum ile ağrı şiddeti arasındaki ilişkiye %0,9 oranında katkıda bulunduğunu saptadık. Bu da bize ağrı şiddeti ve fonksiyonel durum arasındaki ilişkide boyun farkındalığının rolünün olmadığını göstermektedir. Bilgimiz dahilinde literatürde boyun farkındalığının ağrı ve fonksiyonel durum arasındaki ilişkiye katkısını inceleyen bir çalışmaya rastlanmamıştır. Bu anlamda çalışmamız literatürde tektir. Ağrı ile fonksiyonel durum arasındaki doğrudan olmayan ilişkiye katkıda bulunabilecek diğer faktörleri inceleyecek ileri çalışmalara ihtiyaç vardır.

Bu çalışmanın bazı limitasyonları vardır. Bu limitasyonlardan biri katılımcıların egzersiz alışkanlığının sorgulandığı geçerli güvenilir bir sorgulama aracı kullanılmamasıdır. Ayrıca ağrı durasyonunun yanı sıra ağrı frekansı, tekrarı gibi ağrıya özgü parametrelerin de sorgulanması ağrının çok yönlü değerlendirilmesini sağlayacaktır. Çalışmamızın güçlü yönü, güç analizinde elde edilen sayının da üzerinde olgu sayısına ulaşması ve ağrı ile fonksiyonel durum arasındaki ilişkinin çok boyutlu olarak incelenmesidir.

Sonuç olarak kronik boyun ağrılı bireylerde, ağrı şiddeti ve boyun farkındalığının fonksiyonel durumu etkilediğini gördük. Kronik boyun ağrısı ile fonksiyonel durum arasındaki ilişkide asıl etkenin ağrı şiddeti olduğunu ve boyun farkındalığının rolü olmadığını saptadık. Kronik boyun ağrısı olan bireylerde boyun farkındalık egzersizlerinin ağrı şiddeti ve özür düzeyine etkisinin araştırıldığı çalışmaların planlanması ve sonuçlarının incelenmesini öneriyoruz. Kronik boyun ağrılı bireylerde fonksiyonel durumun artırılması için yapılabilecek klinik uygulamaları belirlemede, ağrı ve fonksiyonel durum arasında doğrudan olmadığı öne sürülen ilişkiye katkıda bulunabilecek diğer faktörlerin açığa çıkarılması önemlidir.

Destekleyen Kuruluş: Bu çalışma için herhangi bir kuruluştan destek alınmamıştır.

Çıkar Çatışması: Bu çalışmada yazarlar arasında çıkar çatışması bulunmamaktadır.

Etik Onay: Bu çalışmanın etik onayı, Pamukkale Üniversitesi Girişimsel olmayan Klinik Araştırmalar Etik Kurulu'ndan 07.07.2020 tarihinde 13 karar numarası ile etik onay alınmıştır.

Aydınlatılmış Onam: Tüm katılımcılardan çalışma öncesinde bilgilendirilmiş sözlü ve yazılı onam alınmıştır.

Hakem Değerlendirmesi: Dış bağımsız hakemler tarafından değerlendirilmiştir.

Yazar Katkıları: Konsept – ŞŞ, NY, Tasarım - ŞŞ, Süpervizyon – AOS,MBK; Kaynaklar ve Finansal Destek - AKÖ; Materyaller - ŞŞ, Veri Toplaması ve/veya İşleme - ŞŞ; Analiz ve Yorumlama - AOS; Literatür Tarama - AKÖ; Makale Yazımı - MBK; Eleştirel İnceleme - NY.

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ISSN: 2651-4451 • e-ISSN: 2651-446X

Turkish Journal of Physiotherapy and Rehabilitation

2022 33(2)114-123

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Received: *10.09.2021 (Geliş Tarihi)*
Accepted: *03.03.2022 (Kabul Tarihi)*

INVESTIGATING THE EFFECTS OF SPORTS ON THE QUALITY OF LIFE IN PERSONS WITH PHYSICAL DISABILITIES

ORIGINAL ARTICLE

ABSTRACT

Purpose: Sport is an important tool in improving the quality of life of individuals with disabilities. The study aim to examine the life quality of individuals with physical disabilities with different functionality levels in relation to sports.

