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ORIGINAL ARTICLE / ARAŞTIRMA MAKALESİ

The Content of a Dental Mobile Application for Children from the Perspectives of Parents and Pre-School Teacher Trainees

Ebeveynler ve Okul Öncesi Öğretmen Adaylarının Perspektiflerinden Çocuklara Yönelik Dental Mobil Uygulama İçeriği

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ABSTRACT

Objective: The aim of this study was to describe the most desirable content of a dental application (dental app) for children from the perspectives of parents and preschool teacher trainees.

Materials and methods: In this cross-sectional study, 51 parents whose children (36-72 months) were students in a preschool educational institution and 99 preschool teacher trainees in the same institution were included. Data were collected by the structured questionnaire in the face-to-face interviews regarding the desirable content of the dental app. The ratios of 1st ranked of the most prominent content and videos were noted.

Results: In the study, *"List of institutions for oral and dental health services*" and *"Importance of regular dental examinations"* were observed to be important items for both (21,6%) and teacher trainees (24,2% and 19,2%) according to the scores of 1st ranked contents in a dental app. Moreover, the item "*Funny and educational games containing oral health*" for the video theme were 1st ranked item in the one-third of the parents (33,3 %).

Conclusion: In a dental app, list of dental services was the prominent item for both parents and preschool teacher trainees. Moreover, the use of educational and entertaining videos may help the improvement of children's oral health for them.

Keywords: Oral health, children, parents, preschool teacher trainees, dental app.

ÖZ

Amaç: Bu çalışmanın amacı, ebeveynler ve okul öncesi öğretmen adaylarının bakış açılarından çocuklar için bir diş hekimliği uygulamasında en çok istenen içeriği tanımlamaktır.

Gereç ve Yöntemler: Kesitsel tipte tanımlayıcı araştırmaya, çocukları (36-72 aylık) bir okul öncesi eğitim kurumunda öğrenci olan 51 ebeveyn ve aynı kurumdaki 99 okul öncesi öğretmen adayı dahil edilmiştir. Veriler, dental uygulamanın istenen içeriğine ilişkin yapılandırılmış anket formuyla yüz yüze görüşmelerle toplanmıştır. İçerik ve videolar için 1. sıradaki puanlama oranları dikkate alınmıştır.

Bulgular: Ağız ve diş sağlığı mobil uygulamasında istenilen içerikler için hem ebeveynlerin (%21,6) hem de okul öncesi öğretmen adaylarının (%24,2 ve %19,2) *"Ağız ve diş sağlığı hizmeti almak için başvurulabilecek kurumların listesi"* ve *"Düzenli diş hekimi muayenesinin önemi" maddelerini* öncelikli olarak belirttiği görülmüştür. Ayrıca, video temasındaki *"Oral sağlığa yönelik eğlenceli ve eğitici oyunlar"* maddesi ebeveynlerin (%33,3) üçte biri tarafından 1.sırada belirtilmiştir.

Sonuç: Ebeveynler ve okul öncesi öğretmen adayları perspektifinde, çocuklara yönelik dişhekimliği mobil uygulamalarında ağız ve diş sağlığı hizmeti veren kurumlar listesinin yer alması önerisi öne çıkan madde olmuştur. Ayrıca, eğitici ve eğlenceli videoların kullanılmasının çocukların oral sağlığının geliştirilmesine yardımcı olabileceği düşünülmüştür.

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Anahtar Kelimeler: Oral Sağlık, çocuklar, ebeveynler, okul öncesi öğretmen adayları, dental aplikasyon.

INTRODUCTION

Mobile applications, the delivery of health services via mobile communication devices (Jahan & Chowdhury, 2014; Bhuyan et al., 2016; Fernández-Luque & Bau, 2015), provide an important contribution to health promotion by increasing health literacy with their informative contents (Bhuyan et al., 2016; Ventola, 2014; Liu et al., 2011; Barton, 2012; Buhi et al., 2013). In this perspective, mobile applications for dentistry (dental apps) could provide information regarding oral health, oral hygiene applications, and emergency conditions (Djemal & Singh, 2016; Scheerman et al., 2018; Khehra et al., 2021; Kaczmarczyk et al., 2021). Therefore, well-designed dental apps could be an effective tool for the improvement of oral health (Tiffany et al., 2018). The use of dental apps in oral health education for children through school health projects could contribute to the improvement of oral health (Veiga et al., 2015; Abedi, 2019). Since the oral health of children is affected by the guidance of both their parents and their teachers (Veiga et al., 2015; Ozbek et al., 2015; Liontou et al., 2016; FDI World Dental Federation, 2014), parents' and teacher trainees' opinions and needs are important for the contents of a dental app. Therefore, the aim of this study was to define the desirable content of a dental app for improving oral health in children from parental and preschool teacher trainees' perspectives.

MATERIALS AND METHODS

In this cross-sectional study, 51 parents (F/M: 35/16; 38,92±4,94 years) whose children (36-72 months) were students of preschool education institution in Marmara University were included. These parents were academic staff or employees of the university. In addition, 4th grade students as teacher trainees (F/M: 88/11; 22,84±1,9) were also attended the study. They are students in Preschool Teacher Education Programme at Atatürk Faculty of Education in Marmara University. Data were collected with face-to-face interviews by using the structured questionnaire regarding the frequency of tooth brushing, duration to last dental visit, information sources for oral health, and opinions about dental treatments. In addition, parents and preschool teacher trainees ranked top priority subjects in content and videos of a dental app. It was asked to rank from 1 point (the most important) to 12 points (the least important) to find priorities of the contents and proper video content required to be in a dental app.

This study was approved by the Ethical Committee of Marmara University, Institute of Health Sciences (05.02.2018-42).

Statistical Analysis

Data were analysed by SPSS 26.0 (IBM, USA). Mann-Whitney U Test was used in the analysis due to the non-normal distribution of data. P-value < 0.05 was accepted as significant.

RESULTS

The profile of the study group was presented in Table 1. The mean age of the children was 59,76±8,81 months (36-72 months). As predicted, their parents were older (38,92±4,94) and had longer education period (18,90±4,57) than those of the teacher trainees (22,84±1,90 and 16,32±1,25, respectively) (p=0.000; p=0.003). The frequency of tooth brushing, the reason and duration for the last dental visit, dental fear, and self-reported oral health status were similar in both groups (p>0.05) (Table 1).

Table 1: The Profile of the Study Group

	Parents		**Preschool Teacher Trainees**		
	Mean± SD		**Mean± SD**		**p***
Age (years)	38,92±4,94		22,84±1,90		**0.000**
Education years	18,90±4,57		16,32±1,25		**0.003**
Frequency of daily tooth brushing	1,86±0,60		1,87±0,51		0.768
Last dental visit (years)	1,09±1,41		1,55±2,53		0.581
The ability to use mobile technology (0-100 points)	71,27±21,16		80,71±18,37		**0.007**
	n	**%**	**n**	**%**	**p****
Self-Reported Oral Health Status					
• Poor/moderate	33	64,7	50	50,5	0.13
• Good	18	35,3	49	49,5	
Reason for Last Dental Visit					
• Control	8	15,7	30	30,3	0.08
• Treatment	43	84,3	69	69,7	
Information Source for Oral Health	51	100,0	99	100,0	
Dentist					
• Yes	38	74,5	39	39,4	**0.000**
• No	13	25,5	60	60,6	

Internet					
• Yes	11	21,6	73	73,7	**0.000**
• No	40	78,4	26	26,3	
Dental Fear					
Fear of Dental Treatments					
• Yes	7	13,7	26	26,3	0.115
• No	44	86,3	72	72,7	
Fear of Tools Used in Dental Treatments					
• Yes	11	21,6	31	31,3	0.286
• No	40	78,4	68	68,7	
Fear of Anaesthesia in Dental Treatments					
• Yes	8	15,7	25	25,3	0.258
• No	43	84,3	74	74,7	

*Mann-Whitney U Test and **Chi-square test were used in the analysis

The information source for oral health was dentists for parents (74,5%) and the internet for preschool teacher trainees (73,7%) (p=0.000 for both). The score of ability for mobile technology use was higher in preschool teacher trainees (80,71±18,37) than parents (71,27±21,16) (p=0.007) (Table 1). In the group, 80,4% of the parents and 69,7% of the preschool teacher trainees would like to use a mobile health application recommended by dental healthcare institutions.

Desired Content of a Dental App

When items were listed according to scores of 1st ranked desired features in a dental app for the improvement of children's oral health, *"List of institutions for oral and dental health services*" (parents: 21,6%, teacher trainees: 24,2%) and *"Importance of regular dental examinations"* (21,6%, 19,2%) were observed to be the most important items for both groups (Table 2) (Figure 1). Also *"Nutritional recommendations for the protection of oral health"* was one of the 1st ranked features for both groups (9,8%, 9,1%) (Table 2).

The other 1st ranked items were "*Protection of oral health*" and "*Condition to consult a dentist*" in parents (13,7%). In preschool teacher trainees, *"Oral health problems and their treatments"* (17,2%), "*Planning dental visits*" (6,1%), and "*Common terms used during dental treatments*" (4%) were observed to be other desired features in a dental app (Table 2).

Table 2: The Ratio of 1st Ranked the Most Desirable Features in a Dental App for the Improvement of Oral Health in Children

		Parents		Preschool Teacher Trainees	
		n	%	n	%
	Content				
1.	List of institutions for oral and dental health services	11	21,6	24	24,2
2.	Importance of regular dental examinations	11	21,6	19	19,2
3.	Oral and dental health problems and their treatments	4	7,8	17	17,2
4.	Protection of oral health	7	13,7	9	9,1
5.	Conditions to consult a dentist	7	13,7	8	8,1
6.	Nutritional recommendations for the protection of oral health	5	9,8	9	9,1
7.	Planning dental visits	1	2	6	6,1
8.	Common terms used during dental treatments	0	0	4	4
Videos					
1.	Procedures in dental visits and examinations	7	13,7	23	23,2
2.	Funny and educational games containing oral health	17	33,3	11	11,1
3.	Preventive applications for oral health	7	13,7	20	20,2
4.	Nutritional recommendations for oral health	6	11,8	17	17,2
5.	Dealing with dental fear	6	11,8	9	9,1
6.	Funny and educational songs containing oral health	6	11,8	3	3
7.	3D animations about dental treatments	1	2	9	9,1

Desired Videos of a Dental App

One-third of the parents (33,3 %) were 1st ranked "*Funny and educational games containing oral health*". This was the most prominent item among video contents in the study (Table 2)(Figure 1).

Preschool teacher trainees' 1st ranked items were "*Procedures in dental visits and examinations*" (23,2%), "*Preventive applications for oral health*" (20,2%), and "*Nutritional recommendations for oral health*" (17,2%). Moreover "*Dealing with dental fear*" (11,8%) and "*Funny and educational songs containing oral health*" (11,8%) in parents and "*3D animation about dental treatment*" (9,1%) in preschool teacher trainees were 1st ranked in the group (Table 2)(Figure 1).

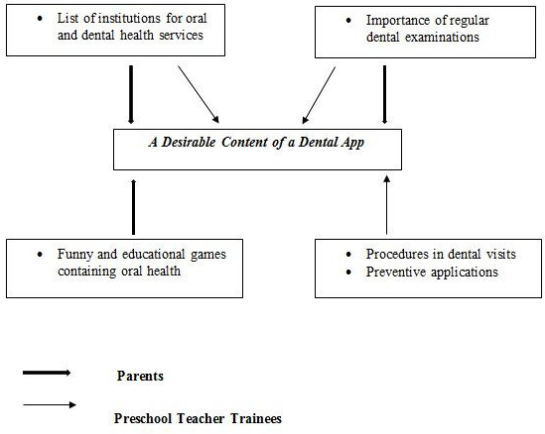

Figure 1: Prominent Desirable Features in a Dental App According to Parents and Preschool Teacher Trainees

DISCUSSION

Since the use of information and communication technologies are increasing in daily life, mobile apps are commonly used for health promotion (Bhuyan et al., 2016; Fernández-Luque & Bau, 2015; Ventola, 2014; Liu et al., 2011; Buhi et al., 2013; Kim & Xie, 2015). In the field of dentistry, dental apps are thought to have an important role in the improvement of oral health, oral health literacy, and oral hygiene habits (Khehra et al., 2021; FDI World Dental Federation, 2014). Since parents and preschool teacher trainees have critical roles in the improvement of the oral health of children (Veiga et al., 2015; Liontou et al., 2016; S Dhull K et al., 2018; Baltaci et al., 2019; Selvarajan et al., 2019; ElKarmi et al., 2019), the desirable content of a dental app was examined from the perspective of parents and preschool teacher trainees in the present study.

In a dental app related to oral and dental health, when looking at the content to be primarily desired; *"List of institutions for oral and dental health services"* and *"Importance of regular dental examinations"* of both parents and preschool teacher trainees were stated as the most priority content. Considering the role of parents and preschool teacher trainees who are effective in protecting the oral and dental health of children, it is expected to obtain information about health institutions in the process of benefiting from oral and dental health services. In addition, understanding the importance of regular examinations is important in terms of being one of the most critical factors in maintaining oral health.

Mobile apps in dentistry can contribute to the improvement of the oral health of children (Patil et al., 2017) because they help to decide the use of services for the children effectively (Iskander et al., 2016) and to overcome dental anxiety of children (Patil et al., 2017; Goldschmidt & Woolley, 2017). Since children could learn the procedure of dental examination with fun by using a dental app (Elicherla et al., 2019; Rasmus et al., 2021), the content of a dental app has a critical role in the utilization of dental services of children and the improvement of oral health literacy of individuals (Glick et al., 2012). For example, the information regarding dental injuries as emergency conditions could be provided to parents and educators by using a dental app (Djemal & Singh, 2016; Khehra et al., 2021).

When looking at the video content that is required to be in a dental app, it was seen that *"Funny and educational games for oral health"* had priority for parents. It is thought that the use of mobile applications containing information about medical applications will contribute positively to the process for children and parents (Voepel-Lewis, 2016; Tark et al., 2019). Oral health education videos are thought to be effective in terms of parents' guidance in protecting their children's oral health (Wilson et al., 2013). Gamification is also found to be an effective option for oral hygiene habits during orthodontic treatment (Scheerman et al., 2018). It was observed that learning by having fun with video content is a priority. In this perspective, tooth brushing could be fun by using a dental app (Rasmus et al., 2021; Aljafari et al., 2015). Similarly, children with asthma and their caregivers could improve their health information in a funny way by using a health application that is specific for asthma disease (Iio et al., 2020).

It was observed that the videos explaining the *"regular dental examination "* and *"preventive applications"* are important for the preschool teacher trainees. It is seen that preschool teacher trainees who are knowledgeable about this subject will be effective in regularly attending dental examinations of children and in raising awareness about protective practices. Due to the widespread use of technology in children's education, it is thought that a mobile application where information on preventive oral health practices can be transferred will provide positive contributions (Rasmus et al., 2021; McCloskey et al., 2018).

It is thought that preschool teacher trainees want to contribute to the oral health development of their students by learning about the importance of oral and dental health, preventive practices, and conditions that require treatment.

Innovative approaches to the delivery of preventive health services emerge with the development of technology (Ventola, 2014; Buhi et al., 2013; Khehra et al., 2021). Since children also come into close contact with technology, a well-designed dental app could be helpful for this purpose. For example, the diagnosis given by the Injured Tooth App is found to be in good agreement with the diagnosis given by health professionals (Mohan et al., 2018).

Another important result of this study was that the sources used to obtain information about oral and dental health are dentists for parents and the internet for preschool teacher trainees. Since preschool teacher trainees as young adults had high technology usage skills, these results could be expected (McCloskey et al., 2018). They prone to technology use the internet for getting information about health (Kim & Xie, 2015). It was expected that parents want to get information from the dentist with a more traditional approach.

CONCLUSION

The use of mobile apps in daily life is increasing day by day. In a dental app, utilisation of dental services was the prominent item for parents and preschool teacher trainees. Moreover, the use of a dental app that contains educational and entertaining videos under the supervision of parents and preschool teacher trainees may help the improvement of children's oral health.

Bullet Points

1. The content regarding the utilization of dental services is a priority for both parents and preschool teacher trainees in a dental app.
2. Videos containing funny and educational games are essential components of children health education from the perspective of parents.
3. Dentists are preferred by parents for getting information about oral health whereas preschool teacher trainees use the internet as a source of oral health information.

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Conflict of Interest Statement

The authors declare that there is no conflict of interest.

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ORIGINAL ARTICLE / ARAŞTIRMA MAKALESİ

Evre III Derece B Periodontitis Hastalarında Başlangıç Periodontal Tedavinin Tükürük IL-6 ve IL-17 Seviyelerine Etkisi

The Effect of Initial Periodontal Treatment on Salivary IL-6 and IL-17 Levels in Stage 3 Grade B Periodontitis Patients

Bahadır KIRALİ, Kübra KUNDAK, Başak DOĞAN, Leyla KURU

ÖZ

Amaç: Bu çalışmada Evre III Derece B periodontitis hastalarında başlangıç periodontal tedavinin klinik parametreler ve tükürük interlökin (IL)-6 ve IL-17 seviyelerine etkisini belirlemek amaçlandı.

Gereç ve Yöntemler: Çalışma popülasyonunu sistemik sağlıklı olan 10 periodontal sağlıklı ve 10 Evre III Derece B periodontitisli olmak üzere 20 katılımcı oluşturdu. Periodontitis grubuna 4 seans başlangıç periodontal tedavi uygulandı. Tüm ağız plak indeks, gingival indeks, sondalama derinliği, sondalamada kanama ve klinik ataşman seviyesi tedavi öncesi ve 3 ay sonrası kaydedildi. Periodontitisli gruptan tedavi öncesi ve sonrası 3. ayda olmak üzere 2 kez, sağlıklı gruptan ise 1 kez tükürük örnekleri alındı. Bu örneklerdeki IL-6 ve IL-17 seviyeleri *sandwich Enzyme-Linked Immunosorbent Assay* (ELISA) yöntemi ile tespit edildi.

Bulgular: Evre III Derece B periodontitis hastalarının başlangıç klinik parametreleri sağlıklı gruba göre istatistiksel anlamlı yüksek bulundu ($p<0,05$). Periodontitisli hastaların tedavi sonrası tüm parametrelerinde istatistiksel olarak anlamlı azalma görüldü ($p<0,05$). Periodontitisli hastaların başlangıç tükürük IL-6 ve IL-17 seviyeleri sağlıklı gruba göre anlamlı derecede yüksek ($p<0,05$) tespit edilirken, tedavi sonrasında her iki biyobelirteç seviyesinde anlamlı azalma görüldü ($p<0,05$).

Sonuç: Periodontitis hastalarında sağlıklı bireylere göre yüksek tespit edilen tükürük IL-6 ve IL-17 seviyesinin başlangıç periodontal tedavinin olumlu etkisiyle azalması, bu pro-enflamatuvar sitokinlerin başlangıç periodontal tedavi başarısını ortaya koyan biyobelirteçler olarak kullanılabileceğini düşündürmektedir.

Anahtar Kelimeler: IL-6, IL-17, periodontitis, tükürük

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ABSTRACT

Objective: The aim of this study is to establish the effect of initial periodontal treatment on salivary interleukin (IL)-6 and IL-17 levels in Stage III Grade B periodontitis patients.

