MCBU SBED
MANİSA CELAL BAYAR ÜNİVERSİTESİ SAĞLIK BİLİMLERİ ENSTİTÜSÜ DERGİSİ
MANISA CELAL BAYAR UNIVERSITY JOURNAL OF INSTITUTE OF HEALTH SCIENCE
ISSN: 2147-9607
ARAŞTIRMA MAKALESİ
RESEARCH ARTICLE
CBU-SBED, 2024, 11 (4): 656-662

The Relationship among Pain Perception, Severity of Temporomandibular Disorders, and Spinal Health in Older Adults: Cross-sectional Study

Yaşlı Erişkinlerde Ağrı Algısı, Temporomandibular Bozuklukların Şiddeti ve Omurga Sağlığı Arasındaki İlişki: Kesitsel Çalışma

Halime Arıkan[1], Meral Sertel[2], Zuhal Şevval Gökdere[3]

[1]Tokat Gaziosmanpaşa Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü Tokat/Türkiye
[2]Bursa Uludağ Üniversitesi, Sağlık Bilimleri Fakültesi, Fizyoterapi ve Rehabilitasyon Bölümü Bursa/Türkiye
[3]Gazi Üniversitesi, Sağlık Bilimleri Enstitüsü, Fizyoterapi ve Rehabilitasyon Anabilim Dalı Ankara/Türkiye

halimearikan92@gmail.com, fzt_meralaksehir@hotmail.com, zuhalgokderee@gmail.com
ORCID: 0000-0003-2381-9978
ORCID: 0000-0002-7575-9762
ORCID: 0000-0003-0216-5688

*Sorumlu Yazar / Corresponding Author: Halime Arıkan
Gönderim Tarihi / Received:19.07.2024
Kabul Tarihi / Accepted: 10.09.2024
DOI: 10.34087/cbusbed.1519013.

Öz

Giriş ve Amaç: Bu çalışmada, yaşlı bireylerde ağrı algısı, temporomandibular bozuklukların şiddeti ve omurga fonksiyonelliği ile bunlar arasındaki ilişkiyi belirlemek amaçlanmıştır.
Gereç ve Yöntemler: Çalışmaya ortalama yaşı 71,57±6,30 yıl (65-95 arası) olan toplam 301 birey (177 kadın ve 124 erkek) katıldı. Kas-iskelet ağrısı (KİA), boyun ağrısı (BA) ve bel ağrısı (BeA) ayrı ayrı değerlendirilirken, ağrı algısı, rahatsızlığa tolerans, omurga fonksiyonel durumu ve temporomandibular bozuklukların şiddeti de değerlendirildi. Bu değerlendirmeler sırasıyla Sayısal Derecelendirme Ölçeği (SDÖ), Ağrıyı Merkezleştirme Ölçeği (AMÖ), Rahatsızlığa İntolerans Testi (RİT), Omurga Fonksiyon İndeksi (OFİ) ve Fonseca Anamnestik İndeks (FAİ) kullanılarak yapıldı. Parametreler arasındaki ilişkiler Pearson korelasyon analizi ile incelendi ve cinsiyetler arasındaki farklar Çok Değişkenli Kovaryans Analizi kullanılarak değerlendirildi.
Bulgular: KİA ile BA (0.518) ve BeA (0.520) arasındaki ilişki ve OFİ ile AMÖ (-0.593) arasındaki ilişki orta ila iyi düzeydeydi. KİA ile AMÖ (0.485), OFİ (-0.372) ve FAİ (0.332) arasındaki ilişki; BA ile BeA (0.495) ve FAİ (0.453) arasındaki ilişki; BeA ile AMÖ (0.412), OFİ (-0.409) ve FAİ (0.366) arasındaki ilişki ve FAİ ile AMÖ (0.377) ve OFİ (-0.352) arasındaki ilişki düşük ila zayıf düzeydeydi. Kadın ve erkek bireyler arasında Mini Mental Test, KİA, BA, BeA, AMÖ, RİT, OFİ ve FAİ skorları açısından farklılıklar gözlendi ($p < 0.05$).
Sonuç: KİA'nın, BA ve BeA artışıyla birlikte artabileceği ve ağrı algısının artmasıyla omurga fonksiyonelliğinin azalabileceği dikkate alınmalıdır.