Methods: A total of 36 individuals with physical disabilities participated in the study. The participants included individuals without any regular exercise (non-sportive, NS), those who played Boccia (B), and persons who played Wheelchair basketball (WCB) who could not provide independent ambulation. The Rivermead Mobility Index (RMI), Functional Independency Measurement (FIM), Trunk Impairment Scale (TIS), and World Health Organization Quality of Life Instrument for People with Intellectual and Physical Disabilities (WHOQOL-DIS) were used for evaluating motor impairment of the trunk, functionality levels, mobility, and quality of life (QoL), respectively.

Results: Group B had lower RMI scores compared to group NS ($p<0.05$). FIM-motor and FIM-total scores were the lowest in group B ($p<0.05$), whereas FIM-cognitive scores were similar across all groups ($p>0.05$). However, TIS-total scores were the lowest in the B group ($p<0.05$) and TIS-coordination scores were higher in the WCB group ($p<0.05$). There was no difference between the groups in TIS static and dynamic evaluations ($p>0.05$). There was no difference between the groups in terms of the WHOQOL subscales and the disability module subdimensions ($p>0.05$). QoL-total score was similar for group B and NS ($p>0.05$), but higher in the WCB group ($p<0.05$).

Conclusions: It is thought that the low functional B players' having similar quality of life with the other participants is due to the psychological and social effects of B rather than its physical effects.

Keywords: Health-Related Quality of Life, Persons with Disabilities, Sports, Sports For Persons With Disabilities, Wheelchair Sports.

FİZİKSEL ENGELLİ BİREYLERDE SPORUN YAŞAM KALİTESİ ÜZERİNE ETKİSİNİN ARAŞTIRILMASI

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Spor, engelli bireylerin yaşam kalitesini artırmada önemli bir araçtır. Çalışmanın amacı değişik fonksiyonellik düzeyindeki fiziksel engelli bireylerin yaşam kalitelerinin sporla ilişkili olarak incelenmesidir.

Yöntem: Çalışmaya toplam 36 fiziksel engelli birey katıldı. Katılımcılar düzenli olarak spor yapmayan (SY), Boccia (B) ve Tekerlekli sandalye basketbolu (TSB) oynayan bağımsız ambulasyonu sağlayamayan bireylerden oluştu. Bireyler Rivermead Mobilite İndeksi (RMI), Fonksiyonel Bağımsızlık Ölçeği (FBÖ), Gövde Etkilenim Ölçeği (GEÖ), Dünya Sağlık Örgütü Zihinsel ve Fiziksel Engelliler İçin Yaşam Kalitesi Ölçeği (WHOQOL-DIS) kullanılarak sırasıyla gövde motor bozuklukları, fonksiyonellik düzeyleri, mobiliteleri ve yaşam kaliteleri değerlendirildi.

Sonuçlar: B grubunun RMI puanlarının SY'e göre daha düşük olduğu belirlendi ($p<0,05$). B grubu FBÖ-Motor ve FBÖ-Toplam puanları diğerlerinden düşük bulundu ($p<0,05$). FBÖ-Kognitif değerleri gruplar arasında benzerdi ($p>0,05$). GEÖ-Toplam puanlarının B grubunda en düşük ($p>0,05$), GEÖ-Koordinasyon puanlarının TSB grubunda en yüksek olduğu belirlendi ($p<0,05$). Grupların GEÖ statik ve dinamik değerlendirmeleri arasında fark görülmedi ($p<0,05$). Gruplar arasında yaşam kalitesi alt ölçekleri ve engelli modülü alt boyutları arasında fark görülmedi ($p>0,05$). B grubundaki bireylerin yaşam kalitesi toplam puanlarının SY grubuyla benzer ($p>0,05$), TSB grubuna göre düşük olduğu görüldü ($p<0,05$).