Materials and Methods: The study population consisted of systemically healthy, 10 periodontally healthy and 10 Stage III Grade B periodontitis individuals. Four sessions of initial periodontal treatment was performed to periodontitis patients. Plaque index, gingival index, probing depth, bleeding on probing and clinical attachment levels were recorded before and 3 months after the treatment. Saliva samples were collected before and 3 months after treatment from periodontitis patients and once from healthy group. Salivary IL-6 and IL-17 levels were determined by ELISA.

Results: At the beginning all clinical parameters were statistically higher in periodontitis group than the healthy group ($p<0,05$). All of the clinical parameters are decreased significantly after treatment in periodontitis group ($p<0,05$). There was a statistically significant decrease in IL-6 and IL-17 level after treatment in Stage III Grade B periodontitis group ($p<0,05$).

Conclusion: The levels of salivary IL-6 and IL-17 which are higher in periodontitis group than healthy individuals decrease by the positive effects of initial periodontal treatment. This finding suggests that IL-6 and IL-17 can be used as markers for the success of initial periodontal treatment.

Keywords: IL-6, IL-17, periodontitis, saliva

GİRİŞ

Periodontitis, periodontopatojenlerin neden olduğu kronik enflamatuvar bir hastalıktır ve dişe destek olan yumuşak ve sert dokuların geri dönüşü olmayan yıkımı ile karakterizedir. Primer etyolojik faktörü mikrobiyal dental plak olmasına rağmen hastalığın ilerlemesi ve şiddeti plağın içindeki bakteriler ve konak cevabı arasındaki etkileşimlere bağlıdır (Becerik ve ark., 2012). Enflamatuvar sistem bakteriyel endotoksinler tarafından aktive edilir ve akut faz proteinleri ve sitokinler gibi doku yıkımına yol açan enflamatuvar mediyatörler salınır (Slade ve ark., 2000).

Periodontitiste patojenler savunma hücrelerinin dokuya infiltrasyonunu arttırırlar. Bu da makrofajlar, nötrofiller, T-hücreleri ve B-hücreleriyle birlikte tümör nekrotizan faktör (TNF) – α, TNF – β, interlökin (IL)-1, IL-6 ve IL-11 gibi enflamatuvar sitokinlerde artışa neden olur (Hienz ve ark., 2015). Kronik enflamasyonda IL-1, TNF-γ ve IL-6 gibi proenflamatuvar sitokinler osteoklastları uyararak kemik yıkımında aktif rol oynarlar (Cekici ve ark., 2014; da Costa ve ark., 2015; Isaza-Guzmán ve ark., 2015).

IL-6, endotoksin olan lipopolisakkarite cevap olarak birçok hücre tarafından üretilen hem proenflamatuvar hem de antienflamatuvar role sahip bir sitokindir. Enflamatuvar, rejeneratif ve metabolik süreçlerde yer alır (Scheller ve ark., 2011). Kronik periodontitis hastalarında sağlıklı bireylere kıyasla dişeti oluğu sıvısı IL-6 düzeylerinin arttığını (Tymkiw ve ark., 2011) ve başlangıç periodontal tedavi (BPT) sonrasında serum IL-6 düzeylerinin azaldığını gösterilmiştir (Zhou ve ark., 2013). IL-17 endotelyal ve epitelyal hücrelerle, fibroblastları uyararak IL-6'nın, matriks metalloproteinazların (MMP) ve kemokinlerin salınımına neden olur (Takahashi ve ark., 2005).

IL-17, Th-17 hücreleri tarafından salgılanan proenflamatuvar sitokindir. Th-17 hücrelerinin üretimi ve olgunlaşması IL-23, IL-6 ve transforme edici büyüme faktörü – β'ya bağlıdır. IL-17 kemokin ekspresyonu sağlayarak nötrofilleri çok güçlü bir şekilde aktive eder. Birçok otoimmün ve enflamatuvar hastalığın patogenezinde yer alır (Yu ve ark., 2007; Lin ve ark., 2015). Kronik periodontitiste IL-17 seviyelerinin arttığı gösterilmiştir (Oda ve ark., 2003; Mitani ve ark., 2015). Periodontal enfeksiyon IL-17'yi indüklediği halde, IL-17'nin kemik yıkımına karşı koruyucu rolü olduğunu gösteren çalışmalar mevcuttur (Yu ve ark., 2007; Goswami ve ark., 2009).

Tükürük IL-6 ve IL-17 seviyelerinin Evre III Derece B periodontitis hastalarında BPT sonrasında azalacağı hipotezinden hareketle bu çalışmanın amacı, BPT'nin Evre III Derece B periodontitis hastalarında klinik parametreler ve tükürük IL-6 ve IL-17 seviyeleri üzerine etkisini değerlendirmektir.

GEREÇ VE YÖNTEM

Çalışma Grubu

Bu çalışmada yer alan 20 birey, Marmara Üniversitesi Diş Hekimliği Fakültesi Periodontoloji Anabilim Dalı'na başvuran, sistemik açıdan sağlıklı yaşları 23-51 arasında değişen, klinik ve radyografik bulgulara göre Evre III Derece B periodontitis teşhisi (Papapanou ve ark., 2018) konulan hastalar (P grubu) ve periodontal olarak sağlıklı gönüllüler (S grubu) arasından seçildi. Araştırmaya katılan bireylerin sigara kullanmamış, son 6 ay içerisinde periodontal tedavi görmemiş ve 3 ay içinde antibiyotik kullanmamış olmalarına dikkat edildi. Bu çalışmaya, klinik ataşman seviyesi KAS ≥ 5 mm, radyografik kemik kaybı bulunan, periodontitise bağlı diş kaybı sayısı <4 olan, kemik kaybı/yaş oranı %0.25-1 arasında olan ve plak birikimi ile orantılı kemik kaybı bulunan hastalar ile SK ≤ %10, sondama derinliği <3 mm olan, interdental ataşman kaybı olmayan, alveol kemiği kaybı gözlemlenmeyen ve geçirilmiş periodontitis hikayesi bulunmayan periodontal sağlıklı bireyler dahil edildi. Bununla birlikte en az 20 doğal dişinin olması, hamilelik ve laktasyon döneminde bulunmaması, düzenli steroid, immunosupresif veya non-steroid anti-enflamatuvar ilaç kullanmaması şartları arandı.

Çalışma protokolü Marmara Üniversitesi Tıp Fakültesi Klinik Araştırmalar Etik Kurulu tarafından 06.11.2020 tarih ve 09.2020.1178 protokol numarası ile onaylandı. Katılan tüm bireylere bilgilendirilmiş onam formu imzalatıldı.

Başlangıç Periodontal Tedavi

Çalışmaya dahil edilen tüm bireylere ağız hijyen eğitimi (AHE) verildi. Uygulanan BPT kapsamında P grubunda tüm ağız supragingival diş taşı temizliği sonrası lokal anestezi altında subgingival diş taşı temizliği ve kök yüzeyi düzleştirme işlemi ultrasonik cihazlar (WOODPECKER® Cavitron, Guilin Woodpecker Medical Ins. Co., China) ve el aletleri (EverEdge®; Gracey, 5/6, 7/8, 11/12, 13/14, Hu-Friedy Ins. Co., USA) yardımıyla, yapıldı. BPT işlemi toplam 4 seansta tamamlandı.

Klinik Değerlendirme

P grubundan BPT'den önce ve 3 ay sonra, S grubundan ise başlangıçta plak indeks (Pİ) (Silness ve Loe, 1964), gingival indeks (Gİ) (Loe ve Silness, 1963), sondalamada kanama (SK), sondalama derinliği (SD) ve KAS içeren klinik ölçümler periodontal sond (University of North Carolina UNC-15, Hu-Friedy, Chicago, IL, ABD) vasıtasıyla 20 yaş dişleri hariç tutularak tüm dişlerin 6 noktasından yapıldı.

Tükürük Örneklerinin Toplanması

Tükürük örnekleri tüm bireylerden başlangıçta periodontal ölçümlerden 1 gün sonra sabah aç karnına ve P grubunda tedaviden sonraki 3. ayda da toplandı. Tüm bireylere ağızlarını musluk suyu ile çalkalaması ve 5 dakika beklemesi söylendi. Bireylerin tükürüğünü yaklaşık 5 dakika boyunca ağız boşluğunda biriktirmesi ve başını öne eğerek steril cam behere yavaşça akıtması istendi. Daha sonra tükürük 2 ml'lik steril polipropilen tüplere aktarıldı ve analiz gününe kadar – 80°C'de muhafaza edildi.

Tükürük Örneklerinin Analizi

Biyokimyasal analiz için önce tüm örnekler buz üzerinde eritilerek oda sıcaklığına getirildi. Tükürük örnekleri 5000 rpm'de 15 dakika santrifüj edildi ve süpernatantlar deney için hemen kullanıldı. Tükürük IL-6 ve IL-17 düzeyleri *enzyme-linked immunosorbent assay* (ELISA) kitleri (Human IL-6 ELISA Kit, Thermo Fisher Scientific, Viyana, Avusturya, Human IL-17 Quantikine ELISA Kit, R&D, Minneapolis, ABD) kullanılarak analiz edildi.

İstatistiksel Değerlendirme

Verilerin istatistiksel analizinde SPSS v24 ((SPSS version 24, Chicago, ABD) kullanıldı. Tüm verilerin dağılımları Shapiro-Wilk testi ile incelendi ve değişken normal dağılım göstermediği için grup içi karşılaştırmalarda Wilcoxon signed testi, gruplar arası karşılaştırmalarda ise Mann-Whitney U testi kullanıldı. İstatistiksel anlamlılık $p<0.05$ olarak kabul edildi.

BULGULAR

Demografik Veriler

S ve P gruplarının yaş ortalamaları sırasıyla 31.70±8.43 ve 40.60±5.60 olarak hesaplandı. P grubundaki hastaların yaşlarının S grubuna göre daha yüksek olduğu görüldü ($p<0.05$).

Klinik Parametreler

Tablo 1'de görüldüğü gibi başlangıçta tüm klinik parametreler P grubunda S grubuna göre anlamlı yüksekti ($p<0.05$). BPT sonrası 3. ayda P grubunun ölçülen tüm klinik parametrelerde ortalamaların başlangıç ortalamalarına kıyasla anlamlı daha düşük olduğu görüldü ($p<0.05$).

Tablo 1. Klinik parametrelerin gruplar arası ve grup içi karşılaştırılması

		S grubu (Ort±SS) n=10	P grubu (Ort±SS) n=10	p*
Pİ	Başlangıç	0.12±0.07	1.89±0.39	**0.000**
	3. ay	-	0.16±0.16	-
	p**	-	**0.005**	
Gİ	Başlangıç	0.13±0.06	1.79±0.26	**0.000**
	3. ay	-	0.21±0.10	-
	p**	-	**0.005**	
SD (mm)	Başlangıç	1.92±0.20	3.52±0.49	**0.000**
	3. ay	-	2.57±0.34	-
	p**	-	**0.005**	
SK (%)	Başlangıç	6.62±2.42	80.35±17.83	**0.000**
	3. ay	-	14.40±5.93	-
	p**	-	**0.005**	
KAS (mm)	Başlangıç	1.94±0.21	3.91±0.76	**0.000**
	3. ay	-	3.11±0.50	-
	p**	-	**0.005**	

S: Sağlıklı, P: Evre III Derece B periodontitis, Pİ: plak indeks, Gİ: gingival indeks, SD: sondalama derinliği, SK: sondalamada kanama, KAS: klinik ataşman seviyesi, Ort: ortalama, SS: standart sapma, * Mann Whitney U testi, $p<0.05$, **Wilcoxon signed testi, $p<0.05$

Biyokimyasal Veriler

Başlangıç ve BPT sonrası 3. ayda tükürük IL-6 ve IL-17'nin konsantrasyonları Tablo 2'de gösterildi. Tükürük IL-6 ve IL-17 seviyeleri başlangıçta P grubunda S grubuna göre daha yüksek olduğu tespit edildi ($p<0.05$). BPT sonrasında P grubunda tükürük IL-6 ve IL-17 seviyelerinde anlamlı bir azalma gözlendi ($p<0.05$).

Tablo 2. Tükürük biyokimyasal parametrelerin gruplar arası ve grup içi karşılaştırılması

		S grubu (Ort±SS) n=10	P grubu (Ort±SS) n=10	p*
IL-6 (pg/ml)	Başlangıç	2.72±0.94	7.25±4.68	**0.013**
	3. ay	-	3.87±1.66	-
	p**	-	**0.005**	
IL-17 (pg/ml)	Başlangıç	14.37±6.6	23.97±5.86	**0.008**
	3. ay	-	16.43±7.16	-
	p**	-	**0.048**	

S: Sağlıklı, P: Evre III Derece B periodontitis, IL: İnterlökin, Ort: ortalama, SS: standart sapma, * Mann Whitney U testi, $p<0.05$, **Wilcoxon signed testi, $p<0.05$

TARTIŞMA

Periodontal hastalık, konak cevabı ile subgingival mikroorganizmalar arasındaki etkileşimlerin sonucu oluşan

ve birçok faktörün etkili olduğu enfeksiyöz ve enflamatuvar bir hastalıktır. Periodontal tedavi sonrası konak cevabını değerlendirirken subgingival bakterilerle birlikte tükürük komponentlerinin incelenmesi, hastalığın ilerlemesinin belirlenmesinde ve tedaviye verilen yanıtın izlenmesinde oldukça önemlidir. Bu bilgilerin ışığı altında bu çalışmada BPT'nin klinik periodontal parametreler ve tükürük IL-6 ve IL-17 seviyeleri üzerine etkisi değerlendirildi.

BPT'nin başarısını ortaya koyan en önemli sonuçlar cep derinliğinin azalması, klinik ataşman kazancı ve SK skorlarının azalmasıdır. Çalışmamızda periodontal parametrelerin tedavi sonrasında azalması yapılan klinik çalışmalarla paraleldir. (Kaldahl ve ark., 1993; Haffajee ve ark., 1997; Cugini ve ark., 2000).

Bakterilerin yapısal özelliği olabileceği gibi aynı zamanda bakteriler tarafından üretilebilen virülans faktörleri konak yanıtının oluşmasında önemlidir. Proteazlar, MMP'ler ve sitokinler gib birçok molekül bağ dokusunu ve alveol kemiğini yıkmak için aktive olur. İnsanlarda IL-6 ve MMP-1'in üretiminin periodontal ligament fibroblastları tarafından uyarıldığı bildirilmiştir. IL-17 MMP-1 üretimini hem direkt olarak hem de IL-6 üretimini arttırarak indirekt olarak uyarır. Bu da periodontal ligamentte bulunan kolajenlerin yıkımına yol açar (Shibata ve ark., 2014).

IL-6 antijene özgü immün cevapla ve enflamatuvar reaksiyonlarla ilişkilidir. Çalışmamızda tükürük IL-6 seviyeleri P grubunda S grubuna göre daha yüksek bulundu ve tedavi sonrasında azaldığı görüldü. Periodontitis hastalarında artan tükürük IL-6 seviyesi, periodontal yıkımın neden olduğu lokal enflamatuvar yanıtın artışını; BPT sonrası azalması ise tedavinin IL-6 seviyesi üzerine olumlu etkisini gösterdi. Bu sonuçlar benzer çalışma bulgularını destekler niteliktedir (Shyu ve ark., 2015; Doğan ve ark., 2016; Torumtay ve ark., 2016; Silvestre-Rangil ve ark., 2017; Al-Hamoudi ve ark., 2018). Bizim bulgularımızdan farklı olarak Bajaj ve ark. (Bajaj ve ark., 2018) tedavi sonrası tükürük IL-6 seviyesinde değişim olmadığını rapor etmiştir. Bunun nedeni, çalışmalarına sistemik sağlıklı değil siroz hastalarını dahil etmeleri olabilir. Sonuçlarımız BPT'nin tükürük IL-6 seviyelerini periodontal iyileşmeyle paralel olarak azalttığını ortaya koydu.

Kemik rezorpsiyonuyla ilişkili olduğu ortaya konan IL-17, farklılaşması ve büyümesi IL-6 ve diğer sitokinler tarafından yönetilen Th17 hücresi tarafından salgılanan proenflamatuvar sitokindir (Garlet, 2010; Luo ve ark., 2015). Çalışmalarda IL-17'nin kronik periodontitisteki görevi değerlendirilmiş olmakla birlikte IL-17'nin kemik rezorpsiyonuna mı yol açtığı yoksa kemiği koruduğu mu henüz bilinmemektedir. Mevcut çalışmada tükürük IL-17 seviyeleri S grubunda P grubuna göre daha düşüktü. İlgili çalışmalarda da, bizim sonuçlarımızla paralel olarak tükürük, dişeti oluğu sıvısı ve serumda IL-17 seviyelerinin periodontitisli hastalarda sağlıklı bireylere kıyasla daha yüksek olduğu bildirilmiştir (Cardoso ve ark., 2009; Azman ve ark., 2014; Prakasam ve Srinivasan, 2014; da Costa ve ark., 2015). Bu çalışmada BPT sonrasında Evre III Derece B periodontitis hastalarında tükürük IL-17 seviyesinde azalma tespit edildi. Her ne kadar Yang ve ark. (Yang ve ark., 2016) çalışmamızla benzer sonuç bulduysa da tedavi sonrasında IL-17 seviyesinin değişmediğini gösteren çalışmalar da mevcuttur (Fine ve ark., 2009; Prakasam ve Srinivasan, 2014). Kullanılan örnekleme yöntemi, klinik değerlendirmenin zamanlaması, hasta ve bölge seçimi, periodontal tedavi protokolündeki ve tedavi sonuçlarının değerlendirilmesindeki farklılıklar nedeniyle sitokin seviyeleri ile ilgili çalışmalarda tutarsız sonuçlar ortaya çıkmaktadır.

SONUÇ

Tükürük IL-6 ve IL-17'nin Evre III Derece B periodontitis hastalarında sağlıklı bireylere göre yüksek seviyede olması ve BPT'nin olumlu etkisiyle klinik parametrelere paralel şekilde azalma göstermesi, bu pro-enflamatuvar sitokinlerin hem periodontal hastalık teşhisinde hem de tedavi başarısının ortaya konmasında kullanılabileceğini düşündürmektedir.

Yazarların Katkıları

Bahadır Kırali, hasta seçimi, biyokimyasal analiz, veri yorumlama ve yazma süreçlerinde yer almıştır. Kübra Kundak, örnek toplama ve tedavi prosedürlerinde yer almıştır. Başak Doğan, çalışma verilerinin yorumlanmasında ve eleştirel okumada yer almıştır. Leyla Kuru, çalışmanın fikir ve tasarımında, verilerin yorumlanmasında, yazımında ve eleştirel okumada yer almıştır. Tüm yazarlar makalenin son halini okumuş ve onaylamıştır.

Çıkar çatışması:

Yazarlar herhangi bir çıkar çatışması olmadığını beyan eder.

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ORIGINAL ARTICLE / ARAŞTIRMA MAKALESİ

The Anxiety and Psychological Resilience of Dentists During COVID-19: A Cross-sectional Study

COVID-19 Pandemisinde Diş Hekimlerinin Anksiyetesi ve Psikolojik Dayanıklılığı: Kesitsel Bir Çalışma

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Abstract

Objective: Healthcare workers are at risk of psychological disorders as a consequence of the COVID-19 pandemic. The aim of this study was to determine the COVID-19-related anxiety level and psychological resilience of dentists who had provided healthcare interventions in Turkey during the pandemic.