Anahtar kelimeler: Yaşlı yetişkinler, Bel, Boyun, Omurga, Temporomandibular bozukluklar

Abstract

Aim; It was aimed to determine pain perception, temporomandibular disorders (TMD) severity, and spine functionality and the relationship between them in older adults.
Method; A total of 301 individuals (177 women and 124 men) with an average age of 71.57±6.30 years (range 65-95) participated in the study. Musculoskeletal pain (MP), neck pain (NP), and low back pain (LBP) severities were each assessed separately, along with pain perception, tolerance to discomfort, spinal functional status, and temporomandibular disorders severity. These were measured using the Numeric Rating Scale (NRS), Centrality

of Pain Scale (COPS), Discomfort Intolerance Test (DIT), Spine Functional Index (SFI), and Fonseca Anamnestic Index (FAI), respectively. Relationships between parameters were analyzed with Pearson correlation analysis, and gender differences were examined using Multivariate Analysis of Covariance.
Results; The relationship between MP with NP (0.518) and LBP (0.520) and between SFI with COPS (-0.593) was moderate to good. The relationship between MP with COPS (0.485), SFI (-0.372), FAI (0.332); and between NP with LBP (0.495) and FAI (0.453); between LBP with COPS (0.412), SFI (-0.409) and FAI (0.366); and between FAI with COPS (0.377) and SFI (-0.352) was low to fair. Differences were observed between female and male individuals in terms of Mini Mental Test, MP, NP, LBP, COPS, DIT, SFI, and FAI scores (p< 0.05).
Conclusion; It should be taken into consideration that MP may increase with the increase in NP and LBP, and spinal functionality may decrease with the increase in pain perception.

Keywords: Older adults, Low back, Neck, Spine, Temporomandibular disorders

1. Introduction

Persistent musculoskeletal pain is prevalent among older adults, with a prevalence ranging from 40% to 60% [1]. Multisite pain serves as a significant contributing factor to disability in this demographic [2]. Persistent or chronic pain is characterized by its duration, extending beyond the usual healing time, typically lasting more than 3 to 6 months. The prevalence of persistent musculoskeletal pain in older adults is substantial, leading to considerable disability and resulting in economic costs for both the individual and society [3]. A systematic review of 28 studies revealed that the prevalence of chronic low back pain exhibits a progressive increase from the third decade of life until the age of 60 [4]. In older adults suffering from chronic low back pain, it is common to observe concurrent multiple joint pains affecting the neck, hips, and/or knees, alongside degenerative radiological changes (e.g., disc space narrowing and osteophytes), as well as psychological issues (e.g., depression and anxiety) [5, 6]. Chronic neck pain, yet another musculoskeletal issue that escalates with age, is associated with risk factors encompassing psychosocial, physical, and neurophysiological aspects [7, 8].

During the aging process, the temporomandibular joint (TMJ), being the only movable joint in the skull, may undergo increased loading [9]. In order for the TMJ to function optimally, there must be a perfect harmony between dental occlusion and neuromuscular balance [9, 10]. Factors such as parafunctional habits, insufficient occlusion, and tooth loss, prevalent among older adults, can lead to temporomandibular disorders (TMD). TMD encompasses a range of disorders characterized by functional and structural changes within the stomatognathic system, affecting the joints, muscles, or both [11].

Patients exhibit diverse experiences of pain, encompassing the physical perception of pain, emotional status and responses to pain, capacity to manage pain, as well as the patient's personal beliefs regarding pain and its natüre [3]. This can also influence the interrelationships between musculoskeletal pains. In the literature, studies examining the correlation between ear fullness, ear pain, and TMD [12], the prevalence of TMD [13], signs and symptoms of TMD [11], as well as the association between TMD, cervical spine degeneration, head and neck posture, masticatory, and myofascial pain in cervical muscles [14] are available for older adults. Nevertheless, no study has been identified that evaluates the correlation among pain perception, TMD severity, and spinal health in older adults. Consequently, the objective of this study was to investigate the relationship among these variables in the elderly population.