Tartışma: Düşük fonksiyonellik düzeyindeki B oyuncularının diğer katılımcılarla benzer yaşam kalitelerine sahip olmalarının B'nin fiziksel etkilerinden ziyade psikolojik ve soysal etkilerinden kaynaklandığı düşünülmektedir.

Anahtar Kelimeler: Sağlıkla İlgili Yaşam Kalitesi, Engelliler, Spor, Engelli Sporları, Tekerlekli Sandalye Sporları

INTRODUCTION

According to International Classification of Functioning, disability, and health (ICF), disability is the umbrella term for disorders or impairments that limit an individual's activity and participation. Both personal and environmental factors play a role in how disabilities affect an individual's life. Disability is affected by personal and environmental factors and adverse environmental conditions may aggravate the level or perception of disability for an individual. Convenient environmental factors, on the other hand, can reduce the extent of frustration despite the physical limitation (1). In this context, sports are considered a positive tool in improving physical, psychological, social aspects of participation and quality of life for people with disabilities (2).

Participation in sports or any physical activity supports the development of self-perception and allows individuals to recognize and fulfill their roles. At the same time, it develops the individual's perspective of her/himself such as self-esteem, physical self (appearance, strength, flexibility), and awareness (3). When done in a group, sports enables individuals to come together with peers and socialize (4). Therefore, sports play an important role in preventing problems such as social isolation, lack of interaction, and self-confidence perception in individuals with disabilities (2).

It is known that the general health of many people with physical disabilities is poor, their social participation is limited, and their quality of life is low (5). Sports, with its entertainment, treatment and competitive features, helps individuals focus on their abilities rather than their disabilities, and improves social relations and psychological health (6). Our study aims to examine this situation, which is valid for all physical disability groups, by comparing it with the sports groups that individuals are separated according to their physical adequacy levels. While Wheelchair basketball (WCB) is a sport performed by physically disabled individuals who can use their upper extremities, Boccia (B) is a sport and game that even individuals without limb and trunk control can do. These two sports require very different physical competencies. Therefore, in our study, we aimed to measure the effect of sports on the quality of life in the groups in which the physical disabilities are classified.

The aim of this study is to examine the quality of life (QoL) of physically disabled people with different levels of functionality in relation to sports. Physical independence levels and quality of life of the physically disabled individuals who play B and Wheelchair WCB and those who do not exercise regularly (non-sportive, NS) were compared in this study.

METHODS

The study is an original study completed between January 2020 and April 2021. The ethical approval of the study was obtained from Erciyes University Non-Interventional Research Ethics Committee (decision numbered 2020/71). Written approval was also obtained from the sport provincial directorate of the center where the study was conducted and from all participants. The research was conducted in accordance with the 2008 Helsinki Declaration of Human Rights.

Participants

The B and WCB participants were collected from Kayseri Youth Services and Sports Activities, 'Boccia' and 'Wheelchair Basketball' Clubs. The NS participants were contacted through Kayseri Orthopedically Handicapped Association. All of the participants were individuals who could mobilize with a wheelchair and did not have independent ambulation. According to the results of the power analysis, we aimed to reach 26 people in each group. The study started with a total of 40 participants; however, 36 individuals completed the study. On the other hand, 3 participants refused to join the Trunk Impairment Scale (TIS) assessment as it entailed close physical contact. The study groups were as follows: Non-sportive Group (NS, n=19), Boccia Group (B, n=9), and Wheelchair basketball Group (WCB, n=8). The Sportive group (S, n=17) consisting of B and WCB.

In our country, the limited opportunities, facilities and motivations of disabled people to do sports are the main obstacles in reaching individuals who can do sports. During the research process, it became more difficult to reach the sensitive groups

with the restrictions of the Covid 19 crisis. Because of reasons such as the participants' unwillingness to meet face-to-face and not being able to reach new participants, the number of group participants were not been able to equate but the number participants in sportive group and the number of participants in non-sportive group are kept in the comparable order.