Materials and Methods: A total of 391 volunteers were enrolled to be literate in Turkish and to have worked at least 1 year before and during the pandemic. Data collection form was bodied in 3 parts. While the demographic questions such as age, gender, etc., was at first part, the other parts consisted of the Coronavirus Anxiety Scale (CAS) and the Brief Resilience Scale (BRS), respectively. Statistical significance was set at $p<0.05$.

Results: The 57.5% of the participants were female. The CAS mean of the dentists working in public hospitals was higher than working in their own offices($p<0.05$). The mean BRS of the participants with duration in profession between 10 and 15 years was the lowets among all subgroups ($p<0.05$). Comparison of mean CAS and BRS values of participants regarding with their speciality showed that surgeons, pedodontists and orthodontists had low CAS mean values ($p<0.05$), whereas BRS levels of these specialities significantly higher ($p<0.05$). There was a negative association between CAS levels and BRS levels ($r=-.145$, $p<0.01$).

Conclusion: The results obtained within the limitations of the study can be interpreted as psychological resilience may be an important factor to prevent the development of anxiety in dentists who worked as forefronted in challenging conditions such as the COVID-19 pandemic.

Keywords: anxiety; coronavirus; dentists; psychological resilience; occupational disease

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ÖZ

Amaç: Sağlık çalışanları, COVID-19 pandemisiyle ilişkili psikolojik bozukluklar açısından risk altındadır. Bu çalışmanın amacı, pandemi döneminde Türkiye'de sağlık hizmeti veren diş hekimlerinin COVID-19 ile ilgili kaygı düzeylerini ve psikolojik sağlamlıklarını belirlemektir.

Gereç ve Yöntemler: Pandemi öncesinde en az 1 yıl çalışmış, pandemi sırasında çalışmaya devam eden ve Türkçe okuryazar olan toplam 391 gönüllü çalışmaya katıldı. Çalışamda kullanılan veri toplama formu 3 bölümden oluşmaktadır. İlk bölümde yaş, cinsiyet vb. demografik sorular yer alırken, diğer bölümlerde sırasıyla Koronavirüs Anksiyete Ölçeği (KAS) ve Kısa Dayanıklılık Ölçeği (KDÖ) yer aldı. İstatistiksel anlamlılık $p<0.05$ düzeyinde değerlendirildi.

Bulgular: Katılımcıların %57,5'i kadındı. Devlet hastanelerinde çalışan diş hekimlerinin KAS ortalamaları kendi muayenehanelerinde çalışan diş hekimlerinden daha yüksekti ($p<0.05$). Meslekte geçirdiği süre 10 ile 15 yıl arasında olan katılımcıların ortalama KDÖ'sü tüm alt gruplar arasında en düşüktü ($p<0.05$). Katılımcıların uzmanlık alanlarına göre ortalama KAS ve KDÖ değerleri karşılaştırıldığında, cerrahların, pedodontistlerin ve ortodontistlerin KAS ortalama değerlerinin düşük ($p<0.05$), bu uzmanlıkların KDÖ değerlerinin anlamlı olarak yüksek olduğu ($p<0.05$) görüldü. KAS ile KDÖ arasında negatif yönlü zayıf bir ilişki saptandı. ($r=-.145$, $p<0.01$).

Sonuç: Çalışmanın limitasyonları dahilinde elde edilen sonuçlar, COVID-19 pandemisi gibi zor çalışma koşullarında ön planda çalışan diş hekimlerinde anksiyetenin önlenmesinde psikolojik dayanıklılığın önemli bir faktör olabileceğine işaret etmektedir.

Anahtar Kelimeler: diş hekimleri; kaygı; koronavirus; meslek hastalığı; psikolojik dayanıklılık

INTRODUCTION

The Coronavirus Disease 2019 (COVID-19) pandemic, which originated in Wuhan City, Hubei Province, China in 2019, has had a tremendous and far-reaching effect on the global population. Coronavirus primarily spreads through droplets and can cause serious, life-threatening symptoms such as organ failure, severe pneumonia, and acute respiratory distress syndrome in some patients (Serafim et al., 2021). In addition, the pandemic has had a significant psychological impact on individuals worldwide, and numerous studies have been conducted to better understand its psychological effects.

Dentists are particularly vulnerable to contracting COVID-19 due to their use of high-speed and water-based instruments that generate aerosols, direct and indirect contact with saliva and blood, and close proximity to patients during procedures (Ge et al., 2020). This increased risk was linked to fear, stress, anxiety, and depression in dentists (Ahmed et al., 2020;Atay et al., 2020;Gasparro et al., 2020;Shacham et al., 2020). Furthermore, healthcare workers not consisted of dentists reported higher levels of anxiety during the pandemic than in other segments of society, and consequently, anxiety disorder, post-traumatic stress disorder, major depression, and alcohol use disorder increased dramatically (Tengilimoğlu et al., 2021). Therefore, it is of paramount importance to explore the psychological resilience of dentists to equip them specifically with the necessary strategies to cope with the challenges posed by the COVID-19 pandemic. Research in this area may help improve the mental health and well-being of dentists, as well as other healthcare professionals, and allow them to better serve their patients during this difficult period.

The aim of this study was to explore the anxiety and psychological resilience of dentists during the COVID-19 pandemic in relation to their demographic characteristics and to test the null hypothesis that demographic factors do not affect dentists' levels of COVID–19 anxiety and psychological resilience. To achieve this, a cross-sectional survey was conducted to measure the psychological resilience of a sample of dentists by assessing their levels of anxiety and stress as well as their coping strategies. The results of the study were used to identify any potential gaps in the current support and educational resources available to dentists to ensure that they have the skills and knowledge needed to effectively manage their anxiety and stress during the pandemic.

MATERIALS AND METHODS

Study Design, Sample Size, and Participants

This cross-sectional, survey-based study was approved by the Istanbul Aydin University Non-Interventional Research Ethics Committee on February 3, 2021 (Ethics Committee No. 2021/374). It was conducted on 391 participants between December 15, 2021, and March 15, 2022. It was designed to gain an in-depth understanding of the current views, attitudes, and behaviors of actively working dentists in Turkey, and a power analysis was used to determine the sample size of the study. This power analysis was conducted using a population of 43,199 registered, actively working dentists in Turkey as the basis, and the G-Power 3.1 program determined the sample size to be 360. An effect size of 0.20, power of 85%, and alpha margin of error of 0.05 were also considered during the power analysis.

The inclusion criteria for this study were literacy in Turkish, having at least one year of experience as a dentist prior to the COVID-19 pandemic, providing healthcare services during the COVID–19 pandemic, being willing to volunteer, and being a member of the Turkish Dental Association. The exclusion criteria were as follows: not being systemically and psychologically healthy, consuming any kind of medication, over-the-counter remedies and illicit drugs, not answering all questions in the survey, and rescinding their consent during the study period. Considering the inclusion and exclusion criteria, this study was conducted with a total of 391 volunteered participants.

Data Collection

The data collection form for this study consisted of three sections. The first section included sociodemographic questions such as age, gender, type place of employment, speciality in dentistry, and years in the profession.

The second section included the Coronavirus Anxiety Scale (CAS) (Table 1), a one-dimensional 5-point Likert-type scale developed by Lee (Lee, 2020) with a Cronbach's alpha reliability coefficient of 0.93. The Turkish version of the CAS has been validated, and its use in the Turkish context has been confirmed. Furthermore, the scale has been shown to be reliable for measuring anxiety levels (Biçer et al., 2020). The points on the scale range from 0 (not at all) to 4 (almost every day over the last two weeks) (Lee, 2020).

Table 1: Statements of scales

Coronavirus Anxiety Scale (Lee et al., 2020)
St. 1: I felt dizzy, lightheaded, or faint, when I read or listened to news about the coronavirus.
St. 2: I had trouble falling or staying asleep because I was thinking about the coronavirus.
St. 3: I felt paralyzed or frozen when I thought about or was exposed to information about the coronavirus.
St. 4: I lost interest in eating when I thought about or was exposed to information about the coronavirus. *St. 5: I felt nauseous or had stomach problems when I thought about or was exposed to information about the coronavirus.*
The Brief Resilience Scale (Smith et al., 2008)
St. 1: I tend to bounce back quickly after hard times.
St. 2: I have a hard time making it through stressful events. (R)
St. 3: It does not take me long to recover from a stressful event.
St. 4: It is hard for me to snap back when something bad happens. (R)
St. 5: I usually come through difficult times with little trouble. *St. 6: I tend to take a long time to get over set-backs in my life. (R)*

St: *Statement;* ***R:*** *Reverse statement*

The third section included the Brief Resilience Scale (BRS), a one-dimensional 5-point Likert-type scale composed of six items (Table 1) that has been developed (Smith et al., 2008) and validated (Haktanir et al., 2016) for use in Turkish. The BRS evaluates the psychological resilience of participants, with scores ranging from 6 to 30, where a higher score implies more resilience. The BRS evaluates the psychological resilience of participants, with scores ranging from 6 to 30, with higher scores indicating greater resilience.

The data collection tool was administered online via Google Forms, and the shared link was sent to all registered members of the Turkish Dental Association via secure email. To ensure privacy, participants were required to provide informed consent through electronic signatures. To avoid repeated participation, only one of the authors (S.E.M.) had access to the participants' email addresses and the data were securely handled in accordance with ethical and legal standards.

Statistical Analysis

The data were analyzed using the NCSS (Number Cruncher Statistical System) 2007, with descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum-maximum values), and the distribution of the data was evaluated through the Shapiro-Wilk Test. The comparison of mean values between two groups was analyzed using the Mann-Whitney U test, whereas the comparison of mean values between more than two groups was analyzed using the Kruskal-Wallis test. Statistical significance was set at $p<0.05$.

RESULTS

The mean age of the 391 participants was 36.45±12.67 (ranged 22-69). The all participants, of whom 57.5% (n=225) were female and 53.7% (n=210) were younger than 35 years of age. Dentists employed at private hospitals had the highest representation (45.3 %). Approximately 56.5% of the participants had less than 10 years of professional experience, with dental practitioners comprising about one-third of the population (Table 2).

Table 2: Demographic variables

		N	%
Total		391	100
Age			
	<35	210	53.7
	35-44	82	21.0
	45-54	49	12.5
	55-64	32	8.2
	≥65	18	4.6
Gender			
	Female	225	57.5
	Male	166	42.5
Workplace Type			
	University hospital	128	32.7
	Public hospital	52	13.3
	Private hospital	34	8.7
	Clinic	177	45.3
Speciality			
	DP	135	34.5
	OMS	33	8.4
	OMR	30	7.7
	Pediatric Dentistry	32	8.2
	Endodontics	30	7.7
	Orthodontics	38	9.7
	Periodontology	32	8.2
	Prosthodontics	30	7.7
	Restorative Dentistry	31	7.9

N: *Number; %: Percentage;* ***DP:*** *Dental Practitioner;* ***OMS:*** *Oral & Maxillofacial Surgery;* ***OMR:*** *Oral & Maxillofacial Radiology*

Table 3 presents a comparison of the mean values of the CAS and BRS as they relate to demographic variables. The mean values of CAS and BRS were 3.37±3.23 and 17.57±2.42 respectively. A significant difference was found for all demographic variables in terms of CAS and BRS ($p<0.05$), except for gender where no significant difference was found ($p>0.05$).

Table 3: Comparision of questionnare mean score in terms of demographical variables

	CAS		BRS	
	Mean±Sd		Mean±Sd	
Total	3.37±3.23		17.57±2.42	
Gender	**Mean±Sd**	**Median (Min-Max)**	**Mean±Sd**	**Median (Min-Max)**
F	3.46±3.1	3 (0-5)	17.74±2.13	18 (12-25)
M	3.25±3.3	2 (0-5)	17.35±2.71	17 (10-25)
***p**	**0.197**		**0.120**	
Workplace type	**Mean±Sd**	**Median (Min-Max)**	**Mean±Sd**	**Median (Min-Max)**
University hospital	3.30±2.9	3 (0-5)	17.14±2.32	17 (10-22)
Public hospital	4.15±3.4	4 (0-5)	17.15±3.41	17 (15-25)
Private hospital	4.82±3.4	4 (0-5)	17.82±3.44	17 (12-24)
Clinic	2.91±3.1	3 (0-5)	18.90±3.10	18 (11-25)
***p**	**0.002**		**0.021**	
Duration in profession	**Mean±Sd**	**Median (Min-Max)**	**Mean±Sd**	**Median (Min-Max)**
≤5 y	2.58±2.76	2 (0-5)	18.61±2.59	18 (10-24)
5<y≤10	3.61±2.75	4 (0-5)	17.96±2.03	18 (14-25)
10<y≤15	4.02±3.09	4 (0-5)	16.21±1.96	17 (12-21)
15<y≤20	3.49±3.82	4 (0-5)	17.76±2.36	18 (15-25)
20<y	3.23±3.92	2 (0-5)	17.56±2.81	18 (10-25)
****p**	**0.004**		**0.02**	
Speciality	**Mean±Sd**	**Median (Min-Max)**	**Mean±Sd**	**Median (Min-Max)**
DP	3.04±2.72	3 (0-5)	17.85±2.48	18 (10-25)
OMS	2.39±3.22	2 (0-2)	18.91±1.59	19 (10-23)
OMR	4.15±2.73	4 (0-5)	16.89±1.88	17 (12-20)
Pedodontics	2.84±2.14	2 (0-4)	18.93±2.94	19 (11-25)
Endodontics	4.63±3.09	5 (0-5)	16.93±2.92	17 (10-24)
Orthodontics	3.61±1.32	3 (0-5)	17.18±1.08	17 (14-22)
Periodontics	4.13±2.99	4 (0-5)	17.36±2.90	17 (14-22)
Prosthodontists	4.37±3.49	5 (0-5)	17.06±2.23	17(14-23)
Restorative dentistry	4.48±3.35	4 (0-5)	16.84±1.53	17 (15-20)
****p**	**0.001**		**0.001**	

CAS:** Coronavirus Anxiety Scale; **BRS:** The Brief Resilience Scale; **F:** female; **M:** male; **y:** year; **DP:** Dental Practitioner; **OMS:** Oral & Maxillofacial Surgery; **OMR:** Oral & Maxillofacial Radiology; **Mean±Sd:** Mean±Standard deviation; **Min-Max:** minimum-maximum values;Mann-Whitney U Test, **Kruskal-Wallis Test, p<0.05***

The CAS scores of dentists working in both public and private hospitals were higher than those of dentists working in their own clinics (p<0.001). Dentists employed in a university hospital setting had lower CAS scores than those working in both private (p<0.001) and public hospitals (p<0.001); those with 5 years or less of professional experience had lower CAS scores than other age groups (p<0.001) Oral and maxillofacial surgeons and specialists in pedodontics had lower CAS scores than those of other participants (for both, p<0.001) without any difference between them (p>0.05).

The mean BRS scores of participants who worked in public hospitals and university hospitals were significantly lower than those of participants who worked in private clinics or in practice (p<0.001). Dentists with 5 or fewer years of professional experience had higher mean BRS scores than those with 6–10 and 11–15 years of professional experience (p<0.001). In addition, the mean BRS scores of oral and maxillofacial surgeons and specialists in pedodontics were significantly higher than those of other participants (p<0.001).

Considering the correlation analyses as shown in Table 4, a negative association between CAS levels and BRS levels was observed (p<0.05)

Table 4: Correlation analysis

		CAS	BRS
CAS	r	1	**-.145***
	p	.	.000
BRS	r	**-.145***	1
	p	.000	.

CAS:** Coronavirus Anxiety Scale; **BRS:** The Brief Resilience Scale; ***Spearman's correlation coefficent (r) is significant at p<0.05 level.

DISCUSSION

This cross-sectional study aimed to assess the impact of demographic features on the levels of anxiety and psychological resilience of dentists during the COVID–19 pandemic. The results indicated that demographic features had an impact on the levels of anxiety and psychological resilience, apart from gender. Additionally, a negative and very weak relationship was observed between anxiety levels and psychological resilience. These findings provide valuable insights into the anxiety and psychological resilience levels of dentists during the pandemic. Therefore, the outcomes supports the assumption that there is a negative relationship between anxiety and psychological resilience in healthcare professionals including dentists, during traumatic

events like the COVID–19 pandemic. Considering all, the null hypothesis of the study was rejected.

Psychological resilience is an important factor in the ability of individuals to withstand traumatic events such as the COVID–19 pandemic. Several studies have suggested a negative relationship between anxiety levels and psychological resilience in healthcare professionals (Huffman et al., 2021;Lin et al., 2020;Mosheva et al., 2020). During the COVID–19 pandemic, healthcare workers apart from dentists have been found to have a higher psychosocial impact than the general population (Biçer et al., 2020;Horesh et al., 2020;Lai et al., 2020;Lee, 2020;Lin et al., 2020;Smith et al., 2021). Dentists are particularly vulnerable to anxiety owing to their high exposure to saliva and aerosols, which are some of the most significant transmission routes for the coronavirus (Pappa et al., 2020;Peng et al., 2020). Consequently, compliance with infection control protocols has become essential for dentists during the pandemic.

Younger dentists who have just started their careers are often more conscious and sensitive to infection control protocols, which can lead to increased anxiety (Sağlam and Saruhan, 2021). Similarly, one study found that dentists with less professional experience had higher levels of anxiety (Sağlam and Saruhan, 2021). The study also found that younger dentists had higher levels of anxiety than middle-aged dentists, while dentists over 50 years of age had the highest levels of anxiety (Jungmann and Witthöft, 2020;Majeed et al., 2021). The study found that dentists who had worked for 0-10 years in the profession had higher levels of psychological resilience than those who had worked for 11-15 years. On the other hand, different studies have shown that with increasing experience in the profession, stress and contamination anxiety decrease (Arslan et al., 2021;Gooding et al., 2012;Majeed et al., 2021). Although biological age and duration in profession are not the same variables, the findings of these variables were found to be parallel in our study population. Since this study was designed specifically for a professional occupational group, the findings were evaluated in terms of duration in profession variable instead of biological age. Our study results are consistent with previous studies (Majeed et al., 2021) which found that dentists with 16 years or more of professional experience had higher psychological resilience levels than those with 11-15 years of experience. Despite their increased risk of health problems and systemic disorders, dentists with more experienced time in the profession have higher levels of psychological resilience, which can be attributed to their sensitivity to infection control, better problem-solving skills, and proactive measures to protect themselves from COVID-19.

Although no study was found to compare, the findings revealed anxiety levels of dental practitioners, oral and maxillofacial surgeons, pedodontists, and orthodontists were significantly lower than remained other specialities. However the outcomes could be attributed that lower risk of COVID-19 transmission from children in terms of pedodontists, emergency treatments and treatments with high risk of transmission are not routinely applied by orthodontists, thanks to nature of speciality the idea that surgeons have already pay attention to the use of personal protective equipment before pandemic.The extensive working hours, improper work schedules, and increased workloads of healthcare professionals who continue to provide medical services at the frontlines of the pandemic, along with increased exposure to COVID-19 patients, can trigger psychological distress (Horesh et al., 2020). Studies on physicians have found that those who provide more than 8 hours of healthcare experience have increased emotional exhaustion (Horesh et al., 2020). Similarly, stress, emotional exhaustion, and depersonalization significantly increased among those who worked for 9 hours or more (Li et al., 2020;Lin et al., 2020). The long hours spent working in dental clinics, insufficient distance during dental procedures, and the presence of bio-particles suspended in the air for an extended time can also contribute to COVID-19 and other infectious diseases (Horesh et al., 2020).