2. Materials and Methods

2.1. Individuals

This study was designed as a prospective and cross-sectional investigation. The study sample comprised older adults aged 65 years and above, residing in Tokat and Kırıkkale, who exhibited good cognitive status and volunteered to take part in the study. The research was carried out between August 1, 2023, and October 1, 2023. Individuals exhibiting any neurological, psychiatric, or cognitive impairment (such as memory impairment, difficulties in concentration, task completion, understanding, recall, following instructions, and problem-solving) were excluded from the study. Approval for the study was obtained from the Social and Human Sciences Research Ethics Committee of Tokat Gaziosmanpaşa University (Approval No: 13.27; Approval Date: August 15, 2023). According to the G*Power analysis conducted with α= 0.05, β= 0.80, an acceptable correlation coefficient of r= 0.70, and a negligible correlation coefficient of r= 0.20, a minimum of 16 individuals were deemed adequate to assess the relationship between the two parameters. Initially, a total of 96 participants were deemed sufficient for the study when evaluating the relationship among the six parameters. However, the study ultimately included 301 participants. In the post-hoc power analysis, with an acceptable correlation coefficient of r = 0.50 and a negligible correlation coefficient of r = 0.25, the power of the relationship between the two parameters was 87% for a sample size of 50 according to the G*Power analysis. The research was conducted in compliance with the principles outlined in the Declaration of

Helsinki. The study is registered on ClinicalTrials.gov (NCT06053008).

2.2. Instruments

During the evaluation of participants, scorable Patient Reported Outcome Measures (PROMs) were utilized instead of objective performance measurements. These PROMs offer both advantages and disadvantages. Benefits of using PROMs include fostering patient engagement, enhancing assessment tailored to individual needs, improving the quality of care, standardizing individual outcomes, and strengthening the relationship and trust between the individual and clinician. Additionally, PROMs facilitate goal-setting and facilitate discussions on sensitive issues. However, alongside these advantages, PROMs also present disadvantages. These include potential shifts in the focus of evaluations, inaccurate predictions of issues, the creation of unrealistic expectations and objectives, diminished patient-clinician interaction, a potential deficit in clinical information, and the lack of suitability for every patient [15]. Moreover, the utilization of PROMs in the assessment, particularly given the study's focus on older adults, can be regarded as a notable advantage of this investigation.

Mini-Mental Test (MMT): The Mini-Mental Test (MMT) was employed to quantitatively evaluate cognitive performance, comprising eleven items categorized into five main domains: orientation, registration of memory, attention and calculation, recall, and language. The total score ranges from 0 to 30 [16], with a minimum threshold of 24 points required. The Turkish version of the MMT, along with its validity and reliability, was conducted by Güngen et al.[17].

Numeric Rating Scale (NRS): Musculoskeletal pain, neck pain, and low back pain severities were individually evaluated using the Numerical Rating Scale (NRS), an 11-point measurement system ranging from 0 (no pain) to 10 (unbearable pain) [18]. Unlike neck and low back pain, total joint and muscle pain were assessed under the category of musculoskeletal pain.

The Centrality of Pain Scale (COPS): The concept of pain centralization, delineating the extent to which pain dominates an individual's life, was assessed using The Centrality of Pain Scale (COPS). This scale comprises 10 items, each rated on a 5-point Likert scale (1: strongly disagree, 2: disagree, 3: neither agree nor disagree, 4: agree, 5: strongly agree). Items 2, 4, and 9 are reverse-scored. The total score is derived from the sum of all item scores, with higher scores indicating a greater degree of 'central' pain. The scale ranges from a minimum score of 10 to a maximum score of 50 [19]. A validity and reliability study of its Turkish version was conducted [20].

Discomfort Intolerance Test (DIT): The assessment of tolerance to bodily discomfort and pain was conducted using the Discomfort Intolerance Test (DIT) developed by Schmidt et al. (2006). This scale comprises 7-point Likert-type questions, with response options ranging from 0 (not at all suitable for me) to 6 (completely suitable for me) [21]. A Turkish version of the scale, along with its validity and reliability study, is available [22].

Spine Functional Index (SFI): The Spine Functional Index (SFI) was developed to assess the impact of spine-related symptoms on functionality. This scale comprises 25 questions, each scored on a scale of 0-0.5-1. The total score is calculated as a percentage, with a higher score approaching 100% indicating normal spinal function [23]. A Turkish version of the scale, along with its validity and reliability study, has been established [24].