The NS group consisted of 3 persons with bilateral lower limb amputation, 5 with spinal cord injuries, 1 with muscular dystrophy, 6 with cerebral palsy, 2 with poliomyelitis, and 2 with spina bifida. The Boccia group consisted of 3 persons with muscular dystrophy, 1 with spinal cord injury, 2 with cerebral palsy, 2 with poliomyelitis, and 1 with spina bifida. The WCB group included 4 persons with spinal cord injuries, 1 with cerebral palsy, and 3 with spina bifida.

Inclusion criteria were being over 18 years of age, having a physical disability, good level of cognition and communication, playing the sport for a minimum of 1 year for the B and WCB groups, and doing no team/individual sports for at least five years for the NS group.

Assessments

Anthropometric measurements were done either by the evaluator or the participants themselves when a face-to-face evaluation session was not possible (5 participants). The demographic information of the individuals and their background in sports were recorded.

Anthropometric Measurements: Participants' weight (kg) and height (m) (measured in the supine position) were used to calculate Body Mass Index (BMI=kg/m^2) (7).

Rivermead Mobility Index (RMI): This one-dimensional assessment of mobility was originally developed for people with acquired brain injury or stroke. Comprising of 14 self-reported items and 1 observational item (8), the RMI is a hierarchical scale that involves a series of activities ranging from rolling in bed to running. All items are coded as either "Yes" (score 1), or "No" (score 0) and total scores range from a minimum of 0 (=inability to perform any of the activities) to a maximum of 15. Higher scores indicate better mobility performance (9,10).

Functional Independency Measurement (FIM): It evaluates the functional performance of individuals with disabilities with all diagnoses within a rehabilitation population (11). Comprising of 18 items in 2 subscales (namely: motor subscale (13 items) and cognition subscale (5 items), the FIM assesses function in six areas including self-care, continence, mobility, transfers, communication, and social perception. Each item is graded on a scale of 1--7 based on level of independence. Total scores range from 18 to 126, wherein higher scores indicate higher level of independency in daily living activities. Scores between18-36 are classified as "maximal assistance required", between 37-72 as "moderate assistance required", and between 73-126 as "minimal supervision required". The Turkish version of FIM, for which validity and reliability studies are already available, was used in the present study (12).

Trunk Impairment Scale (TIS): It assesses static and dynamic sitting balance and trunk coordination. Developed by Geert Verheyden (2003) to evaluate motor impairment of the trunk after stroke, TIS can be used in many neurological diseases such as Parkinson, multiple sclerosis, and cerebral palsy (13-15). The validity and reliability of the Turkish version has been demonstrated by Sağ et al (3) The first 3 items on the scale evaluate static sitting balance, the next 10 items assess dynamic sitting balance, and the last 4 items evaluate coordination. Scores range from a minimum of 0 to a maximum of 23. During all evaluations, the individuals were seated on an examination table with their feet flat on the floor, and hips and knees at 90° flexion. Each scale item was repeated 3 times and the best performance was recorded as the final score (17).

World Health Organization Quality of Life Instrument for People with Intellectual and Physical Disabilities (WHOQOL-DIS): With a total of 39 questions, this scale consists of two parts: 1) WHOQOL-BREF (26 questions): including Physical, Psychological, Social relations, and Environmental health subscales, and 2) WHOQOL-DIS disability module (13 questions): including 'discrimination and support', 'autonomy/independence', and 'community participation' sub-dimensions. Although the disability module consists of 13 questions, the first question of this module is a screening question and

is not included in scoring. The questions are scored on a scale of 1 to 5, and higher scores indicate higher quality of life. We used the Turkish version of the WHOQOL-DIS to assess QoL of our participants (18).

Statistical analysis

IBM SPSS Statistics 22.0 (SPSS Statistics for Windows, version 22.0, IBM Corp. Armonk, NY/USA) was used for statistical analyses. G*Power 3.1.9.2 program was used for power analysis.