The study also found that workplace type can impact the emotional well-being of healthcare workers. A study that assessed the stress levels of physicians in relation to their workplace found no relationship between the type of workplace and stress or anxiety (Kulu and Özsoy, 2021). However, our results showed that dentists working in public hospitals had higher anxiety levels and lower psychological resilience than participants working in private hospitals had . This can be attributed to the fact that dentists in private clinics had more control over their work schedules and less contact with patients during the pandemic, which may have provided a more conducive environment for maintaining psychological resilience and reducing anxiety.

Dentists during the COVID-19 pandemic may experience fear of infection as well as anxiety due to factors such as flexible work hours, increased workload, exposure to COVID–19 positive patients, lack of physical distancing during dental procedures, and long hours of work. Workplace

type can also have an impact, with dentists working in public hospitals exhibiting higher levels of anxiety and lower levels of psychological resilience than those working in private clinics.

The current study has several limitations, such as not taking into account the participants' anxiety and psychological resilience levels prior to the pandemic, as well as other potential factors that may have contributed to their mental health, such as working conditions or economic status. This could potentially lead to incomplete assessment of the impact of the pandemic on the mental health of dentists, and it is important to consider these aspects to gain a full understanding. Additionally, the study was conducted in a single geographic area, which may have limited the applicability of the findings to other regions. Future studies should consider the potential impact of such factors and extend the research to other areas to provide a more comprehensive understanding of the effects of the COVID–19 pandemic on the mental health of dentists. It is also necessary to gain insight into the psychological resilience of dentists during this difficult period and their need for improved mental health services. Therefore, future studies should comprehensively assess the impact of the pandemic on dentists' mental health and focus the mental health promotion strategies.

CONCLUSION

The results of our study suggest a positive correlation between high psychological resilience and low anxiety among dentists during the COVID–19 pandemic. Specifically, dentists who work in their own practices, have 1–10 years of experience, or have more than 16 years of experience showed low levels of anxiety and high levels of psychological resilience. These findings indicate that improved working conditions and comprehensive psychological support may be instrumental in helping to reduce anxiety and strengthen psychological resilience among healthcare workers, who are essential to providing services to their communities. Therefore; it is vital to ensure that healthcare workers have access to the resources and support they need to maintain and protect their mental health and well-being. Moreover, further research should be conducted to explore how different gender, age, and cultural backgrounds affect psychological resilience and ways to promote psychological well-being among healthcare workers. This could include exploring the role of different policies and procedures, such as national and international guidelines, in promoting and preserving the mental health of healthcare workers. Additionally, it would be beneficial to investigate how access to resources and support, as well as work-life balance, can play a role in mediating levels of anxiety and psychological resilience among dentists. Such research could help guide the development of strategies to support the mental health of healthcare workers and promote their psychological well-being.

Conflict of Interests

The authors declare that there is no conflict of interests.

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ORIGINAL ARTICLE / ARAŞTIRMA MAKALESİ

Bakteriyel Selüloz Bazlı Hidrojel Taşıyıcı ile Topikal Uygulanan Tideglusib'in Sıçanlarda Oluşturulan Palatinal Yaranın İyileşmesi Üzerine Etkisinin Makroskobik Olarak Değerlendirilmesi: Bir Öncül Çalışma

Macroscopic Evaluation of the Effect of Topically Applied Tideglusib with Bacterial Cellulose-Based Hydrogel Carrier on Healing of Palatal Wound in Rats: A Preliminary Study

Elif VAR ODABAŞ, Semra ÜNAL YILDIRIM, Oğuzhan GÜNDÜZ, Berna ALEMDAĞ, Deniz Mukaddes TÜRET, Ömer Birkan AĞRALI

ÖZ

Amaç: Bu çalışmanın amacı, bakteriyel selüloz (BS) bazlı hidrojel taşıyıcı ile topikal olarak uygulanan tideglusib (Td)'nin sıçanlarda oluşturulan palatinal yaranın iyileşmesi üzerine erken etkisini makroskobik olarak değerlendirmektir.

Gereç ve Yöntemler: Bu çalışmada deney hayvanı olarak; ortalama 3 aylık, ağırlıkları 250-300 gr arasında değişen, 12 adet genç erişkin erkek Sprague Dawley sıçan kullanıldı. Sıçanların palatinal mukozalarının ortasında 4 mm çapında mukozal defekt oluşturuldu. Üç hayvan, defekt oluşturulduktan hemen sonra sakrifiye edildi ve başlangıç grubunu oluşturdu. Diğer 9 hayvan, pasif kontrol, sadece taşıyıcı uygulanan (hidrojel) ve taşıyıcı içinde Td uygulanan (Td+Hidrojel) olmak üzere rastgele üç gruba ayrıldı. Bu üç gruptaki hayvanlar 7. günde sakrifiye edildi. Ortalama yara yüzey alanı fotoğraf üzerinden ölçülerek makroskobik olarak değerlendirildi.

Bulgular: Gruplar arası karşılaştırmada yara yüzey alanında istatistiksel olarak anlamlı farklılık gözlendi (p=0,033). Gruplar arası ikili karşılaştırmalarda sadece başlangıç grubu ile Td+Hidrojel grubu arasında istatistiksel olarak anlamlı bir fark bulundu (p= 0,028).

Sonuç: BS bazlı hidrojel ile topikal olarak uygulanan Td'nin, sıçanların palatal mukozal yara iyileşmesi üzerinde olumlu etkilere sahip olduğu makroskobik olarak gösterilmiştir.

Anahtar Kelimeler: yara iyileşmesi, palatinal mukozal iyileşme, yara örtücü, tideglusib, wnt sinyal yolu

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ABSTRACT

Objective: The aim of this study is to macroscopically evaluate the early effect of topically applied bacterial cellulose (BC) based hydrogel carrier including tideglusib (Td) on palatal wound in rats.

Materials and Methods: The study group consisted of 12 Sprague Dawley rats, 3 months old male, each weighing an average of 250-300 gr. Three animals were instantly sacrificed and represented the baseline group at time 0 (initial group). The remained nine were divided into three groups at random: empty group, hydrogel group, Td+hydrogel group. Mean wound surface area was measured photographically.

Results: In the intergroup comparison, a statistically significant difference was observed in the wound surface area (p=0,033). In the pairwise comparisons between the groups, a statistically significant difference was found only between the initial group and the Td+Hydrogel group (p= 0,028).

Conclusion: Td topically applied with BC based hydrogel has positive effects on palatal mucosal wound healing of rats.

Keywords: wound healing, palatal mucosal healing, wound dressing, tideglusib, wnt signaling pathway

GİRİŞ

Yara iyileşmesi skar oluşumu ile sonuçlanan bir süreçtir. Mukozal yaralar, tükürük içindeki elementlerden ve oral fibroblastların benzersiz fenotipinden dolayı cilt yaralarından daha hızlı iyileşme eğilimindedir ve bu yara tipinde en az skar oluşumu gözlenmektedir. Bu nedenle fonksiyon ve estetik üzerinde en az etkiye sahiptir (Lee ve Eun, 1999; Hakkinen ve ark., 2000; Evans, 2017).

Ancak, nispeten hızlı yara iyileşmesine rağmen, periodontal cerrahi ve implant cerrahisi sırasında hasar

gören dokular ağız boşluğunda sürekli olarak bakteriyel enfeksiyon ile karşı karşıya kaldığından ağız hijyeninin ve ek plak kontrolünün titizlikle sürdürülmesi gerekir (Kozlovsky ve ark., 2007).

Dişeti grefti cerrahilerinde bakteriyel kontaminasyonun önlenmesi palatinal verici bölgede önemli miktarda doku kaybedildiği için daha da önemlidir. Otojen dişeti grefti operasyonlarında sıklıkla hastanın durumuna bağlı olarak rahatsızlık, ağrı ve gecikmiş doku tamiri gözlenir. Cerrahi sonrası oluşan bu problemlerden kaçınmak için antimikrobiyal tedavinin topikal uygulanması önerilir (Kozlovsky ve ark., 2007; Shanmugam ve ark., 2010; Hammad ve ark., 2011).

1960'lı yıllarda yara örtücü malzemelerin iyileşme sürecine etkisinin çok az olduğuna inanılırken son yapılan araştırmalarda, yara örtücü malzemelerin biyoaktif rol oynayarak iyileşme sürecine pozitif katkısı olabileceği gösterilmiştir (Abbenhaus ve ark., 1965; Jones ve ark., 2006; Francesko ve Tzanov, 2011; Ahmed ve Ikram, 2016; Deng ve ark., 2022).

Cerrahi operasyon sonrası oluşan defektlerin rekonstrüksiyonunda (Cortellini ve ark., 1995; Rastogi ve ark., 2009), implant çevresinde oluşan defektlerin kapatılmasında (Fowler ve ark., 2000; Speroni ve ark., 2010), mukozal açıklıkların onarımında (Tal, 1999; Narang ve Gupta, 2011), metastatik çene hastalıkları ve osteoradyonekroz sonucu ekspoze olmuş maksillofasiyal kemik defektlerinin kapatılmasında (Chandarana ve ark., 2013), vestibül derinleştirme gibi preprotetik operasyonlarda (Guler ve ark., 1997; Bhola ve ark., 2003), yarık dudak damak olgularında (Duskova ve ark., 2006) ve oroantral fistül onarımında (Waldrop ve Semba, 1993) otojen mukozal greftlerden kolajen membrana kadar birçok yara örtücü materyal tercih edilmektedir.

BS, çeşitli bakteriler tarafından üretilen bir ekstraselüler polisakkarit formudur (Ross ve ark., 1991). BS'nin; biyouyumluluğu, doku gelişimi ve hücre etkileşimlerini kolaylaştırması ve birbirine bağlı gözenekli bir yapıya sahip olması gibi sebeplerle yara örtücü olarak kullanımı düşünülebilmektedir. Ayrıca BS, hücre adezyonu ve proliferasyonunda anlamlı etki göstermesi, yüksek saflık seviyesi, mikroporozite, biyolojik olarak parçalanabilirlik, biyolojik olarak emilebilirlik, toksik olmama, canlı dokunun hücre dışı matriksine benzeme, kristallik özelliklerinden dolayı doku mühendisliğinde ön plana çıkmıştır (Zaborowska ve ark., 2010; Abdelraof ve ark., 2019; Noh ve ark., 2019).

Çalışmalar, BS'yi diğer polimerlerle birleştirmenin gelişmiş mekanik özelliklerle sonuçlanabileceğini göstermiştir (Nakayama ve ark., 2004). Örneğin BS ve kitosan, BS levhalarının kitosan çözeltilerine daldırılmasıyla birleştirilebilir. Kitosan BS ile birleşerek daha iyi mekanik özelliklere sahip bir BS ve kitosan kombinasyonu oluşturur (UI-Islam ve ark., 2011).

Wnt sinyal yolağı (WSY), erişkin dönemde rejeneratif hücrelerin adezyonunda önemli bir rol oynar. Wnt/β-katenin sinyal sisteminin aktive edilmesi, doku hasarına erken yanıttır ve tüm dokularda hücre düzeyinde tamirin uyarılması için gereklidir (Neves ve ark., 2017).

Wnt sinyal sistemi aktif veya pasif durumda olabilir. Hücre bölünme siklusunu kontrol etmek için çok önemli olan Glikojen Sentaz Kinaz-3 (GSK-3) molekülü, Wnt proteininin hücresel reseptörlere bağlanmasından sonra inhibe edilir. Sonrasında WSY hedef genlerinin transkripsiyonu başlar. Bu stimülasyon, hücre çoğalması, hücre döngüsü ve farklılaşma süreçleri için gereklidir. Çok sayıda çalışma, Wnt sinyalindeki azalmanın kemik kaybına ve rejenerasyon kapasitesinde azalmaya yol açtığını göstermiştir (Minear ve ark., 2010; Whyte ve ark., 2012).

Memelilerde cilt yaralanmalarında iyileşme genelde skarla olmaktadır ancak WSY aktive edildiğinde tamamen işlevsel epidermis oluştuğu görülmüştür (Ito ve ark., 2007). Kemoterapi ve radyoterapi sonrası ortaya çıkan oral mukozitisin tedavisi amacıyla yapılan bir çalışmada, Wnt agonisti olan R-spondin'in sistemik kullanımının bazal tabaka epitel rejenerasyonunu arttırarak ve Wnt/β-katenin sinyal yolunun yukarı regülasyonu yoluyla mukozal onarımı hızlandırarak oral mukozitis için güçlü bir terapötik ajan olduğu gösterilmiştir (Zhao ve ark., 2009).

GSK-3'ün farmakolojik inhibitörlerinin Alzheimer hastalığı, diğer nörodejeneratif hastalıklar, bipolar affektif bozukluk, tip 2 diyabet, kafa travması, inme gibi çeşitli hastalıkların tedavisinde kullanılabileceği düşünülmüştür. GSK-3'ün pek çok molekül inhibitöründen biri de Alzheimer gibi nörolojik bozuklukların tedavisinde klinik olarak denenen, farelerde pulpa hasarında reperatif dentin oluşturduğu bilinen, GSK-3β inhibitörü, TDZD (Thiadiazolidinones) grubu bir ilaç olan Td (NP-12, NP03112)'dir (Adamowicz ve ark., 2012).

Oncu ve ark.'nın *in-vitro* olarak yaptıkları çalışmada (Oncu B. ve ark., 2020), DMSO'da (dimetilsülfoksit) çözünmüş farklı konsantrasyonlardaki (50 nM, 100 nM, 200 nM) Td'in insan dişeti fibroblastları (hgf-1), periodontal

ligament fibroblastları (hpdlf) ve osteoblast hücreleri (hob) üzerine etkisi incelenmiştir. 50 nM Td uygulanması ile hgf-1 ve hob hücrelerindeki tip I kolajen salınımının kontrol grubuna göre anlamlı derecede yüksek bulunduğu tespit edilmiştir.

Literatürde Td'in kullanıldığı ve palatinal mukozada yara iyileşmesinin değerlendirildiği bir çalışma mevcut değildir. 50 nM Td'in hgf-1 hücrelerinde tip I kolajen seviyesinde anlamlı bir artış sağladığı öncül bir *in-vitro* çalışmayla tarafımızca gösterilmiştir (Oncu B. ve ark., 2020). Bu bulguların ışığında bu öncül çalışmanın amacı, BS ile uygulanan Td'in palatinal yaranın epitelizasyonu üzerindeki makroskobik etkisini değerlendirmektir.

GEREÇ VE YÖNTEMLER

Bu çalışmada deney hayvanı olarak; ortalama 3 aylık, ağırlıkları 250-300 gr arasında değişen, 12 adet genç erişkin erkek Sprague Dawley sıçan kullanıldı. Dişi sıçanlar, hormonal değişimler yara iyileşmesini etkileyebileceğinden çalışmaya dâhil edilmedi. Çalışmada kullanılacak deney hayvanları, Marmara Üniversitesi Deney Hayvanları Uygulama ve Araştırma Merkezi'nden temin edildi ve hayvanların bakımı Marmara Üniversitesi Deney Hayvanları Uygulama ve Araştırma Merkezi Deney Hayvanları Laboratuvarı'nda yapıldı. Sıçanlar standart deney kafesleri içerisine konuldu ve hayvan odasında (21±3°C'de nem oranı %45-55 12 saat gece 12 saat gündüz aydınlatma sağlanarak) barındırıldı. Sıçanlar *ad libitum* saf su ve standart sıçan yemi ile beslendi. Tüm deney basamakları, Marmara Üniversitesi Hayvan Deneyleri Yerel Etik Kurulu tarafından 09.11.2020 tarih ve 57.2020.mar proje kodu ile onaylandı.

Hayvanlar deneyin başında rastgele olarak başlangıç (n=3), pasif kontrol (n=3), hidrojel (n=3), Td+hidrojel (n=3) olmak üzere dört gruba ayrıldı. Hayvanlarda yara oluşturulmadan önce sıçanlar intraperitoneal olarak 100 mg/kg Ketamin-HCL (10 mg/100 g, Richter Pharma, Wels, Austria), 10 mg/kg Ksilazin HCL (Rompun, Bayer, Almanya) enjeksiyonuyla anestezi altına alındı.

Tüm cerrahi işlemler steril cerrahi koşullar altında asepsi, antisepsi ve sterilizasyon kurallarına dikkat edilerek gerçekleştirildi. Sıçanlarda palatal mukozanın ortasında, tek kullanımlık "*punch*" biyopsi aleti (Kai Medikal, Kai Industries Co., Ltd., Seki, Japonya) kullanılarak 4 mm çapında kemiğe kadar mukozal defekt oluşturuldu.

Kanama kontrolü yapıldıktan sonra mukoperiostal yaralar sekonder iyileşmeye bırakıldı. Defektin oluşturulduğu ilk gün sıfırıncı gün olarak kaydedildi. Cerrahi işlemden iki saat sonra hayvanlara *ad libitum* saf su ve piyasada mevcut yumuşak gıdalar (sabah Hero Baby bebek maması, akşam Nutricia Fortimel Energy) verildi. Başlangıç grubundaki sıçanlar 0. günde, diğer gruplardaki sıçanlar operasyon sonrası 7. günde yüksek dozda (200mg/kg) iv sodyum pentotal enjeksiyonu ile sakrifiye edildi. Ardından sıçanlara dekapitasyon uygulandı, maksillaları ayrıldı ve makroskopik olarak değerlendirildi.

Makroskopik Değerlendirme

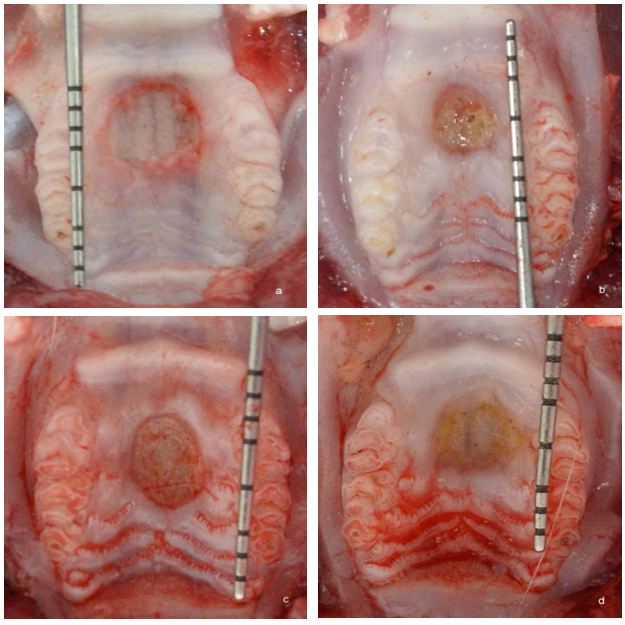
Palatal örnekler sabit bir mesafede ve büyütülmüş olarak Nikon Coolpix (Nikon Corp., Tokyo, Japan) ile fotoğraflandı. Standardizasyon için 10 mm'lik periodontal sond (Williams Sond, Hu Friedy, ABD) kullanıldı. Dijital fotoğraflar bilgisayara aktarıldı ve ortalama yara yüzey alanı 0. ve 7. günlerde bir görüntü işleme programı (Image J 1.53k; US National Institutes of Health, Bethesda, MD, USA) kullanılarak hesaplandı. Ölçümler çalışmaya katılmayan, grupların çalışmadaki karşılığını bilmeyen bir araştırmacı tarafından yapıldı.