Fonseca Anamnestic Index (FAI): The presence and severity of TMD in individuals were assessed using the Fonseca Anamnestic Index (FAI). This index comprises 10 questions, each answered with 'Yes' (10 points), 'No' (0 points), or 'Sometimes' (5 points). The total score ranges from 0 to 60, with higher scores indicating greater severity of TMD [25]. The Turkish version of the FAI has been demonstrated to possess validity and reliability [26].

2.3. Statistical Analysis

Statistical Package for Social Sciences (SPSS) version 22.0 was used for statistical analysis. Statistical data were given as mean±standard deviation (X±SD), median, or percent (%). One-Sample Kolmogorov-Smirnov test was used to show the parametric or nonparametric distribution of the data. The relationship between the continuous variables was analyzed using Pearson correlation analysis. Correlation coefficients of ≤ 0.25, 0.25-0.50, 0.50-0.75, and ≥ 0.75 mean little or no relationship, low to fair, moderate to good and strong relationship, respectively [27, 28]. Differences between independent groups were examined with Multivariate Analysis of Covariance (MANCOVA). The statistical significance value was accepted as $p<0.05$.

3. Results and Discussion

3.1. Results

The study encompassed a total of 301 older adults, with a mean age of 71.56±6.30 years, consisting of 177 females and 124 males. Table 1 provides details regarding the demographic characteristics of the participants, cognitive status scores, as well as assessments of musculoskeletal pain severity, neck pain severity, low back pain severity, pain centralization, discomfort tolerance, spine functionality, and severity of TMD.

Table 1. Descriptive characteristics of individuals

	Mean±SD
Age (years)	71.57±6.30
Weight (kg)	77.73±13.48
Length (m)	1.64±0.09

BMI (kg/m^2)	28.84±5.23
MMT	25.91±2.32
MP	5.33±2.40
NP	4.04±2.65
LBP	5.29±2.84
COPS	28.99±8.46
DIT	20.05±5.14
SFI	49.21±24.91
FAI	30.03±17.28
	n (%)
Gender	
Female	177 (58.8)
Male	124 (41.2)
Marital status	
Single	50 (16.61)
Married	251 (83.39)
Education history	
Primary school	149 (49.50)
Middle school	37 (12.29)
High school	31 (10.30)
Associate degree	2 (0.67)
Bachelor degree or above	82 (27.24)
Smoking	
Yes	56 (18.61)
No	245 (81.39)
Alcohol use	
Yes	11 (3.66)
No	290 (96.34)

COPS: Centrality of Pain Scale; DIT: Discomfort Intolerance Test; FAI: Fonseca Anamnestic Index; LBP: Low back pain; MP: Musculoskeletal pain; NP: Neck pain; SD: Standard deviation; SFI: Spine Functional Index

The correlations among musculoskeletal pain severity, neck pain severity, low back pain severity, pain centralization, discomfort tolerance, spine functionality, and severity of TMD for all individuals are summarized in Table 2. These correlations ranged from low to good, with coefficients ranging from 0.145 to -0.593. Furthermore, the correlations among these variables were separately examined for male and female participants. In females, correlations ranged from low to good (-0.150 to -0.548), while in males, correlations also ranged from low to good (-0.188 to -0.579), as presented in Table 3.

Table 2. Pearson correlation coefficients among musculoskeletal pain severity, neck pain severity, low back pain severity, pain perception, tolerance to bodily discomfort, spine-related symptoms on functionality and presence and severity of TMD (r/ p)

	MP	NP	LBP	COPS	DIT	SFI
NP	**0.518/ <0.001**					
LBP	**0.520/ <0.001**	**0.495/ <0.001**				
COPS	**0.485/ <0.001**	**0.274/ <0.001**	**0.412/ <0.001**			
DIT	**-0.146/ 0.011**	-0.046/ 0.428	**-0.153/ 0.008**	**-0.190/ 0.001**		
SFI	**-0.372/ <0.001**	**-0.236/ <0.001**	**-0.409/ <0.001**	**-0.593/ <0.001**	**0.145/ 0.012**	
FAI	**0.332/ <0.001**	**0.453/ <0.001**	**0.366/ <0.001**	**0.377/ <0.001**	**-0.118/ 0.041**	**-0.352/ <0.001**