Numerical variables conforming to the normal distribution were expressed as mean ± standard deviation and ordinal variables in percentages (%). Student t test was used for the comparison of two groups for normally distributed data, while Mann Whitney-U test was used for non-normally distributed groups. While making comparisons according to the type of sport performed, the F test was used for data showing normal distribution, while the Kruskal Wallis-H test was used for data not showing normal distribution. The results of multiple regression analysis performed to examine the effect of the type of sport and the functional level of individuals on the quality of life.

According to the results of the G*Power analysis to determining the sample size, for statistical power of 0.80, significance level of 0.05, and effect size of 0.80 in the two-tailed t test for independent groups, a total of 78 participants (26 people per group) was required. Within the scope of the independent samples t-test applied for the WHOQOL-DIS scores, the effect value was calculated as approximately 0.362. According to the power values, with a total of 36 observations in the study, test power would be 62%. Using the TIS scores, it was concluded that a test power of 70% could be obtained with 33 observations.

RESULTS

Demographic data of the participants (n=36) was as follows: Gender: 7 females and 29 males, mean age: 31.57±10.15 years, and BMI: 24.80±4.60 kg/m2. The non-ambulatory ages of the groups NS, B, WCB were 4.68±6.36, 4.56±6.15, 6.81±10.56,

Table 1. Participants' Age and BMI in Relation with The Type of Sports

State of Sportiveness and Type of Sports			
Variables	**Non-Sportive X±Sd**	**Boccia X±Sd**	**Wheelchair Basketball X±Sd**
Height (cm)	159.36±44.63	165.78±10.54	162.62±13.02
Weight (kg)	78.80±15.90	61.88±13.24	60.00±11.74
Age of non-ambulation (y)	4.68±6.36	4.56±6.15	6.81±10.56
Age of start sports (y)	-	22.78±8.63	15.75±4.10
Period of doing sports(y)	-	4.22±0.97	9.58±5.62

State of Sportiveness			
	Non-Sportive (n=19)	**Sportive (n=17)**	**p**
	X±Sd	**X±Sd**	
BMI (kg/m²)	27.42±4.21	22.49±3.68	**0.001***
Age (y)	34.50±11.81	28.47±7.14	0.790

Type of Sports				
	Non-Sportive (n=19)	**Boccia (n=9)**	**Wheelchair Basketball (n=8)**	**p**
	X±Sd	**X±Sd**	**X±Sd**	
BMI (kg/m²)	27.42±4.21[b]	22.36±3.61[a]	22.65±4.01[a]	**0.006***
Age (y)	34.50±11.81	29.44±8.52	27.38±5.58	0.199

*p<0.05. X±Sd=mean±standart deviation, BMI: Body Mass Index, Student t test (for the comparison of two groups) , F:F-test (Analysis of variance). a. and b. stands for indicating significant difference between the means defined by different letters in the same line (p < 0.05).

Table 2. Comparison of Participants' Trunk Impairment, Functional Independence, Mobility, and Quality of Life in Relation with State of Sportiveness and The Type of Sports