İstatistiksel Analiz

Verilerin analizinde SPSS 23. versiyonu kullanılmıştır (SPSS Inc., Chicago, IL, ABD). Değişkenlerin normal dağılıma uygunluğu Kolmogorov Smirnov testi ile değerlendirildi. Değerlendirmelerin sonucunda çalışmadaki sayısal değişkenlerin normal dağılıma uymadığı belirlendi. Gruplar arası çoklu karşılaştırmalar için Kruskal-Wallis testi, anlamlı farklılık olması durumunda iki grubu karşılaştırmak için Bonferroni düzeltmeli Mann-Whitney U testi uygulandı. İstatistiksel anlamlılık *p* değeri 0.05 olarak tanımlandı.

BULGULAR

Ameliyat sonrası ilk hafta boyunca yaranın klinik değerlendirmesi (Resim 1) yaranın yavaş iyileştiğini göstermiştir. Kemiğin üzerini fibrinöz bir tabaka kaplamış olup yara kenarlarında peteşi gözlenmiştir.



Resim 1. Palatinal yaraların klinik görüntüsü, a: başlangıç grubu, b: pasif kontrol grubu, c: hidrojel grubu, d: Td+hidrojel grubu

Tüm grupların minimum, maksimum, ortalama yara yüzey alanı ve standart sapma değerleri Tablo 1'de gösterilmiştir. Ameliyattan hemen sonra 0. günde ortalama yara yüzey alanı 14.507 ± 1,95 mm² olarak hesaplanmıştır. Gruplar arası karşılaştırmada yara yüzey alanında istatistiksel olarak anlamlı fark gözlenmiştir (p=0,033). Gruplar arası ikili karşılaştırmalarda sadece başlangıç grubu ile Td+Hidrojel grubu arasında istatistiksel olarak anlamlı bir fark bulunmuştur (p= 0,028).

Tablo 1. Yara yüzey alanı

YARA YÜZEY ALANI (mm²)										
		n=3 Medyan Min-Maks (Ort ± SS)								
Başlangıç (a)	Pasif Kontrol (b)	Taşıyıcı (Hidrojel) (c)	Tideglusib+Hidrojel (d)	p*	p(a,b)	p(a,c)	p(a,d)	p(b,c)	p(b,d)	p(c,d)
13,548 13,222 – 16,753 (14,507 ± 1,951)	10,848 9,648 – 14,33 (11,608 ± 2,431)	10,519 7,91 – 10,778 (9,735 ± 1,586)	1,179 0,833 – 4,42 (2,144 ± 1,978)	**0,033**	1,000	0,678	**0,028**	1,000	0,249	1,000

*Kruskal Wallis testi, Bonferroni düzeltmeli Mann Whitnet U testi, SS: Standart Sapma, p<0,05

TARTIŞMA

Sekonder iyileşmeye bırakılan yara yüzeyleri ameliyat sonrası dönemde hastada kanama, ağrı ve hassasiyet gibi şikayetlere sebep olabilir. Açık bırakılan yaralar, enfeksiyona, kontraksiyona, skara ve diğer klinik komplikasyonlara karşı daha hassastır. Yara örtücü materyallerin kullanımı ile bu sorunlar giderilebilmektedir (May, 1991; Rastogi ve ark., 2009).

Son yıllarda; hücre yenilenmesi, hücre adezyonu, hedef hücre genlerinin transkripsiyonu, hücre polaritesinin ayarlanması, hücre proliferasyonu, hücre farklılaşması ve hücre göçünde etkili ayrıca doku hasarında oluşan erken yanıtta da görevli WSY üzerine yapılan araştırmalar önem kazanmıştır. Bu nedenle, GSK inhibisyonu da dahil olmak üzere çeşitli yollarla WSY aktivasyonu, onarım ve rejenerasyonda birincil hedeftir (Eisenmann, 2005; Tanır ve Demirezen, 2009; Popelut ve ark., 2010; Whyte ve ark., 2012).

2017 yılında Wnt/β-katenin sinyal yolunun dentin rejenerasyonu üzerine olan etkinliğinin kanıtlanması ile Wnt sinyal yollarının diş hekimliği alanında da araştırıldığı çalışmalar önem kazanmıştır (Neves ve ark., 2017). Diş hekimliği ve özellikle periodontoloji alanında yara iyileşmesi üzerine yapılan çalışmalar göz önüne alındığında her geçen gün, yeni biyomateryallerin etkinliği üzerine yapılan araştırmalar artmaktadır.

Td, doku rejenerasyonu, osteoblast proliferasyonu ve reperatif dentin üretimi için etkili olan küçük bir kimyasal GSK-3 inhibitörüdür. Literatürde Td kullanan ve damak mukozasında yara iyileşmesini değerlendiren bir çalışma bulunmamaktadır. DMSO'da çözünmüş farklı konsantrasyonlarda (50 nM, 100 nM, 200 nM) Td'nin insan dişeti fibroblastları (hgf-1), periodontal ligament fibroblastları (hpdlf) ve osteoblast hücreleri (hob) üzerindeki etkisi *in vitro* olarak araştırılmıştır (Oncu B ., Yılmaz A.M. ve diğerleri 2020). 50 nM Td uygulaması ile hgf-1 ve hob hücrelerinde tip I kollajen salınımının kontrol grubuna göre anlamlı derecede yüksek olduğu belirlenmiştir.

Bu çalışmanın makroskobik sonuçları, Td yüklü BS bazlı hidrojel yara örtücünün sıçan damağındaki yaranın iyileşmesi üzerinde yararlı etkileri olacağı hipotezine dayanarak gerçekleştirildi.

Çalışmamızda kullanılan yara modeli, Kahnberg ve ark.'nın uyguladığı yöntem referans alınarak "*punch*" biyopsi aleti kullanılarak yara oluşturacak şekilde tasarlanmıştır (Kahnberg ve Thilander, 1984).

Çalışmamızda, daha önce Hammad ve ark. tarafından tanıtılan bir yara alanı hesaplama yöntemi kullanılmıştır (Hammad ve ark., 2011). Bu yöntem, bir bilgisayar tarafından büyütülmüş dijital fotoğrafları standartlaştırarak, *Image J* yazılımı yardımıyla yara sınırlarının belirlenmesini ve bir yüzey alanı hesaplamasını içermektedir. Fotoğraflarda standardizasyon elde etmek için periodontal

sond kullanılmıştır. Bu teknik, diğer yöntemlerde mevcut olabilecek insan kaynaklı hataların etkisini azaltmaktadır.

Çalışmalarda farklı uygulamaların ve malzemelerin sıçanlarda oluşturulan palatinal yara modeli üzerindeki iyileşmeye etkisi değerlendirilmiştir. Kozlovsky ve ark. tarafından 2007 yılında yayınlanan bir çalışmada (Kozlovsky ve ark., 2007) palatinal verici bölgeye antimikrobiyal ajanlar (%0.12 klorheksidin diglukonat, %1 klorheksidin jel, Listerine Ve Meridol) topikal olarak uygulanmış ve yara yüzeyindeki etkinliği değerlendirilmiştir. Operasyon sonrası ilk hafta makroskobik olarak yavaş bir iyileşme gözlenirken 7-14 gün arası dönemde defekt boyutunda anlamlı bir küçülme gözlenmiştir. Histolojik değerlendirmede ise %1 klorheksidin jel ve Listerin kullanımından sonra önemli ölçüde yüksek bir yara epitelizasyon oranı gözlenirken Meridol solüsyonu uygulandığında daha düşük bir yara epitelizasyon oranı gözlenmiştir. Ayvazyan ve ark.'nın 2011 yılında yayınladıkları bir çalışmada (Ayvazyan ve ark., 2011) kolajen-jelatin taşıyıcı içine eklenmiş temel fibroblast büyüme faktörü mini vidalarla naylon bir *mesh* ile yaraya uygulanmış olup tedaviyi takiben tüm gruplarda 7. günde yaranın tamamen kapanmadığı, 14. günde test gruplarında yaranın tamamen kapandığı bildirilmiştir. Taşkan ve ark.'nın 2020 yılında yayınladıkları bir çalışmada (Taskan ve ark., 2021), topikal olarak uygulanan hyaluronik asitin palatinal yara iyileşmesindeki etkisi değerlendirilmiş ve test grubunda 7. günden itibaren makroskobik olarak yara yüzeyinde istatistiksel olarak anlamlı küçülme gözlenmiştir. Zhao ve ark. 2008 yılında yayınladıkları bir çalışmada (Zhao ve ark., 2009) Wnt-β katenin sinyal yolunu uyaran R-spondin1'in (RSpo1) kemoterapi ve radyoterapi gören kanser hastalarının dilindeki oral mukozitis üzerindeki etkisini değerlendirmişlerdir. Rekombinant RSpo1, transgenik farelere enjekte edilerek oral mukozitis üzerindeki etkisi incelenmiş ve bazal tabaka epitel rejenerasyonunu arttırarak oral mukozitis için güçlü bir terapötik ajan olduğunu göstermiştir. Alpan ve ark. 2020 yılında yayınladıkları bir çalışmada (Lektemur Alpan ve ark., 2020), Td'nin sıçan kalvaryal defektlerinde apoptozu azaltarak ve osteoblastogenezisi arttırarak kemik mineral yoğunluğunu, yeni kemik alanını ve toplam kemik alanını arttırdığı gösterilmiştir.

Çalışmamızda Td, BS bazlı hidrojel yara örtücü ile yaraya uygulanmış olup 7 gün boyunca yara örtücüden defekt alanına Td'nin salınımının yapılması sağlanmıştır. Çalışmamızın makroskobik değerlendirme sonucunda gruplar arası karşılaştırmada yara yüzey alanında istatistiksel olarak anlamlı farklılık gözlenmiştir. Gruplar arası ikili karşılaştırmalarda sadece başlangıç grubu ile Td+Hidrojel grubu arasında istatistiksel olarak anlamlı bir fark bulunmuştur. Böylece, GSK-3 antagonisti Td'nin damaktaki yara bölgesine uygulanmasının operasyon sonrası 7. günde yara yüzey alanında makroskobik olarak küçülme sağladığı gösterilmiştir.

Çalışmanın klinik sonuçlarının histolojik olarak teyit edilmesine ve daha ileri çalışmalara ihtiyaç olduğu düşünülmektedir.

SONUÇ

Çalışmamızın sonucunda, Wnt/β-katenin sinyal yolu üzerinden etki eden GSK-3 antagonisti Td'nin BS bazlı hidrojel yara örtücü ile yara bölgesine uygulanmasının erken dönemde yara iyileşmesinde makroskobik olarak olumlu sonuçları olduğu gözlenmiştir.

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ORIGINAL ARTICLE / ARAŞTIRMA MAKALESİ

Retrospective 3-dimensional Evaluation of Skeletal and Dental Structures Following Treatment with Hybrid Hyrax-Mentoplate with Class III Elastics in Class III Patients with Vertical Growth Pattern: A Pilot Study

Dikey Büyüme Paterni Olan Sınıf III Hastalarda Sınıf III Elastiklerle Hibrit Hyrax-Mentonplak Tedavisi Sonrası İskeletsel ve Dental Yapıların Retrospektif Olarak 3 Boyutlu Değerlendirilmesi: Bir Pilot Çalışma

Gamze YILDIRIM[1], Elvan Önem ÖZBILEN[2], Fulya ÖZDEMIR[3]

ABSTRACT

Objective: The aim of the present study is to evaluate the skeletal and dental changes three-dimensionally in patients with skeletal Class III malocclusion and vertical growth pattern treated with hybrid hyrax-mentoplate and Class III elastic combination**.**

Materials and Methods: In this retrospective study, cone-beam computed tomography images of 6 patients (5 females and 1 male; Mean age: 11.9±0.9 years) who had undergone an orthopedic treatment with hybrid hyrax-mentoplate and Class III elastic combination were retrieved from the archive of Marmara University, Department of Orthodontics. Initial and post-protraction skeletal and dental parameters were investigated by using 3D SLICER version 5.0.2 software (www.slicer.org). Statistical significance was set at $p<0.05$.

Results: Sagittal skeletal evaluation showed statistically significant increases of 2.31° in SNA, and 2.8° in ANB ($p<0.05$), with no significant change in SNB ($p>0.05$). There were no significant changes in vertical skeletal parameters except significant decreases in FH-OP and SN-OP angles of 5.28° and 5.18°, respectively. In terms of dental changes, while a significant decrease was found in LI-OP angle (8.82°), significant increases in LI-MP angle and in overjet change were found (5.27°, 3.75 mm, respectively) ($p<0.05$). There were no significant changes in upper incisor parameters, UI-LI angle, and overbite ($p>0.05$). A significant increase was found in both SN-16M and SN-26M (5.79 mm, 4.10 mm, respectively) ($p<0.05$), while a significant decrease was observed in MP-36M and MP-46M measurements (1.62 mm, 2.29 mm, respectively) ($p<0.05$).

Conclusion: With the use of hybrid hyrax-mentoplate and Class III elastic combination, orthopedic sagittal correction can be achieved in patients presenting high angle skeletal Class III without causing any changes in facial height, and the slope of mandibular and palatal planes.

Keywords: Orthodontic Anchorage Procedures, Orthodontics-Corrective, Orthodontic Appliance Design

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ÖZ

Amaç: Bu çalışmanın amacı, hibrit hyrax-mentonplak ve Sınıf III elastik kombinasyonu ile tedavi edilen iskeletsel Sınıf III maloklüzyonlu ve vertikal yönde artmış büyüme paterni olan hastalarda meydana gelen iskeletsel ve dental değişiklikleri üç boyutlu olarak değerlendirmektir.

Gereç ve Yöntemler: Bu retrospektif çalışmada hibrit hyrax-mentonplak ve Sınıf III elastik kombinasyonu ile ortopedik tedavi görmüş 6 hastanın (5 kadın ve 1 erkek, Ortalama yaş: 11,9±0,9 yıl) Konik Işınlı Bilgisayarlı Tomografi görüntüleri, Marmara Üniversitesi Ortodonti Anabilim Dalı arşivinden alınmıştır. Başlangıç ve protraksiyon sonrası iskeletsel ve dental parametreler 3D SLICER versiyon 5.0.2 yazılımı (www.slicer.org) kullanılarak incelenmiştir. İstatistiksel anlamlılık $p<0,05$ olarak belirlenmiştir.

Bulgular: Sagital iskeletsel değerlendirmede SNA açısında 2,31° ve ANB açısında 2,8° istatistiksel olarak anlamlı artış bulunurken ($p<0,05$), SNB açısında anlamlı değişiklik bulunamamıştır ($p>0,05$). Vertikal iskeletsel değerlendirmede FH-OP ve SN-OP açılarında sırasıyla 5,28° ve 5,18° anlamlı azalma gözlenirken ($p<0,05$), diğer vertikal iskeletsel ölçümlerde anlamlı bir değişiklik bulunmamıştır ($p>0,05$). Dental değerlendirme parametrelerinden, LI-OP açısında 8,82° anlamlı azalma, LI-MP açısında 5,27° artış ve *overjet* değişiminde 3,75 mm anlamlı artış gözlenmiştir ($p<0,05$). Üst keser açıları, UI-LI açısı ve *overbite* ölçümlerinde anlamlı bir değişiklik bulunamamıştır ($p>0,05$). Hem SN-16M hem de SN-26M'de (sırasıyla 5,79 mm ve 4,10 mm) ($p<0,05$) anlamlı artış bulunurken, MP-36M ve MP-46M ölçümlerinde (sırasıyla 1,62 mm ve 2,29 mm) ($p<0,05$) anlamlı azalma gözlenmiştir.

Sonuç: Hibrit hyrax-mentonplak ve Sınıf III elastik kombinasyonu uygulaması ile iskeletsel Sınıf III maloklüzyonlu ve artmış vertikal büyüme paternli hastalarda, yüz yüksekliğinde değişiklik olmaksızın ve mandibular ve palatal düzlemde rotasyon gözlenmeksizin sagittal yönde ortopedik düzeltme sağlanabilmektedir.

Anahtar Kelimeler: Ortodontik Tespit İşlemleri, Ortodonti-Düzeltici, Ortodontik Alet Dizaynı

INTRODUCTION

Skeletal Class III malocclusion is usually characterized by a retrognathic maxilla (Ellis III & McNamara Jr, 1984). The effectiveness of orthopedic correction with the use of face masks has been proven in growing patients; however,

it is not preferred in high-angle patients due to increase of existing vertical deformity (Baccetti et al., 2000; Arman et al., 2006). Therefore, the only treatment option for patients with increased vertical growth was thought to be orthognathic surgery; which could only be performed following the cessation of growth.

Skeletal anchorage systems have been adapted to and widely used in clinical orthodontic practice in the recent years (Çetinsahin & Arman, 2005). In studies examining the application of miniplate supported face masks, it was reported that an effective maxillary protraction was obtained, and mandibular posterior rotation was less than it was caused by face mask treatment (Kircelli & Pektas, 2008; Nevzatoglu & Kucukkeles, 2014; Şar et al., 2014; Liang et al., 2021). When BAMP (Bone-Anchored Maxillary Protraction) protocol studies were reviewed, it was seen that vertical control could be achieved (De Clerck et al., 2010; Heymann et al., 2010). However, the patients examined in these studies presented normal or low angle facial pattern.

In the literature, Hybrid hyrax-mentoplate studies reported that vertical control could be achieved with this treatment protocol. Katyal et al., Tarraf et al. and Willmann et al. reported that there were no significant changes in vertical values while skeletal maxillary protraction could be successfully achieved (Katyal et al., 2016; Willmann et al., 2018; Tarraf et al., 2023). Moreover, Tarraf et al. and Willmann et al. reported that this method could be beneficial especially in patients with increased facial height (Willmann et al., 2018; Tarraf et al., 2023). Similar to previous studies, the patient group examined in these three studies had normal or low angle vertical growth patterns. To the best of our knowledge, none of these studies had investigated the efficacy of this treatment protocol in patients with high angle growth pattern so far. Hence, the aim of this study was to evaluate effects of the hybrid hyrax-mentoplate and Class III elastics combination in patients with increased vertical height in three-dimension.

MATERIALS AND METHODS

The present retrospective study was approved by the Ethical Committee of Marmara University, Faculty of Medicine (Istanbul, Turkey, 28.03.2022-09.2022.243). The inclusion criteria were as follows:

- Age range between 10-13 years,
- Skeletal Class III malocclusion due to maxillary retrognathia (coexistence of one or more; SNA<78°, N⊥A< 0 mm, Witt's< – 5 mm, ANB<0)
- High angle vertical growth pattern (GoMe-Sn angle >39°, FMA angle >25°),
- Concave profile.