COPS: Centrality of Pain Scale; DIT: Discomfort Intolerance Test; FAI: Fonseca Anamnestic Index; LBP: Low back pain; MP: Musculoskeletal pain; NP: Neck pain; SFI: Spine Functional Index

Table 3. Pearson correlation coefficients among musculoskeletal pain severity, neck and low back pain severities, pain perception, bodily discomfort tolerance, spine-related symptoms, and TMD severity in both genders (r/ p)

Female (n= 177)	MP	NP	LBP	COPS	DIT	SFI
NP	**0.485/ <0.001**					
LBP	**0.524/ <0.001**	**0.436/ <0.001**				
COPS	**0.485/ <0.001**	**0.267/ <0.001**	**0.393/ <0.001**			
DIT	-0.019/ 0.801	0.072/ 0.344	-0.093/ 0.217	**-0.150/ 0.047**		
SFI	**-0.362/ <0.001**	**-0.241/ 0.001**	**-0.419/ <0.001**	**-0.548/ <0.001**	0.037 / 0.622	
FAI	**0.222/ 0.003**	**0.395/ <0.001**	**0.288/ <0.001**	**0.298/ <0.001**	-0.074 / 0.325	**-0.326/ <0.001**
Male (n= 124)	**MP**	**NP**	**LBP**	**COPS**	**DIT**	**SFI**
NP	**0.501/ <0.001**					
LBP	**0.388/ <0.001**	**0.527/ <0.001**				
COPS	**0.340/ <0.001**	**0.179/ 0.047**	**0.315/ <0.001**			
DIT	**-0.188/ 0.037**	-0.148/ 0.101	-0.129/ 0.152	-0.127/ 0.159		
SFI	**-0.247/ 0.006**	-0.138/ 0.127	**-0.297/ 0.001**	**-0.579/ <0.001**	**0.195 / 0.030**	
FAI	**0.420/ <0.001**	**0.506/ <0.001**	**425/ <0.001**	**0.426/ <0.001**	-0.112 / 0.215	**-0.329/ <0.001**

COPS: Centrality of Pain Scale; DIT: Discomfort Intolerance Test; FAI: Fonseca Anamnestic Index; LBP: Low back pain; MP: Musculoskeletal pain; NP: Neck pain; SFI: Spine Functional Index

Differences were noted between female and male participants concerning cognitive status scores, musculoskeletal pain severity, neck pain severity, low back pain severity, pain centralization, discomfort tolerance, spine functionality, and severity of TMD. Females exhibited higher levels of musculoskeletal pain, neck pain, low back pain, pain centralization, and TMD severity, whereas males displayed higher levels of discomfort tolerance, spine functionality, and cognitive status scores, as presented in Table 4.

Table 4. Comparison of musculoskeletal pain severity, neck and low back pain severities, pain perception, bodily discomfort tolerance, spine-related symptoms, and TMD severity between genders using MANCOVA that controls for age with planned corrected post-hoc tests (Bonferroni)

	Female (n= 177) Mean±SD	Male (n= 124) Mean±SD	Mean differences (95% CIs) (between genders F-M)	Effect size (η_p^2)	p
MP	6.04±2.29	4.31±2.19	1.762	0.137	**<0.001**
NP	4.46±2.72	3.44±2.45	1.028	0.037	**0.001**
LBP	5.93±2.82	4.39±2.61	1.537	0.072	**<0.001**
COPS	31.08±8.02	26.00±8.20	5.154	0.094	**<0.001**
DIT	19.20±5.23	21.26±4.78	-2.098	0.041	**<0.001**
SFI	44.05±23.40	56.58±25.23	-12.752	0.066	**<0.001**
FAI	32.40±17.65	26.65±16.20	5.699	0.026	**0.005**
MMT	25.46±2.14	26.54±2.42	-1.091	0.055	**<0.001**

CIs: Confidence intervals; MP: Musculoskeletal pain; NP: Neck pain; LBP: Low back pain; COPS: Centrality of Pain Scale; DIT: Discomfort Intolerance Test; SFI: Spine Functional Index; F: Female; FAI: Fonseca Anamnestic Index; M: Male; MMT: Mini Mental Test; SD: Standard deviation; η_p^2: Partial eta squared (effect size)

3.2. Discussion

This study, examining the relationship among pain centralization, severity of TMD, and spinal functionality in older adults, revealed significant moderate to good correlations. Specifically, good correlations were observed between musculoskeletal pain and neck pain severities, musculoskeletal pain and low back pain severities, as well as between pain centralization and spinal functionality. Additionally, a low correlation was noted between TMD severity and the other parameters, except for discomfort tolerance. The investigation of these relationships within the older adult population represents a pioneering aspect of this study.