Variables	State of Sportiveness			Type of Sports			
	Non-Sportive X±Sd	Sportive X±Sd	p	Non-Sportive X±Sd	Boccia X±Sd	Wheelchair Basketball X±Sd	p
RMI	9.11±3.36	6.00±4.60	0.026**	9.11±3.36[a]	3.44±3.43[b]	8.88±4.12[ab]	0.005*
FIM-Motor Functions	76.84±15.98	65.53±24.86	0.285	76.84±15.98[a]	52.11±26.05[b]	80.63±12.06[a]	0.033*
FIM-Cognitive Functions	34.11±7.76	34.35±2.67	0.639	34.10±7.76	33.78±3.67	35.00±0.00	0.620
FIM-Total Score	110.42±15.38	100.65±27.13	0.471	110.42±15.38[b]	85.11±26.22[a]	118.13±15.41[b]	0.002*
TIS- Static Sitting Balance	5.69±1.66	4.53±2.45	0.217	5.69±1.66	4.11±2.62	5.00±2.33	0.269
TIS- Dynamic Sitting Balance	6.44±2.80	5.76±3.91	0.576	6.44±2.80	3.89±4.11	7.88±2.47	0.074
TIS - Co-ordination	3.06±1.77	4.12±2.18	0.118	3.06±1.77[a]	2.89±2.03[a]	5.50±1.41[b]	0.008*
TIS –Total Score	15.37±4.34	14.29±7.34	0.608	15.36±4.33[ab]	11.00±7.58[a]	18.00±5.26[b]	0.044*
WHOQOL - Physical health	66.16±16.30	67.44±18.07	0.731	66.17±16.30	62.70±22.24	72.77±10.96	0.581
WHOQOL- Psychological	68.64±16.75	73.53±19.98	0.232	68.64±16.75	75.00±11.41	71.88±27.53	0.463
WHOQOL- Social relationships	75.66±11.48	77.45±19.49	0.415	75.66±11.48	75.93±24.45	79.17±13.36	0.866
WHOQOL-Environment	74.51±15.21	68.75±14.41	0.253	74.51±15.21	67.01±17.34	70.70±11.07	0.463
WHOQOLDIS - Discrimination	42.11±23.92	40.44±18.37	0.818	42.11±23.92	29.17±15.63	53.13±12.05	0.061
WHOQOLDIS -Autonomy	65.13±18.55	59.93±15.79	0.374	65.13±18.55	60.42±11.69	59.38±20.32	0.673
WHOQOLDIS - Community	71.49±11.64	69.85±24.76	0.731	71.49±11.64	61.11±29.02	79.69±15.18	0.119
WHOQOLDIS –Total Score	62.85±7.75	59.96±13.99	0.456	62.85±7.75[ab]	53.21±14.55[a]	67.55±8.99[b]	0.016*

*p<0.05. X±Sd=mean±standart deviation, RMI: Rivermead Mobility Index, FIM: Functional Independency Measurement, TIS: Trunk Impairment Scale, WHOQOL-DIS: The World Health Organization Quality of Life Instrument for Physically and Intellectually - Disabled Individuals U: Mann whitney U test (for variables that do not show a normal distribution)..t: Student t test, KW:Kuruskal Wallis-H test (for variables that do not show a normal distribution). F:F-test (Analysis of variance). a. b. and c stands for indicating significant difference between the means defined by different letters in the same line (p < 0.05).

respectively. The NS group has never done sport regularly. The Boccia group was playing the game for 4.22±0.9 years and the WCB group was playing wheelchair basketball for an average of 9.57±5.6 years. The age of starting the sport was 22.77±8.6 and 15.75±4.06 years for the boccia and basketball players, respectively (Table 1).

The age and BMI values of the participants are given in Table 1. The groups were similar in terms of their mean age (p=0.790). Compared to the sports groups, the NS group had higher BMI values and was in the pre-obesity category, whereas B and WCB groups were similarly in normal weight category (p=0.006).All comparisons of the participants are shown in Table 2. The mobility level and motor functional in group B had lower than both NS and WCB groups (RMI, FIM-Motor Functions, respectively; p=0.005, 0.033). Although there was no difference between the FIM total scores of the NS and S groups (p=0.471), FIM motor functions were higher in the WCB and NS groups than B group. In terms of FIM-Cognitive functions, there was no difference between the groups (p=0.062). However, FIM-Total score differed according to the type of sport (p=0.002). FIM-Total score of group B was lower than both NS and WCB groups (p=0.002), (Table 2).

There was no difference between the groups in TIS-S and TIS-D scores (p=0.269; p=0.074 respectively, Table2). However, TIS-C scores were different depending on the type of sport (p=0.008). The TIS-C mean score of the WCB group was higher than both NS and B groups The TIS-Total scores also differed according to the type of sport (p=0.044). The TIS-Total mean score of group B was similar to the NS but lower than the WCB group (Table 2).