The exclusion criteria were as:

- Craniofacial deformity, growth disorder or hormonal disorder,
- Missing files, routine records and cone-beam computed tomography (CBCT) data,
- Non-cooperative patients.

According to these criteria 6 patients (5 females and 1 male, Mean age: 11.9±0.9 years) were retrieved from the archive of Marmara University, Faculty of Dentistry, Department of Orthodontics and included in the present retrospective study.

According to the information obtained from the patient files, 1.7×8 mm (OrthoEasy® Pal Forestadent®, Bernhard Foerster GmbH, Pforzheim, Germany) palatal screws were inserted at the anterior palate on both sides of midpalatal suture or near the third palatal rugae as suggested by Wilmes et al. (Wilmes et al., 2011). After the placement of two orthodontic bands for maxillary first molars and abutments for palatal screws, an alginate impression (Alginate, Tropicalgin, Zhermack, Rovigo, Italy) was taken to fabricate a hybrid hyrax device. The hybrid hyrax device was secured with two fixation screws in the mouth. For the placement of mentoplates (ANCOR Orthodontics, Ankara, Türkiye), a mucoperiosteal flap was elevated. The mentoplates were placed to the anterior symphysis under local anesthesia and secured with three screws by the same surgeon (GG) (Fig. 1a and 1b).

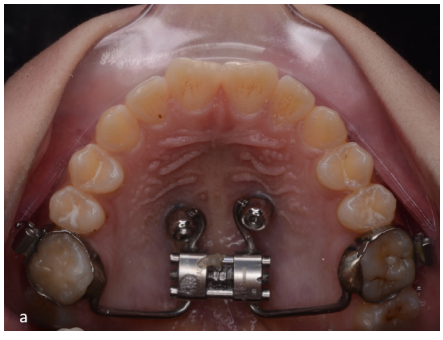

Figure 1: a) Upper occlusal photo with clear view of the hybrid-hyrax device

Figure 1: b) Intraoral frontal photo with a clear view of the mentoplate

One week of rapid maxillary expansion (RME) with the hybrid hyrax device was performed by the parents of patients by activating the screws 0.5 mm/day (1/4 turn in the morning and 1/4 turn in the evening). Following RME, orthopedic force (200-250 gr. unilaterally) was applied with Class III elastics from the hooks of molar bands of hybrid-hyrax to the hooks of the mentoplates. The orthopedic force was checked at 6-week intervals. When dental Class II canine relationship was achieved and the desired change in the profile was obtained, the treatment was terminated (6 months on average).

CBCT images were taken before (T0: before mentoplate and hybrid-hyrax application) and after (T1: before mentoplate removal) the intervention via an Iluma Imtec Imaging Machine (3M, Ardmore, OK, USA; X-ray tube voltage: 120 kV; X-ray tube current: 1–4 mA; scanning time: 40 seconds maximum and 7.8 seconds minimum; field of view: 14.2 × 21.1 cm; voxel size: 0.0936 mm; grey scale: 14 bit); while the patients were sitting in an upright position with their Frankfort horizontal plane set parallel to the floor. Skeletal and dental changes were analyzed using 3D SLICER version 5.0.2 software (www.slicer.org) (Fedorov et al., 2012). All CBCT images were reoriented by arranging midsagittal, Frankfort horizontal and transporionic planes to match with sagittal, axial and coronal planes, respectively, which were already available in the software (de Oliveira Ruellas et al., 2016). Following the reorientation of the head, three-dimensional (3D) models were created, and skeletal and dental points were marked and checked in both CBCT slices and 3D models (Table 1 and Table 2). To create midpoints and perform measurements, "Slicer CMF" extension was used. For intraosseous landmarks, "Volume Rendering" extension was used.

Table 1. Definition of the anatomical landmarks and planes

Landmark	Abbreviation	Definition
		Dental
Molar Right	MoR	Midpoint of mesiobuccal cusps of right upper and lower first molars
Molar Left	MoL	Midpoint of mesiobuccal cusps of left upper and lower first molars
Upper Right Molar	16M	Mesial cusp tip of upper right first molar
Upper Left Molar	26M	Mesial cusp tip of upper left first molar
Lower Left Molar	36M	Mesial cusp tip of lower left first molar
Lower Right Molar	46M	Mesial cusp tip of lower right first molar
Upper Incisor Mesial	UIm	The most mesial point of upper right central incisor
Upper Incisor Distal	UId	The most distal point of upper right central incisor
Lower Incisor Mesial	LIm	The most mesial point of lower right central incisor
Lower Incisor Distal	LId	The most distal point of lower right central incisor
Line	Abbreviation	Definition
Frankfort Horizontal Line	FH	a line passes from the midpoint of Orbitales through the midpoint of Porions
Sella Nasion Line	SN	a line passes through Sella and Nasion
Palatal Plane Line	PP	a line passes through ANS and PNS
Mandibular Plane Line	MP	a line passes from the midpoint of Gonions through Menton
Occlusal Plane Line	OP	a line passes from the midpoint of MoR and MoL through the midpoint of UIm-UId (midpoint of UIm and UId) and LIm-LId (midpoint of LIm and LId)
Upper Incisor Line	UI	a line passes from the midpoint of UIm and UId through the upper right central apex
Lower Incisor Line	LI	a line passes from the midpoint of LIm and LId through the lower right central apex

Table 2. Definition of measurements

Skeletal Measurements	
Abbreviation	Definition
FH-PP (°)	pitch angle between FH line and PP line
FH-OP (°)	pitch angle between FH line and OP line
FH-MP (°)	pitch angle between FH line and MP line
SN-PP (°)	pitch angle between SN line and PP line
SN-OP (°)	pitch angle between SN line and OP line
SN-MP (°)	pitch angle between SN line and MP line
N-ANS (mm)	superoinferior component of distance between N and ANS
N-Me (mm)	superoinferior component of distance between N and Me
ANS-Me (mm)	superoinferior component of distance between ANS and Me
S-K(mm)	superoinferior component of distance between S and midpoint of GoR and GoL
Jarabak Ratio	SK / N-Me
SNA (°)	pitch angle between SN line and A point
SNB (°)	pitch angle between SN line and B point
ANB (°)	Arithmetic difference of SNA angle and SNB angle
Dental Measurements	
UI-SN (°)	pitch angle between SN line and UI line
UI-OP (°)	pitch angle between UI line and OP line
UI-PP (°)	pitch angle between UI line and PP line
LI-OP (°)	pitch angle between LI line and OP line
LI-MP (°)	pitch angle between LI line and MP line
UI-LI (°)	pitch angle between UI line and LI line
SN-16M (mm)	superoinferior component of distance between SN line and 16M
SN-26M (mm)	superoinferior component of distance between SN line and 26M
MP-36M (mm)	superoinferior component of distance between MP line and 36M
MP-46M (mm)	superoinferior component of distance between MP line and 46M
Overjet (mm)	anteroposterior component of distance between the midpoint of UIm and UId to LI and LIm
Overbite (mm)	superoinferior component of distance between the midpoint of UIm and UId to LI and LIm

Statistical Analysis

IBM SPSS Statistics (version 23, IBM Corp, Armonk, NY) software was used for statistical analyses. Due to the small number of patients, parametric assumptions could not be provided; therefore, Wilcoxon paired two-sample test was used to analyze the changes between the T0 and T1 time points. P<0.05 was considered as statistically significant. For method error evaluation, all measurements were repeated by the same author (GY) four weeks after the first tracing and intraclass correlation coefficient (ICC) was calculated.

RESULTS

ICC was found close to 1.00 for all measurements, showing that all skeletal and dental measurements can be repeated with a non-significant error that would not affect the results (P<0.001).

Sagittal evaluation showed that, while there was a statistically significant increase of 2.31° and 2.80° in SNA and ANB angles respectively (p<0.05), no significant change was found in SNB angle (Table 3 and 5). When vertical measurements were evaluated, no significant changes were found except occlusal plane angles (p>0.05), in which there were statistically significant decreases of 5.28° and 5.18° in FH-OP and SN-OP angles, respectively (p<0.05) (Table 3 and 5).

Table 3. Inital and post-treatment evaluation of skeletal changes.

	T0				T1				p
Parameters	Mean	SD	Min	Max	Mean	SD	Min	Max	
FH-OP (°)	9.78	2.73	5.7	12.11	4.5	2.38	2.68	8.92	0.028*
FH-PP	2.88	1.48	0.33	4.91	3.77	4.61	0.32	11.88	0.600
FH-MP (°)	31.07	1.81	28.55	33.2	29.08	2.52	25.95	32.23	0.075
SN-PP (°)	10.82	5.39	3.39	19.33	8.88	4.81	2.86	14.78	0.249
SN-OP (°)	19.42	4.29	13.29	25.8	14.24	4.94	6.66	21.17	0.046*
SN-MP (°)	40.95	2.81	37.77	45.06	39.73	4.63	35.29	47.95	0.345
N-ANS (mm)	49.23	2.51	44.4	51.61	49.96	1.13	48.66	51.39	0.345
N-Me (mm)	109.76	6.09	101.4	119.35	111.1	5.67	106.58	121.7	0.249
ANS-Me (mm)	60.53	4.7	57	69.43	61.13	6.02	57.16	73.04	0.345
Jarabak Ratio	0.6	0.06	0.52	0.7	0.6	0.05	0.5	0.66	0.917
S-K	66.71	6.19	56.92	72.51	66.98	6.87	56.21	76.85	0.753
SNA (°)	78.27	3.01	73.35	81.56	80.58	2.8	76.8	83.87	0.028*
SNB (°)	79.85	3.17	74.53	84.01	79.36	3.06	74.37	82.53	0.753
ANB (°)	-1.58	1.36	-3.48	0.32	1.22	1.84	-0.35	4.36	0.028*

Wilcoxon test statistic, Mean, SD (standard deviation), Min (minimum), Max (maximum),
*T0: Initial, T1: Post-treatment, *p<0.05*

No significant changes were observed in UI-SN, UI-OP and UI-PP angles (p>0.05) (Table 4 and 5). On the contrary, a significant increase of 5.27° in the LI-MP angle and a significant decrease of 8.82° in the LI-OP angle were found (p<0.05) (Table 4 and 5). Significant increases were found for both SN-16M and SN-26M which were 5.79 mm and 4.10 mm, respectively (p<0.05) (Table 4 and 5). In contrast, significant decreases of 1.62 mm for the MP-36M and 2.29 mm for the MP-46M were observed (p<0.05) (Table 4 and 5). Moreover, while there was a significant increase of 3.75 mm in the overjet (p<0.05), no significant change in overbite was found (p>0.05) (Table 4 and 5).

Table 4. Inital and post-treatment evaluation of dental changes.

	T0				T1				p
Parameters	Mean	SD	Min	Max	Mean	SD	Min	Max	
UI-SN (°)	109.29	7.65	99.64	118.35	109.47	6.09	100.67	118.95	0.917
UI-OP (°)	50.48	6.35	44.38	60.99	56.27	7.05	47.74	64.25	0.249
UI-PP (°)	119.72	6.77	111.06	131.09	118.66	9.51	103.55	130.93	0.345
LI-OP (°)	76.05	8.6	67.75	89.67	67.23	5.62	60.26	76.02	0.046*
LI-MP (°)	82.06	7.63	70.54	93.17	87.34	5.08	82.53	96.47	0.028*
UI-LI (°)	127.89	12.06	112.25	143.67	123.44	10.34	111.93	135.45	0.917
SN-16M (mm)	62.50	3.54	58.37	66.87	68.29	3.91	64.52	75.14	0.028*
SN-26M (mm)	63.42	4.97	58.02	71.78	67.52	3.06	64.81	73.19	0.028*
MP-36M (mm)	20.29	1.5	18.37	21.86	18.68	0.98	17.08	20.11	0.028*
MP-46M (mm)	19.98	2.16	17.17	22.72	17.69	1.60	16.28	20.10	0.028*
Overjet (mm)	-0.55	2.28	-3.37	2.08	3.19	2.15	1.18	7.32	0.028*
Overbite (mm)	-0.02	2.71	-3.63	3.8	-0.08	1.87	-2.33	2.24	0.917

Wilcoxon test statistic, Mean, SD (standard deviation), Min (minimum), Max (maximum),
*T0: Initial, T1: Post-treatment, *p<0.05*

Table 5. Skeletal and dental changes between T0 and T1

	ΔT1-T2				
Parameters	Mean	SD	Min	Max	p
FH-PP (°)	0.89	4.60	-3.97	8.61	0.600
FH-OP (°)	-5.28	3.20	– 9.36	-2.24	0.028*
FH-MP (°)	-1.99	2.02	-4.55	1.06	0.075
SN-PP (°)	-1.94	5.43	-7.98	7.93	0.249
SN-OP (°)	-5.18	5.85	-15.60	1.8	0.046*
SN-MP (°)	-1.22	2.48	-4.26	2.89	0.345
N-ANS (mm)	0.73	1.90	-1.25	4.34	0.345
N-Me (mm)	1.34	2.81	-2.84	5.18	0.249
ANS-Me (mm)	0.61	2.47	-3.47	3.61	0.345
S-K	0.27	3.54	-5.84	4.33	0.753
Jarabak Ratio	-0.01	0.04	-0.09	0.02	0.917
SNA (°)	2.31	1.64	0.34	4.87	0.028*
SNB (°)	-0.49	2.16	-4.49	1.45	0.753
ANB (°)	2.80	2.41	0.27	6.81	0.028*
UI-SN (°)	0.18	7.67	-10.33	10.90	0.917
UI-OP (°)	5.79	9.80	-6.26	17.47	0.249
UI-PP (°)	-1.06	5.73	-7.51	6.35	0.345
LI-OP (°)	-8.82	9.73	-25.05	1.25	0.046*
LI-MP (°)	5.27	6.71	1.00	18.49	0.028*
UI-LI (°)	-4.45	13.60	-31.74	3.91	0.917
SN-16M (mm)	5.79	2.78	1.57	9.23	0.028*
SN-26M (mm)	4.10	2.88	0.21	7.49	0.028*
MP-36M (mm)	-1.62	1.10	-3.30	-0.02	0.028*
MP-46M (mm)	-2.29	1.84	-5.04	9.23	0.028*
Overjet (mm)	3.75	2.90	0.08	6.06	0.028*
Overbite (mm)	-0.07	1.02	-1.56	1.30	0.917

*Wilcoxon test statistic, Mean, SD (standard deviation), Min (minimum), Max (maximum), T0: Initial, T1: Post-treatment, *p<0.05*

DISCUSSION

Many treatment approaches have been reported for the orthopedic treatment of skeletal Class III malocclusion; however, most of them are not suitable to be used in patients with high angle vertical pattern due to the resulting downward and backward rotation of the mandible. It is an established fact that face mask treatment produces posterior rotation of the mandible (Baccetti et al., 2000; Westwood et al., 2003; Arman et al., 2006).

Various treatment protocols have been suggested in the literature to overcome this problem. In a study by Şar et al., it was reported that applying forces to face mask from anchoring miniplates placed on the lateral walls of apertura priformis significantly reduced the clockwise rotation of the mandible (Şar et al., 2011). Still, there are also some studies reporting that a similar treatment approach would cause an increase in vertical facial values (Kircelli & Pektas, 2008; Kaya et al., 2011).

In an attempt to minimize vertical changes, some researchers suggested maxillary protraction that is achieved using the hybrid-hyrax appliance as an anchorage unit with face mask (Nienkemper et al., 2013; Ngan et al., 2015; Nienkemper et al., 2015; Maino et al., 2018). In a study where altramec protocol was used, it was stated that there was no significant change in the vertical facial values (Maino et al., 2018). However, there are other studies which state that this method also caused an increase in vertical values (Nienkemper et al., 2013; Ngan et al., 2015; Nienkemper et al., 2015). In all these studies, the groups of patients investigated were composed of individuals presenting normal vertical facial pattern.

With the introduction of BAMP protocol, it was reported in the first publications that following treatment, while vertical control was provided in most of the cephalometric values of the patient groups, some vertical values were increased (De Clerck et al., 2009; Heymann et al., 2010). On the other hand, there are also studies reporting that counterclockwise rotation of the mandible was observed in patients treated with the BAMP protocol (De Clerck et al., 2010; Eid et al., 2016).

Studies on hybrid hyrax-mentoplate protocol, which is a relatively new method, indicate that clockwise rotation does not occur in the mandible in individuals with a normal vertical pattern (Katyal et al., 2016; Willmann et al., 2018; Tarraf et al., 2023). Only one study have investigated the effects of this treatment protocol in patients with increased vertical values so far, in which a MARPE (Miniscrew-Assisted Rapid Palatal Expansion) system was used as maxillary anchorage (Facio-Umaña et al., 2021). No studies were found in the literature evaluating the dental and skeletal effects of hybrid hyrax-mentoplate combination in high angle patients.

While traditional lateral cephalometric analysis neglects the mediolateral axis, frontal cephalometric radiographs neglect the postero-anterior dimension (Rossini et al., 2011). On the other side, in the present study, 3D variables that we measured on the available CBCT data, which was used for the surgical procedure, provided more reliable data, as it eliminated distortion such as overlapping of anatomical structures and magnification problems that make it difficult to obtain accurate measurements on 2D images (Leung et al., 2010; Özbilen et al., 2021).

One week rapid maxillary expansion was done in order to enhance treatment outcome by activating surrounding sutures. There are many studies which suggest that rapid maxillary expansion increases the effectiveness of maxillary protraction by increasing cellular activity in the circummaxillary sutures (Kapust et al., 1998; Baccetti et al., 2000; Saadia & Torres, 2000; Tortop et al., 2007)

The patients included in the study were in the 10-13 years old range, which is more than recommended maximum age for standard facemask treatment; however this age group is compatible with the literature in terms of age group for bone-anchored maxillary protraction (BAMP) protocol (Merwin et al., 1997; Sung & Baik, 1998; Yüksel et al., 2001).

A significant increase of 2.31° was found in the SNA angle in the present study; which indicates an anterior movement of the maxilla. In other studies using the same technique as our study, Katyal et al. found an increase of 2.1° and Willman et al. found an increase of 2.23° in SNA angle (Katyal et al., 2016; Willmann et al., 2018) similar to our results. In another study a 4.26° increase was found in SNA angle (Tarraf et al., 2023), which is higher than the present study. The reason for this difference may lie in treating younger patients, longer treatment duration and variation in patient numbers.

With a similar treatment technique, Facio-Umaña et al. found a 4.08° increase in SNA angle (Facio-Umaña et al., 2021). The reason why more increase were reported in this study might be the use of more and longer screws in the MARPE system and also the different expansion protocol.

On the other hand, Miranda et al. reported an increase of 1.47° in the SNA angle (Miranda et al., 2021), which was less than reported in the present study. Although the treatment duration was longer in their study, the differences between two studies in terms of SNA angle change might be attributed to the use of miniscrews as mandibular anchorage in their study instead of miniplates as in the present study.

If the results of the studies carried out with the BAMP protocol were evaluated, Eid et al. and Elnagar et al. reported 2.8° and 5.65° increases in SNA angle, respectively (Eid et al., 2016; Elnagar et al., 2016). The slight difference between our study and the study of Eid et al. may be due to the differences in elastic force which was higer in their study (Eid et al., 2016). However, the increase in SNA angle was dramatically high in the study of Elnagar et al. which may be related with the longer duration of orthopedic force application (Elnagar et al., 2016).