While there may exist a decrease in sensitivity to painful stimuli among older adults, it is crucial to recognize that this does not necessarily equate to a reduction in the perception of pain. In fact, expressions of pain among older adults may signify that the underlying condition causing the pain has progressed to a more severe stage, in comparison to younger individuals reporting similar levels of pain [29]. Hence, pain and its associated conditions hold significant importance. An expected good correlation exists between musculoskeletal pain severity, neck pain severity, and low back pain severity, considering the interconnected nature of these anatomical structures. Furthermore, the positive association noted between pain centralization, low back pain severity, and spinal functionality indicates a potential alteration in pain perception as it progresses to a chronic state. The noteworthy correlation between neck pain severity and severity of TMD may be attributed to the functional and biomechanical interrelation between the neck and temporomandibular joint. A study by Woo Hong et al. demonstrated a link between degenerative changes in the cervical spine, altered head postures, and the development of active myofascial trigger points in the craniocervical musculature among older adults with myofascial TMD [14]. Previous studies have indicated a higher prevalence of deformities in the masticatory muscles and articulating surfaces of the TMJ among older individuals. It has been reported that more than half of patients above the age of seventy present with severe joint deformities and atrophy in the clicking and masticatory muscles. Moreover, the risk of TMJ osteoarthritis significantly escalates in individuals aged 65 and above, a finding supported by radiographic evidence [30, 31].

The observed differences between male and female individuals regarding musculoskeletal pain severity, neck and low back pain severities, pain perception, discomfort tolerance, spine-related symptoms, and severity of TMD highlight the influence of gender on these parameters. These disparities may be attributed to a multitude of factors, including sensory mechanisms (such as impaired neuroplasticity or dysfunctional nociceptive pathways), behavioral components (such as variations in pain acceptance, levels of catastrophizing, and self-efficacy beliefs), social factors (such as access to social support), and hormonal influences (such as estrogen levels), all of which contribute to the modulation of pain perception among older adults [32]. Additionally, at this point, the importance of assessing body awareness, such as lumbar [33] and cervical awareness [34], should also be considered. Moreover, studies have documented a prevalence of low back pain among older adults ranging from 14% to 49%. Furthermore, numerous studies have consistently indicated that elderly women are at a heightened risk of experiencing low back pain compared to their male counterparts [31, 35].

The principal limitation of the study lies in its challenge to offer an extensive discussion owing to the scarcity of similar studies available.

Nevertheless, in an effort to mitigate this limitation, insights derived from clinical experience and practical observations were amalgamated with support from the existing literature. Additionally, while studies on the Turkish versions of the utilized outcome measures have been conducted, the absence of validity and reliability studies specifically targeting older adults stands as another potential limitation.

4. Conclusion

The findings of this study suggest that there may be a relationship between pain severity, pain perception, and spinal functionality in older adults, and that these factors could potentially influence each other. Furthermore, associations were observed between musculoskeletal pain severity, discomfort tolerance, and these parameters. Hence, it is imperative to conduct a comprehensive assessment of older adults encompassing factors such as physical activity, quality of life, functionality, pain severity, and pain perception. Additionally, the provision of requisite treatments and education concerning their musculoskeletal disorders remains paramount.

5. Acknowledgment

The authors are grateful to the individuals who participated in the study.