Regarding WHOQOL results, there was no difference between the groups in the WHOQOL-BREF subscale (physical, psychological, social relations, and environmental) and the WHOQOL-DIS disability module (discrimination, autonomy, community) (p = 0.581; 0.483; 0.866; 0.463; 0.061; 0.673; 0.119, respectively). The WHOQOL-DIS total score varied according to the type of sport (p=0.016), and this difference was due to the lower quality of life in

group B than WCB.

The results of multiple regression analysis performed to examine the effect of the type of sport and the functional level of individuals on the quality of life were found to be statistically insignificant ($p>0.05$).

DISCUSSION

It is known that sports or recreational activities support the physical, psychological, social, and economic well-being of persons with disabilities, while inactivity poses many health risks such as musculoskeletal conditions, weight problems, personality disorders, and depression (19-21). Studies have also shown that individuals with physical disabilities can reduce these inactivity-related risks by exercising regularly (20-22). We observed that while BMI values of B and WCB group were in normal weight range, the NS group was at the pre-obesity level and thus, exposed to health risks associated with obesity. This highlights the importance of sports and physical activity on weight control.

Individuals in group B had lower mobility, and functional independency than the WCB and NS groups. As an important component of functionality, mobility is the ability to move from one position to another. Mobility impairments limit daily living and transfer activities. Many factors affect functional mobility, including spasticity, limitation in normal range of joint movement, loss of selective motor control, and loss of gross motor functions (23). Individuals with severe physical disabilities can play Boccia (24). Indeed, our participants in group B had severe physical disabilities and the lowest levels of mobility and independent functionality, as indicated by their RMI and FIM values. However, based on FIM classification criteria, our B group can be classified in "low disability" level (FIM≥73). Despite their low level of mobility, our Boccia players were as functional as the participants in other groups. This shows the effectiveness of Boccia on the functional independence of individuals with physical disabilities. Similarly, many studies have reported increased FIM scores in individuals who do sports. In their study with 60 paraplegic sportsmen, Porto et al. (2016) reported that sports can improve functional independence (25). In female athletes, Saltan et al reported a direct relationship between sportive skills and independence in daily life (26).

Although there was no difference between the groups in terms of trunk evaluation results, sitting balance was numerically lower in the NS group. Based on the TIS-C results, the WCB group had the highest and NS group had the lowest level of coordination. Although there was no statistical difference between the static and dynamic body results of the groups (TIS-D score of group B is half of other groups), the fact that coordination was higher in the WCB group can be due to the effect of basketball on improving coordination. It has been shown that in individuals with physical disabilities, sports help increase endurance, strength, speed, aerobic and cardiopulmonary capacity, and improves coordination, balance and mobilization skills (27-30). Boccia and basketball require controlled movements and precise coordination in the upper limbs. In these sports, the ability to throw a ball necessitates wrist, elbow, and shoulder movements, trunk stabilization, and eye-hand and head coordination (31-33). This explains the high coordination level in the two sportive groups of our study. The fact that coordination scores were lower in group B than WCB, is associated with the higher levels of physical disabilities in individuals in group B. Dynamic balance scores of Boccia players were way below compared to the scores of the NS and WCB groups. Boccia players had higher levels of physical disability and 5 of them used assistive devices to play the game. The low coordination results in group B seem to be related to their higher physical disability levels. WCB is a sport that requires and improves upper limb and trunk control. Although trunk and functional independence results of the WCB and NS groups were similar, the fact that basketball players had the highest scores is due to the physical skill-enhancing effects of WCB. This difference can be clearly seen in TIS-Coordination results. According to a previous study, individuals with physical disabilities who play basketball are more independent in daily life in terms of mobility, have higher social participation levels, and higher quality of life compared to those who do not play any sports (34).