No significant change was found in the SNB angle in the present study which was consistent with previous literature findings (Katyal et al., 2016; Willmann et al., 2018; Tarraf et al., 2023). Moreover, in the present study, there was a significant increase of 2.8° in ANB angle. In the literature, Katyal et al., Willmann et al., and Tarraf et al. found increases of 1.9°, 2.54°, and 5.25° in ANB angle, respectively, where the treatment protocols were the same as in the present study (Katyal et al., 2016; Willmann et al., 2018; Tarraf et al., 2023). Since none of these studies have found significant change in SNB angle, the difference in ANB angle depends on the change of SNA angle. Many studies have found an increase in ANB angle, as in this present study, and almost all are due to increases in SNA angle (Eid et al., 2016; Elnagar et al., 2016; Facio-Umaña et al., 2021).

In terms of vertical measurements, no significant changes were found in SN-MP and FH-MP angles; which means there was no significant rotation of the mandibular plane. Katyal et al., Willman et al. and Tarraf et al. also reported no significant change in SN-MP angle which supports our results (Katyal et al., 2016; Willmann et al., 2018; Tarraf et al., 2023). Although there are methodological differences, Eid et al. and Elnagar et al. also found the same results for SN-MP angle as in the present study (Eid et al., 2016; Elnagar et al., 2016). Miranda et al. compared the hybrid hyrax-miniscrew combination with the conventional hyrax-miniscrew group and reported an increase of 0.95° in the FH-MP angle(Miranda et al., 2021). However, it should be noted that there is a methodological difference between this studies and our study.

According to the findings of the present study, there was no significant change in SN-PP angle which is parallel with the study of Willman et al. (Willmann et al., 2018). On the contrary, Katyal et al. reported a 0.8° significant decrease, which may not be clinically significant (Katyal et al., 2016). In the studies where the BAMP protocol was applied, Elnagar et al., Eid et al., and De Clerck et al. reported that no significant rotation was observed in the maxilla when compared to the control group (De Clerck et al., 2010; Eid et al., 2016; Elnagar et al., 2016). Although there are many studies supporting our result plane (Willmann et al., 2018, De Clerck et al., 2010; Eid et al., 2016; Elnagar et al., 2016), there is a study reporting rotation in the palatal (Katyal et al., 2016). Various researchers have described different anatomical points for the center of resistance of the maxilla. That is because, the location of the center of resistance of maxilla cannot be determined exactly and it cannot be clearly identified extraorally. Also, the applied elastics cannot pass through the center of resistance of the maxilla due to anatomical limitations. Inability to determine the exact location of the resistance center of the maxilla may cause rotation in the palatal plane after treatment with different techniques.

No significant change was observed in any of the vertical measurements and also Jarabak ratio. Since no significant clockwise rotation was observed in the mandible, these results are consistent with other findings in this present study.

Significant increases were found in SN-16M and SN-26M which showed upper molar extrusion. Moreover, significant decreases found in MP-36M and MP-46M indicated the intrusion of lower molars. Although the upper molars were attached to the skeletal anchor unit, extrusion may have occurred due the vectorial force of the Class III elastics. Also, it was written in the patient files that composite blocks were made on the lower first molars in order to avoid contact in the anterior region during anterior traction. This may be the reason for the significant intrusion of lower molars over the time. When the literature was reviewed, no information was found evaluating the vertical movements of molar teeth in patients who were treated with the current technique. was applied. In the present study, in terms of vertical measurements, significant changes were seen only in SN-OP and FH-OP angles, as 5.18° and 5.28° of decreases, respectively, showing counterclockwise rotation

of the occlusal plane. Within the lights of these findings, one may conclude that the movement of the molar teeth caused the counterclockwise rotation of the occlusal plane.

No significant changes were observed in UI-SN and UI-PP angles in the present study. This is in concordance with the other studies using either the same or similar treatment protocols (De Clerck et al., 2010; Elnagar et al., 2016; Katyal et al., 2016; Willmann et al., 2018; Facio-Umaña et al., 2021; Tarraf et al., 2023). On the other hand, Eid et al. reported significant increases in these angles and explained with occlusal interferences formed by the contact of the upper incisors with the lower incisors during maxillary protraction (Eid et al., 2016). Singer et al. also reported that retroclination occurred for the same reason in the case report they published (Singer et al., 2000). In the present study, in patients with the possibility of occlusal interference, occlusion was opened with bite raisers until the contact disappeared. This could be the reason why significant protrusion or retrusion was not observed in the UI-SN and UI-PP angles.

A statistically significant increase of 5.27° was found in the LI-MP angle. Different from our result, Katyal et al., Willmann et al. and Tarraf et al. reported no significant change in LI-MP (Katyal et al., 2016; Willmann et al., 2018; Tarraf et al., 2023). When the previous studies using similar technique was evaluated, while some of them reported significant protrusion in the lower incisors as in the present study, some others reported no significant movement (Cevidanes et al., 2010; De Clerck et al., 2010; Eid et al., 2016; Elnagar et al., 2016). Şar et al. suggested that the hooks of mandibular miniplates could reduce the lower lip pressure, showing lip bumper effect; which might be the reason of lower incisor protrusion (Şar et al., 2014).

UI-LI angle did not change significantly in the present study. Katyal et al. also reported no significant change in UI-LI angle. However, Eid et al., stated a significant increase in UI-LI angle which might have occurred as a result of significant protrusion in the upper incisors (Eid et al., 2016).

In our study, a statistically significant increase of 3.75 mm was found in overjet. Katyal et al. also reported a 2 mm of increase (Katyal et al., 2016). In their studies, it was stated that 3/16, 3.5 oz. elastics were used throughout the entire treatment. Since force will decrease using the same diameter elastic during the forward movement of the maxilla; this could be the reason why they found smaller increase in overjet. Tarraf et al. reported 4.12 mm increase in overjet (Tarraf et al., 2023). Although they reported a value close to the change we found, methodological differences (longer expansion duration, different age group, different number of patients) may be why they found a greater increase in overjet compared to our study. In the literature, following similar treatment protocols, Elnagar et al. reported 7.11 mm, De Clerck et al. reported 3.7 mm and Cevidanes et al. reported 3.7 mm overjet increase. The variation in results may again be due to methodological differences.

No statistically significant change was found in the measurement of overbite. Katyal et al. and Tarraf at. al. did not report any significant change in overbite measurement, parallel to the present study (Katyal et al., 2016; Tarraf et al., 2023). When similar studies were evaluated, contrary to our results, while Elnagar et al. found significant decrease, De Clerck et al. found significant increase in overbite change (De Clerck et al., 2010; Elnagar et al., 2016). The fact that the overbite measurement can be influenced not only by the rotation of the mandible but also by the incisor angles, might be the reason for the differences in the literature.

CONCLUSION

Hybrid hyrax-mentoplate and Class III elastics combination provides sagittal skeletal correction without increasing the facial height in patients with skeletal Class III malocclusion with high angle vertical growth pattern. However, counterclockwise rotation of the occlusal plane was observed as a result of the treatment in the present study, which may be due to extrusion of the upper molars and intrusion of the lower molars. Moreover, while this treatment protocol did not cause a significant change in the upper incisor angles, it created a significant increase in the lower incisor angles.

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Conflicts of interest

None to declared.

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ORIGINAL ARTICLE / ARAŞTIRMA MAKALESİ

Evaluation of Mandibular Condyle Shape Distribution Using Digital Panoramic Images

Temporomandibuler Eklem Kondil Şekillerinin Dağılımlarının Dijital Panoramik Radyograflar ile İncelenmesi

Elvan ÖNEM ÖZBİLEN[1], Begüm TURAN[2], Ece BAŞAL[1], Gamze YILDIRIM[2]

ABSTRACT

Objective: The human condyle is capable of remodelling over time as numerous factors such as age, sex, occlusal force, malocclusion, and skeletal relationship influence this remodelling. This change in shape can lead to the numerous symptoms of degenerative joint disease. The aim of this study was to investigate the different morphologies of the condyle in different age groups at the Faculty of Dentistry, Marmara University, Department of Orthodontics, using orthopantomography.

Materials and Methods: A total of 681 panoramic radiographs obtained for this study. The study group consists of 399 female and 282 male individuals aged between 15-55 years. Articular eminence and glenoid fossa regions of the mandibular condyle was traced. The mandibular condyle morphology was classified into six types such as oval, birdbeak, diamond, flat, crooked finger and bifid. Intergroup differences were evaluated with Chi-square and McNemar tests. ($p<0.05$)

Results: A total of 1362 right and left condyles of 681 patients were examined. The most common shape among the six condylar types – regardless of age and gender – was oval condylar morphology, followed by flat, diamond-shaped, crooked finger, birdbeak, and bifid.

Conclusions: As a result of the examination of condyle shapes in individuals with different ages on panoramic radiographs, the process of remodelling of the temporomandibular joint condyle over time was observed. The differences found between the age groups are interpreted to be related to the cumulative increase in the amount of functional loading to which the condyle is exposed with increasing age.

Keywords: Condyle shape, mandibular condyle, orthopantomogram

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ÖZ

Amaç: Temporomandibular eklem kondili, yaş, cinsiyet, oklüzal kuvvet, maloklüzyon ve iskeletsel patern gibi birçok sayıda faktörün etkisiyle zaman içinde yeniden şekillenebilmektedir. Kondil şeklinde oluşan bu değişiklik, dejeneratif eklem hastalığının çeşitli semptomlarına yol açabilir. Bu çalışmanın amacı, Marmara Üniversitesi Diş Hekimliği Fakültesi'ne başvuran hastalarda farklı yaş gruplarında mandibuler kondilin farklı morfolojilerini panoramik radyografi yardımıyla araştırmaktır.

Gereç ve Yöntemler: Toplam 681 panoramik radyografi ile yapılan bu çalışmada, çalışma grubu 15-55 yaş arası 399 kadın ve 282 erkek bireyden oluşmaktadır. Mandibular kondilin artiküler eminens ve glenoid fossa bölgeleri incelenerek şekilleri belirlenmiştir. Mandibular kondil morfolojisi oval, kuş gagası, elmas, düz, çarpık parmak ve bifid olmak üzere altı tipte sınıflandırılmıştır. Gruplar arası farklar Ki-kare ve McNemar testleri yardımıyla analiz edilmiştir. ($p<0,05$)

Bulgular: 681 hastaya ait toplam 1362 sağ ve sol kondil incelenmiştir. Altı kondil tipi arasında yaş ve cinsiyet farkı gözetmeksizin en yaygın görülen şekil oval kondil morfolojisi olarak saptanırken, bunu sırasıyla düz, elmas, çarpık parmak, kuş gagası ve bifid kondil şekilleri izlenmiştir.

Sonuç: Farklı yaşlardaki bireylerde kondil şekillerinin panoramik radyograflarda incelenmesi sonucunda, temporomandibular eklem kondilinin zaman içinde yeniden şekillenme süreci gözlenmiştir. Yaş grupları arasında tespit edilen farklılıkların, bireyin artan yaşı ile birlikte kondilin maruz kaldığı fonksiyonel yükleme miktarının birikimsel artışı ile ilişkili olduğu düşünülmektedir.

Anahtar Kelimeler: Kondil şekli, mandibular kondil, ortopantomogram

INTRODUCTION

The temporomandibular joint (TMJ) is the most intricate and significant component of the body and masticatory system. It helps with speech, swallowing, and food chewing. The condylar process, glenoid fossa, articular disc, and articular prominence form the majority of the mandible (Ulhuq, 2008). Between normal and abnormal conditions, dentists — especially orthodontists and maxillofacial

radiologists — need to have a thorough knowledge of the anatomy and morphology of the TMJ (Sonal et al., 2016). The management of temporomandibular disorders (TMD) is carried out by dentists with a variety of specializations. Due to its multifactorial character, it necessitates a comprehensive evaluation and treatment strategy. In orthodontics, the location of the condyle may be important for two reasons: to diagnose and treat TMJ dysfunctions or to differentiate the body of mandible postures (Westesson, 1993).

Panoramic radiographs (OPG) are the most frequently used diagnostic instrument by dental clinicians to obtain general information about teeth, the mandible, and other related structures of the jaw (Momjian et al., 2011). It provides clinician important information about the osseous changes or flattening that occur over time, as well as the anatomical diversity of the maxilla and mandible (Honda et al., 1994). Moreover, the American Academy of Oral and Maxillofacial Radiology has also suggested routine panoramic view for evaluating the structural components of the temporomandibular joint due to the low cost and risk of the relatively low radiation exposure compared to computed tomography (Epstein et al., 2001).

Various condyle shapes have been discussed by a number of authors from around the globe (Ahn et al., 2006; Ribeiro et al., 2015; Sonal et al., 2016; Khanal & Pranaya, 2020). Condyle variation in size and form aids in the diagnosis of TMDs linked to malocclusions like cross bite, deep bite, and open bite (Al-Saedi et al., 2020). The mandibular condyle has an oval and biconvex upper surface and a rounded head in healthy people. The human condyle has the ability to change over time due to a variety of influences, including age, sex, occlusal force, dental and skeletal malocclusion (Bae et al., 2017). With age, this remodeling is seen to become more pronounced as the TMJ is subjected to increasing amounts of occlusal loading from grinding and chewing (Hegde et al., 2013). It is thought to be the result of a long-lasting inflammatory process that causes a number of biomechanical adjustments in the joint's hard and soft tissues, causing the immune system to release inflammatory mediators like cytokines and chemokines (Egloff et al., 2012; Wang et al., 2012). As a result of the process, the complement system is activated and cartilage-degrading substances like matrix metalloproteinase (MMPs) and prostaglandin E (PGE) are released, further damaging the joint cartilage. As a consequence, the bone changes and the joint cartilage eventually deteriorates and is abraded (Tanaka et al., 2008; Egloff et al., 2012). By flattening the condyle head, this remodelling can alter the condyle's shape from being rounded or oval to diamond shape, pointed, birdbeak shape, or crooked finger shape.

The most prevalent classification method used in the majority of prior studies comprises the oval, birdbeak, diamond, and crooked finger types of condyles (Sonal et al., 2016; Jawahar & Maragathavalli, 2019; Khanal & Pranaya, 2020; Shaikh et al., 2022). Two other studies had used the second most common classification consisting of the condyles with rounded, angled, flattened, and mixed types (Ribeiro et al., 2015; Singh & Chakrabarty, 2015).

The aim of the present research is to document the types of typical morphological variations of the condyle by using OPG and to determine how frequently various condylar morphological variations occur in patients who had applied to Marmara University.

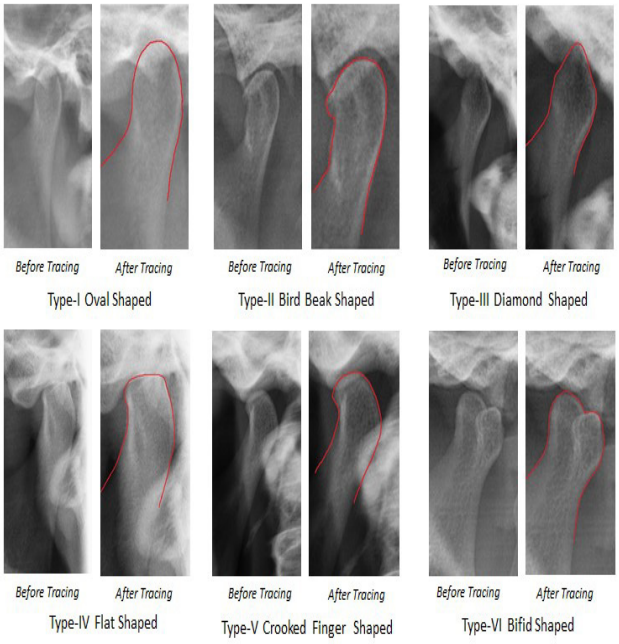
MATERIALS AND METHODS

A retrospective cross-sectional study that included radiographic evaluation of 681 patients was approved by the Ethical Committee of Marmara University, Faculty of Medicine (09.2022.1464, 30/05/2023) and conducted in Faculty of Dentistry, Department of Orthodontics. All recoverable OPGs of the individuals who had visited the department between November 2018 to March 2023 were retrieved from the faculty archive together with the other required information about age, gender. The selected digital OPGs revealed a complete view of the condyle on either side with the best density and contrast. Planmeca ProMax 2D (Planmeca, Helsinki, Finland) with exposure parameters of 5 Ma and 66 Kv was used to get OPGs. The inclusion criteria were as follows: i) panoramic radiographs of patients aged 15 years and older with demographic information (age and gender), ii) showing a full view of either side of the mandible with optimal density and contrast, iii) no projection errors that would distort the image. Panoramic radiographs showing any pathology (osteomyelitis, osteoporosis, etc.) in the maxilla or mandible or showing any indication of fracture in the mandible, developmental anomalies of the jaws, craniofacial syndromes, plating for fractures, odontogenic cysts or tumors of the jaws, complete dentures, and edentulous dental arches were excluded.

A number of 681 OPGs were visualized by two orthodontists (BT and GY) to ascertain the condyle's morphology. The sample consisted of 1362 condyles of 681 patients. The subjects' ages ranged from 15 to 55 years, with

399 female patients and 282 male patients among the 681 cases. A 10-year age gap was used to categorize panoramic radiographs into 4 groups: 15–25, 26–35, 36–45, and 46–55 years. There were 222 panoramic radiographs in group I (15-25 years), 147 in group II (26-35 years), 170 in group III (36-45 years), and 142 in group IV (46-55 years). The mandibular condyle morphology was classified into six types – oval (Type-I), birdbeak (Type-II), diamond (Type-III), flat (Type-IV), crooked finger (Type-V) and bifid (Type-VI) (Fig. 1).

Figure 1: Six types of condyle shapes.



All statistical analyses were performed using IBM SPSS Statistics 22.0 software (Armonk, NY, USA). In addition to descriptive statistical methods, Chi-Square and McNemar tests were used to compare qualitative data. The significance was evaluated at p<0.05 level.

RESULTS

Amongst six condyle types, oval condylar morphology (57.2%) was the most prevalent and followed by flat (19.3%), diamond (10.3%), crooked finger (7.3%), birdbeak (4.9%), and bifid (0.95%).

There was a statistically significant difference between the right and left condyles in terms of condylar morphology (p=0.001). The proportion of oval morphology in the right condyle (60.2%) was significantly higher than in the left condyle (54.2%) (Table 1).

Table 1. Evaluation of right and left condyle differences

	Right condyle	Left condyle	
	n (%)	n (%)	p
Bifid	8 (1.2%)	5 (0.7%)	
Birdbeak	26 (3.8%)	41 (6%)	
Crooked finger	**42 (6.2%)**	**57 (8.4%)**	**0.001*****
Diamond	66 (9.7%)	75 (11%)	
Flat	129 (18.9%)	134 (19.7%)	
Oval	**410 (60.2%)**	**369 (54.2%)**	

*McNemar Test *p<0.05 **p<0.01 ***p<0.001*
Bold letters mean statistically significant differences.