6. References

1. Dahlhamer, J, Prevalence of chronic pain and high-impact chronic pain among adults—United States, 2016, *MMWR Morbidity and Mortality Weekly Report* 2018, 67(36), 1001-1006.
2. Rundell, S.D., Patel, K.V., Krook, M.A., Heagerty, P.J., Suri, P, Friedly, J.L., Turner, J.A., Deyo, R.A., Bauer, Z, Nerenz, D.R., Avins, A.L., Nedeljkovic, S.S., Jarvik, J.G., Multi-site pain is associated with long-term patient-reported outcomes in older adults with persistent back pain. *Pain Medicine*, 2019, 20(10), 1898-1906.
3. Welsh, T.P., Yang, A.E., Makris, U.E., Musculoskeletal pain in older adults: a clinical review, *Medical Clinics of North America*, 2020, 104(5), 855-872.
4. Meucci, R.D., Fassa, A.G., Faria, N.M.X., Prevalence of chronic low back pain: systematic review, *Revista de Saúde Pública*, 2015, 49, 73.
5. Karp, J.F., DiNapoli, E.A., Wetherell, J., Bolon, C., Rodriguez, E., Shega, J., Weiner, D.K., Deconstructing chronic low back pain in the older adult—step by step evidence and expert-based recommendations for evaluation and treatment: Part IX: Anxiety, *Pain Medicine*, 2016, 17(8), 1423-1435.
6. Wong, C.K., Mak, R.Y., Kwok, T.S., Tsang, J.S., Leung, M.Y., Funabashi, M., Macedo, L.G., Dennett, L., Wong, A.Y. Prevalence, incidence, and factors associated with non-specific chronic low back pain in community-dwelling older adults aged 60 years and older: a systematic review and meta-analysis, *The Journal of Pain*, 2022, 23(4), 509-534.
7. Shahidi, B., Curran-Everett, D., Maluf, K.S., Psychosocial, physical, and neurophysiological risk factors for chronic neck pain: a prospective inception cohort study, *The Journal of Pain*, 2015, 16(12), 1288-1299.
8. Ünlüer, N.Ö., Ateş, Y., An investigation of neck pain in older adults, and its relation with shoulder position sense and upper extremity function, *Somatosensory & Motor Research*, 2021, 38(4), 333-338.
9. Lucena, L.O., Nascimento, C.M.M., Asano, N.M.J., Coriolano, M.G.W.S., Lins, C.C.S.A., Manual therapy for temporomandibular disorder in older adults: an integrative literature review, *Revista CEFAC*, 2022, 24, e9721.
10. Quinto, C.A., Classification and Treatment of Temporomandibular Disorder: What is the Role of Speech Therapy in the Treatment of These Disorders?, *Revista CEFAC*, 2000, 2(2), 15-22.
11. Nguyen, M.S., Jagomägi, T., Nguyen, T., Saag, M., Voog-Oras, Ü., Symptoms and signs of temporomandibular disorders among elderly Vietnamese, *Proceedings of Singapore Healthcare*, 2017;26(4):211-216.
12. Macedo,J., Doi, M., Oltramari-Navarro, P.V., Gorres, V., Mendes, M.S., Silva, I.M., Navarro, R., Marchiori L.L., Association between ear fullness, earache, and temporomandibular joint disorders in the elderly. *International Archives of Otorhinolaryngology*, 2014, 18(4), 383-386.
13. Murrieta, J.F., Alvarado, E.L., Valdez, Orozco, L., Meza, J., Juárez, M.L., Prevalence of temporomandibular joint disorders in a Mexican elderly group, *Journal of Oral Research*, 2016, 5(1), 13-18.
14. Hong, S.W., Lee, J.K., Kang, J.H., Relationship among cervical spine degeneration, head and neck postures, and myofascial pain in masticatory and cervical muscles in elderly with temporomandibular disorder, *Archives of Gerontology and Geriatrics*, 2019, 81, 119-128.
15. Campbell, R., Ju, A., King, M.T., Rutherford, C., Perceived benefits and limitations of using patient-reported outcome measures in clinical practice with individual patients: a systematic review of qualitative studies, *Quality of Life Research*, 2022, 31(6), 1597-1620.
16. Folstein, M.F., Folstein, S.E., McHugh, P.R., "Mini-mental state": a practical method for grading the cognitive state of patients for the clinician, *Journal of Psychiatric Research*, 1975, 12(3), 189-198.
17. Güngen, C., Ertan, T., Eker, E., Yaşar, R., Engin, F., Reliability and Validity of The Standardized Mini Mental State Examination in The Diagnosis of Mild Dementia in Turkish Population, *Türk Psikiyatri Dergisi*, 2002, 13(4), 273-281.
18. Flaherty, S.A., Pain measurement tools for clinical practice and research, *The AANA Journal*, 1996, 64(2), 133-140.
19. Nicolaidis, C., Chianello, T., Gerrity, M., Development and preliminary psychometric testing of the centrality of pain scale, Pain Medicine, 2011, 12(4), 612-617.
20. Ozsoy-Unubol, T., Unal-Ulutatar, C., Cross-cultural adaptation and validation of the Turkish version of Centrality of Pain Scale in patients with fibromyalgia syndrome, *International Journal of Rheumatic Diseases*, 2020, 23(6), 772-777.
21. Schmidt, N.B., Richey, J.A., Fitzpatrick, K.K., Discomfort intolerance: Development of a construct and measure relevant to panic disorder, *Journal of Anxiety Disorders*, 2006, 20(3), 263-280.
22. Özdel, K., Yalçınkaya-Alkar, Ö., Taymur, İ., Türkçapar, M.H., Zamkı, E., Sargın, A.E., Discomfort Intolerance Scale: A Study of Reliability and Validity, *Bilişsel Davranışçı Psikoterapi ve Araştırmalar Dergisi*, 2012, 1(1), 52-58.
23. Gabel, C.P., Melloh, M., Burkett, B., Michener, L.A., The Spine Functional Index: development and clinimetric validation of a new whole-spine functional outcome measure, *The Spine Journal*, 2019, 19(2), e19-e27.
24. Tonga, E., Gabel, C.P., Karayazgan, S., Cuesta-Vargas, A.I., Cross-cultural adaptation, reliability and validity of the Turkish version of the spine functional index, *Health and Quality of Life Outcomes*, 2015, 13, 1-9.
25. Fonseca, D.M., Bonfante, G., Valle, A.L., Freitas, S.F.T., Diagnosis of the craniomandibular disfunction through anamnesis, *Revista Gaúcha de Odontologia (Porto Alegre)*, 1994, 42(1), 23-28.
26. Arikan, H., Citaker, S., Ucok, C., Psychometric properties of the Fonseca Anamnestic Index (FAI) for temporomandibular disorders: Turkish version,