In our study, there was no difference between the groups in the WHOQOL-BREF scores; however,

group B had the highest score in the psychological domain. Individuals with all kinds and levels of disability can actively play Boccia. Even if players have low physical capacity, they can actively participate in the game by using different compensatory mechanisms or physical assists. For these reasons, Boccia is preferred by individuals with severe locomotor dysfunction due to neurological disorders, musculoskeletal disorders, and limb deformities (International Paralympic Committee 2015). Although Group B had the lowest mobility and functional independence, the group's quality of life was similar to that of other groups, even the highest in the psychological domain. This clearly indicates the positive effect of sports on social participation and life perception. Similarly, in the WHOQOL-DIS module, there were no differences between the groups in any of the sub-dimensions, again suggesting that the quality of life in Group B was similar to that of Group NS despite being more severely disabled. Team sports -such as Boccia- strengthen an individual's sense of belongingness, provide opportunities for friendship and socialization, and increase self-esteem and confidence (35). Therefore, the quality of life of the individuals in group B is similar to the NS group despite their severe physical disability, and they are even at the highest level in the psychological subscale. Similarly, in the study conducted by Safania and Mokhtari on 240 disabled individuals, physically active disabled individuals had better physical and psychological health and WHOQOL (environmental and social dimension) scores compared to nonactive persons (36). In this context, our findings are in line with the relevant literature.

Our study makes a different contribution to the literature in terms of comparing group B individuals with low mobility and motor function to individuals with higher functionality. When we examine the groups in terms of the sub-dimensions of quality of life, we see that group B has the lowest scores in the sub-dimensions of physical health, environment and discrimination, which are mostly related to the physical disability dimension. On the other hand it has the highest psychological score. In terms of social relationships and autonomy, it is in the middle level among the groups. B is a sport that can be done even in the most severe physical handicap situations since there is no physical performance prerequisite for participation and physical disability can be compensated under all circumstances. Therefore, it is not always expected that B improves the physical health of the players. However, it increases the quality of life of the individual with its cognitive, psychological and social effects (19,20,35,37). The fact that group B had high results in terms of psychological and social relations in our study shows exactly this situation. Group B has similar quality of life as individuals with better physical functionality. The difference in total scores seems to be related to physical health and its related sub-dimensions. Possibly, the low number of our data prevented this result from being clearly demonstrated. This is an important limitation of our study. Another limitation is that the physical activity levels of the participants were not evaluated.

The inability to find significant results in the regression analysis performed to measure the effect of sports or physical disability on quality of life may also be due to similar factors. In addition to its social and psychological effects, WCB has positive effects on physical health (strength, endurance, cardiopulmonary performance, etc.) because it is an aerobic sport (22,26). B is a strategy and group game. The contributions of both types of sports to the quality of life are different from each other. The NS group, on the other hand, consists of individuals with a higher level of mobility, even if they are not doing sports. For this reason, it is an expected result that they have higher physical activity. The contribution of this study to the literature is to show that sports or recreational activities can affect the quality of life of individuals, even at low mobility and functionality levels. In order to reveal this situation with more precise results, it is recommended to compare groups with the same mobility and motor functionality at a larger sample level in future studies.

Contributorship Information: Concept development (provided idea for the research): M.Y.G., C.A; Design (planned the methods to generate the results): M.Y.G., C.A.Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript): M.Y.G., A.K; Data collection/processing (responsible for experiments, pa-

tient management, organization, or reporting data): M.Y.G., A.K; Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): H.K; Literature search (performed the literature search): M.Y.G., A.K; Writing (responsible for writing a substantive part of the manuscript): M.Y.G., A.K; Critical review (revised manuscript for intellectual content, this does not relate to spelling and grammar checking): M.Y.G, A.K., H.K.

Conflict Of Interest: There is no conflict of interests.

Acknowledgments: We would like to thank Azime Nur Okal, Ayşenur Korkmaz, Şerife Şeyda Aydemir, Özge Aksak and Yusuf Kılınç from Nuh Naci Yazgan University students for their support.

Financial Support/ Funding: No funding was received for this study.

Informed Consent: Informed verbal and written consent was obtained from all participants before the study.

Ethics approval: The study was approved by Approved by the Erciyes University Non-Invasive Research Ethics Committee (Approval date and number: 2020/71).

Peer Review: Evaluated by external independent reviewers.

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