responsiveness, reliability, and validity study, *Disability and Rehabilitation*, 2023, 46(7), 1408-1415.

27. Portney, L.G., Watkins, M.P., Correlation. In: Portney LG, Watkins MP, ed. Foundations of clinical research: application to practice. 3rd ed. Philadelphia FA Davis Co. 2015:525.
28. Portney, L.G., Correlation. In: Portney LG, ed. Foundations of clinical research: applications to evidence-based practice. 4th ed. Philadelphia FA Davis Co. 2020:430.
29. Molton, I.R., Terrill, A.L., Overview of persistent pain in older adults, *American Psychologist*, 2014, (2), 197-207.
30. Erzurumlu, Z.Ü., Çelenk, P., Effects of Aging on Temporomandibular Joint, *Türk Diş Hekimliği Araştırma Dergisi*, 2022, 1(2), 75-78.
31. Kalladka, M., Quek, S., Heir, G., Eliav, E., Mupparapu, M., Viswanath, A., Temporomandibular joint osteoarthritis: diagnosis and long-term conservative management: a topic review, *The Journal of Indian Prosthodontic Society*, 2014, 14(1), 6-15.
32. Dagnino, A., Campos, M.M., Chronic pain in the elderly: Mechanisms and perspectives, *Frontiers in Human Neuroscience*, 2022, 16, 736688.
33. Erol, E., Yildiz, A., Yildiz, R., Apaydin, U., Gokmen, D., Elbasan, B. Reliability and validity of the turkish version of the Fremantle back awareness questionnaire. *Spine*, 2019, 44(9), E549-E554.
34. Onan, D., Gokmen, D., Ulger, O. The Fremantle Neck Awareness Questionnaire in chronic neck pain patients: Turkish version, validity and reliability study. *Spine*, 2020, 45(3), E163-E169.
35. Yağcı, N., Cavlak, U., Baskan, E., Öztop, M., Low back pain risk among older adults, *Cukurova Medical Journal*, 2020, 45(2), 421-427.