A statistically significant difference was found between the genders regarding the condylar morphology in both right and left condyles (p=0.003, p=0.001 respectively). While flat morphology rate in men (25.5%) was significantly higher than in women (14.3%), crooked finger morphology rate in women (7.8%) was significantly higher than in men (3.9%) for the right condyle (Table 2). For the left condyle, while flat morphology rate in men (24.5%) was significantly higher than in women (16.3%), crooked finger and diamond morphology rates in women (11.5%, 13.3% respectively) were significantly higher than in men (3.9%, 7.8% respectively) (Table 3).

Table 2. Evaluation of the right condyle according to gender

	Male	Female	
Right condyle	n (%)	n (%)	p
Bifid	4 (1.4%)	4 (1%)	
Birdbeak	11 (3.9%)	15 (3.8%)	
Crooked finger	**11 (3.9%)**	**31 (7.8%)**	**0.003****
Diamond	22 (7.8%)	44 (11%)	
Flat	**72 (25.5%)**	**57 (14.3%)**	
Oval	162 (57.4%)	248 (62.2%)	

*Chi-square test *p<0.05 **p<0.01 ***p<0.001*
Bold letters mean statistically significant differences.

Table 3. Evaluation of the left condyle according to gender

	Male	Female	
Left condyle	n (%)	n (%)	p
Bifid	2 (0.7%)	3 (0.8%)	
Birdbeak	18 (6.4%)	23 (5.8%)	
Crooked finger	**11 (3.9%)**	**46 (11.5%)**	**0.001*****
Diamond	**22 (7.8%)**	**53 (13.3%)**	
Flat	**69 (24.5%)**	**65 (16.3%)**	
Oval	160 (56.7%)	209 (52.4%)	

*Chi-square test *p<0.05 **p<0.01 ***p<0.001*
Bold letters mean statistically significant differences.

Moreover, there was a statistically significant difference between the age groups for the right condyle distribution

(p=0.001). The birdbeak morphology rate in the group 2 (26-35 years) (8.8%) was significantly higher than in the group 1 (15-25 years) (1.4%) and group 4 (46-55 years) (1.4%). Crooked finger rate in the group 4 (46-55 years) (2.1%) was significantly lower than in the group 1 (15-25 years) (7.2%) and group 3 (36-45 years) (8.2%). The diamond rate (15.9%) in the group 3 (36-45 years) was significantly higher than all the other groups. The flat rate in the group 1 (15-25 years) (12.6%) was significantly lower than in the group 3 (36-45 years) (22.9%) and group 4 (46-55 years) (26.1%). The oval rate in the group 1 (15-25 years) (70.7%) was significantly higher than all the other age groups. The oval rate in the group 3 (36-45 years) (47.1%) was significantly lower than other groups (Table 4).

Table 4. Evaluation of the right condyle by age

	15-25 (Group 1)	26-35 (Group 2)	36-45 (Group 3)	46-55 (Group 4)	
Right condyle	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**p**
Bifid	1 (0.5%)	3 (2%)	2 (1.2%)	2 (1.4%)	
Birdbeak	**3 (1.4%)**	**13 (8.8%)**	8 (4.7%)	**2 (1.4%)**	
Crooked finger	**16 (7.2%)**	9 (6.1%)	**14 (8.2%)**	**3 (2.1%)**	**0.001*** **
Diamond	**17 (7.7%)**	**10 (6.8%)**	**27 (15.9%)**	**12 (8.5%)**	
Flat	**28 (12.6%)**	25 (17%)	**39 (22.9%)**	**37 (26.1%)**	
Oval	**157 (70.7%)**	**87 (59.2%)**	**80 (47.1%)**	**86 (60.6%)**	

*Chi-square test *p<0.05 **p<0.01 ***p<0.001*
Bold letters mean statistically significant differences.

Table 5. Evaluation of the left condyle by age

	15-25 (Group 1)	26-35 (Group 2)	36-45 (Group 3)	46-55 (Group 4)	
Left condyle	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**p**
Bifid	1 (0.5%)	0 (0%)	2 (1.2%)	2 (1.4%)	
Birdbeak	12 (5.4%)	10 (6.8%)	12 (7.1%)	7 (4.9%)	
Crooked finger	24 (10.8%)	11 (7.5%)	13 (7.6%)	9 (6.3%)	0.070
Diamond	24 (10.8%)	15 (10.2%)	26 (15.3%)	10 (7%)	
Flat	32 (14.4%)	24 (16.3%)	41 (24.1%)	37 (26.1%)	
Oval	129 (58.1%)	87 (59.2%)	76 (44.7%)	77 (54.2%)	

*Chi-square test *p<0.05 **p<0.01 ***p<0.001*

DISCUSSION

The mandibular condyle is the part of the mandible that joins the TMJ (Solberg et al., 1985; Scapino, 1997). It has an oval and biconvex top surface, and a rounded head and located in the glenoid fossa, articulates with the articular disc to allow the condyle to move both translatorily and rotatorily (Blasberg & Greenberg, 2003). Depending on the amount of functional loading it is exposed to, the condyle varies significantly with age. Degenerative disorders of the condyle and the other parts of the temporomandibular joint can result from persistent, forceful stress. Examples of degenerative joint illnesses include osteophytes at the head of the condyle, flattening of the condyle surface, and internal disturbance of the articular disc resulting in disc perforation (Crow et al., 2005).

The shape of the condyle was studied using a variety of radiological techniques, which can help to determine how the condition is progressing. Transcranial, transorbital, and transpharyngeal views are a few examples of frequent conventional procedures.

Orthopantomography is an important diagnostic tool used in radiographic examination in dentistry to diagnose teeth and arches also it is cost-efficient and has a low radiation impact dosage (Kikuchi et al., 2003). Because of its benefits, OPGs are utilized in the present study (Dahlström & Lindvall. 1996, Crow et al., 2005).

There are no previous studies in the literature that classify condyle shapes as we do in our study, but these shapes have been used in different previous studies. In our study, we compiled these studies and included all condyle types used.

In this study, oval shape was determined to be the most prevalent shape in the sample, regardless of gender or whether it was the right or left side. Since the condyle shape is oval under normal conditions, it was already expected that the proportion of oval-shaped condyles to be higher in the current study. This finding was also similar in previous studies (Singh & Chakrabarty, 2015; Sonal et al., 2016; Anisuzzaman et al., 2019; Jawahar & Maragathavalli, 2019; Khanal & Pranaya, 2020, Shaikh et al., 2022).

The second most common condyle shape was found to be flattened in this study (19.3%) which was similar to the study by Gupta et al. (Gupta et al., 2022) (8.76%). While some other studies reported flattened shaped condyles in quite lower ratio (Singh & Chakrabarty, 2015; Nagaraj et al., 2017), some of them did not address this shape at all in their investigations (Sonal et al., 2016; Anisuzzaman et al., 2019; Khanal & Pranaya, 2020; Shaikh et al., 2022).

The third most prevalent shape observed in our analysis was diamond shaped (10.35%), which was also observed priorly in the studies of Sonal et al. (9%) (Sonal et al., 2016), Singh et al. (3.2%) (Singh et al., 2020), Anisuzzaman et al. (9%) (Anisuzzaman et al., 2019) and Gupta et al. (4.7%) (Gupta et al., 2022). However, in their studies, Nagaraj et al. (Nagaraj et al., 2017) and Singh and

Chakrabarty (Singh & Chakrabarty, 2015) did not discuss diamond shape.

The crooked finger shape of the condyle (7.3%) followed the previous morphologies in the present study. On the contrary, crooked finger shape condyles were reported to be the least common in research conducted by Anisuzzaman et al. (1%) (Anisuzzaman et al., 2019), Gupta et al. (1.2%) (Gupta et al., 2022), and Khanal et al.(4.2%) (Khanal & Pranaya, 2020).

Bifid shape was the least common shape seen in this study. The majority of the other studies did not mention bifid condyle. The bifid mandibular condyle is an uncommon abnormality whose source is unknown. The evidence implies that this abnormality is either traumatic or developmental in nature (Alpaslan et al., 2004). Therefore, it is an expected result that the likelihood of bifid condyles between patient groups is low.

In current study, patients were divided into 4 age groups. It was seen that as the age increases, the number of patients falling to the oval shaped category was seen to decrease, however in group 4 (46-55 years), oval shaped condyles (57.3%) were higher than group 3 (36-45 years) (45.9%) for both left and the right condyles. The oval condyle rate was significantly lower in the group 3 (36-45 years). As the number of patients with an oval-shaped condyle decreased with age, the number of patients with other shapes increased. According to our results flat shaped and birdbeak shaped condyles increased with age significantly. The condyle's cumulative increase in functional loading with age could be the reason for this situation. In the literature, it was also reported that the wear of the condylar head which leads to osteophyte growth can cause a change in the morphology of the condyle in older age groups (Tanimoto et al., 1990; Pereira Jr et al., 1994; Blasberg & Greenberg, 2003; Crow et al., 2005; Hegde et al., 2013).

When examined by gender, flat shaped condyle was found significantly higher in male patients (25%) than females (15.3%). On the contrary, crooked finger shaped condyle was found significantly higher in female patients (9.65%) than males (3.9%). In their study Gupta et al. also found flat shaped condyles are higher in male patients (Gupta et al., 2022).

Most of the previous studies identified 4 types of condyles in their research whereas in the current study 6 types were identified. The variations in the results might be due to the fact that the current research population was completely different from previous studies which had smaller sample sizes. Since the present study was carried out following the other studies, it was attempted to find as many forms as feasible, as it was stated in the previous studies.

There is no consistently recognised categorization for condyle shapes universally, and none of the previous research proposed a categorization with six various types of condylar forms except Gupta et al. (Gupta et al., 2022). The sample size of the current study was quite higher than the others, for this reason this range of condylar shape variations should be considered normal. This categorization will also serve as a benchmark for future research. It is recommended conducting a nationwide study to gather more precise information about the frequency of different condyle forms in the population. Additionally, this investigation was carried out using a panoramic radiograph, while three-dimensional imaging might have provided more precise results.

CONCLUSION

Based on the findings, it can be inferred that oval was the most observed morphology of the mandibular condyle regardless of gender and age. Bifid condyle shape was the least common shape in the study group. The youngest group (group 1) has the lowest rate of flat and bifid condyle shape; therefore, the oldest group (group 4) had the highest rate of flat and bifid shaped condyles. As expected in the current study, other condyle shapes were seen more frequently than oval condyle shape in patients due to increasing occlusal forces with age.

Conflicts of interest

None to declared.

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CASE REPORT / OLGU SUNUMU

Joubert Sendromunda Klinik ve Radyolojik Bulgular: Olgu Sunumu

Clinical and Radiological Findings in Joubert Syndrome: Case Report

Yeliz GÜNEŞ, Asım DUMLU

ÖZ

Joubert sendromu, otozomal resesif geçişli nadir olarak görülen bir hastalıktır. Beyincik ve beyin sapı anomalileri, okülomotor bozukluklar, solunum düzensizliği, hipotoni ve ataksi ile karakterizedir. İlk kez 1969 yılında, pediatrik nörolog Marie Joubert tarafından tanımlanmıştır. Bu olgu sunumunda, 14 yaşındaki Joubert sendromlu erkek hasta klinik ve radyolojik bulgular yönünden değerlendirilmiştir. Joubert sendromlu hastaların diş hekimliği açısından multidisipliner olarak tedavi edilmesi gerekmektedir. Bununla birlikte bu hastalarda genelde solunum depresyonu görüldüğü için genel anestezi altında tedaviye temkinli yaklaşmak gerekmektedir.

Anahtar Kelimeler: Joubert sendromu, bifid dil, hipodonti, taurodontizm, molar diş

ABSTRACT

Joubert syndrome is a rare autosomal recessive disorder. It is characterized by anomalies of the cerebellum and brainstem, oculomotor disorders, respiratory irregularity, hypotonia and ataxia. It was first described in 1969 by pediatric neurologist Marie Joubert. In this case report, a 14-year-old male patient with Joubert syndrome was evaluated in terms of clinical and radiological findings. Patients with Joubert syndrome should be treated multidisciplinary in dentistry. In addition, since these patients usually have respiratory depression, it is necessary to approach the treatment cautiously under general anesthesia.

Keywords: Joubert syndrome, bifid tongue, hypodontia, taurodontism, molar tooth

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GİRİŞ

Joubert sendromu, 1969 yılında ilk kez Marie Joubert tarafından tanımlanan otozomal resesif olarak aktarılan, konjenital sinir sistemi gelişim bozukluğudur (Joubert ve ark., 1969). Yaklaşık 80 ile 100 bin doğumda bir görülen nadir bir hastalıktır (Goswami ve ark., 2016).

Joubert sendromunun 3 temel belirteci vardır: Gelişimsel gerilik, hipotoni ve Manyetik Rezonans Görüntüleme (MRG)' de molar diş görünümüdür. Molar diş görünümü; serebellar vermis hipoplazisi veya displazisi, kalın ve yatay superior serebellar pedinküller, derin interpeduncular fossa içeren radyolojik bir bulgu ile karakterizedir (Brancati ve ark., 2010). Joubert sendromlu hastalarda ektraoral bulgu olarak; uzun yüz şekli, bitemporal daralma ile frontal çıkıntı, belirgin burun köprüsü ve burun ucu, pitozis, epikantal katlantı, kaş anomalileri, kalın kulak lobları, prognatizm gibi spesifik özellikler görülebilmektedir (Braddock ve ark., 2007). Bu hastalarda izlenebilecek oral bulgular ise anterior openbite ve maloklüzyon, bifid dil ve dilde fibromatöz dokular, dudak damak yarığı, damak derinliğinde artış, ekstra frenulumlar ve yüksek çürük riskidir (Goswami ve ark., 2016). Bu olgu sunumunda, kliniğimize sendromik fiziksel özelliklerle ve orofasiyal bulgularla başvuran Joubert sendromlu hastanın, ayrıntılı fiziksel muayene sonuçları ile intraoral, ekstraoral ve radyolojik muayene bulguları anlatılmıştır.

OLGU SUNUMU

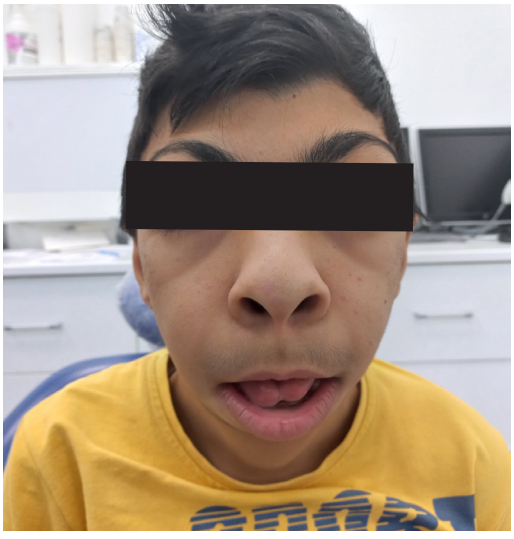
Bu olguda, Marmara Üniversitesi Diş Hekimliği Fakültesi Ağız, Diş ve Çene Radyolojisi Kliniğine kapanış problemi ve çiğneme zorluğu şikayetiyle ailesi eşliğinde başvuran Joubert sendromu tanısı konulmuş 14 yaşında erkek hasta sunulmuştur. Ailesinden alınan anamneze göre

hastanın bilateral damak yarığıyla ve sendromik fiziksel özelliklerle doğduğu ve Joubert sendromu tanısının 11 yaşına kadar konulamadığı bildirilmiştir. Anne ile babanın akraba olduğu, kardeşinde veya akrabalarında sendromun olmadığı söylenmiştir.

Hastaya Joubert sendromu tanısı, 2020 yılında Cerrahpaşa GETAM' da Whole Exom Sequencing (WES) analizi sonucunda, ARL13B geninde saptanan homozigot genetik değişimi ve protein dizisindeki 418. aminoasit olan arjininin glutamine dönüşmesine neden olan yanlış anlamlı mutasyon saptanmış olmasıyla konulmuştur. Hasta doğumdan günümüze damak yarığı, ankiloglossi, kasık fıtığı, testis, göz yaşı kanalı tıkanıklığı ve işitme kaybı nedeniyle çeşitli operasyonlar geçirmiştir. Çocukken solunum yolu problemleri, yürüme, dengeyi sağlama ve konuşma zorluğu olan hastanın büyüdükçe bu şikayetlerinin azaldığı öğrenilmiştir.

Ekstraoral Bulgular

Hastada ekstraoral bulgu olarak; kaşların yuvarlanmış şekilde yukarı kalkık, gözlerin hipertelorik, alt göz kapaklarının dışa doğru dönük olduğu gözlenmiştir. Hastanın düz burun köprüsüne, öne doğru ve geniş nostrillere, normale göre daha inferiorda kulak yapısına sahip olduğu görülmüştür. Dolikofasiyal yüz yapısı ve yüzün orta üçlüsünde yükseklik artışı tespit edilmiştir (Resim 1A). Hastanın ileri derece kifozu ve göğüs ön duvarı kamburluğu olduğu görülmüştür (Resim 1B). El ve ayak parmakları muayenesinde anormal bir durum saptanmamıştır. Yürüme ve dengeyi sağlamada zorluk izlenmiştir.



Resim 1A. Joubert sendromlu hastada ektraoral bulgular

Resim 1B. Joubert sendromunda kifoz ve göğüs ön duvarı kamburluğu

İntraoral Bulgular

İntraoral muayenede, anterior openbite ve protrüze dil izlenmiştir. Kapanış pozisyonunda sadece molar dişlerin temasta olduğu görülmüştür. Dişlerde şekil ve boyut anomalisine rastlanılmamıştır. Mandibula anterior bölgede yoğun diş taşı birikimi, hipersalivasyon ve tükrüğün yutmayla kontrolünün sağlanamadığı tespit edilmiştir (Resim 2A). Sert damağın geniş, düz ve kare ark yapısında olduğu görülmüştür (Resim 2B). Dil ucunda bifid yapı ve sol dil altı bölgesinde yüzeyi düzgün, palpasyonda yumuşak kıvamlı, ağrısız fibromatöz doku kitlesi saptanmıştır (Resim 2C).

Resim 2A. Joubert sendromunda kapanış pozisyonunda anterior open bite görüntüsü

Resim 2B. Joubert sendromlu hastada opere edilmiş bilateral damak yarığı

Resim 2C. Bifid dil ve sol sublingual bölgede anteriorda fibromatöz doku kitlesi

Radyolojik Bulgular

Radyolojik muayenede daha önce sadece 1 süt diş çekim hikayesi bulunan hastanın; 18, 25, 28, 38 ve 48 numaralı dişlerin germlerinin eksik olduğu tespit edilmiştir. 26, 36 ve 46 numaralı dişlere taurodontizm tanısı konulmuştur. 65 numaralı süt dişi persiste olarak izlenmiştir. 16, 26, 36, 37, 47 ve 65 numaralı dişlerde çürükler tespit edilmiştir (Resim 3).

Resim 3. Joubert sendromlu hastanın panoramik görüntüsü

TARTIŞMA

Joubert sendromu ilk kez 1969 yılında Fransız asıllı Kanadalı 4 kardeşte görülen, serebellar vermis agenezisi, mental retardasyon, anormal göz hareketleri ve epizodik hızlı solunum ile Marie Joubert tarafından tanımlanmıştır (Joubert ve ark., 1969). Joubert sendromunda MRG' deki spesifik radyolojik bulgular tanı koymaya yardımcıdır. Bu hastaların %85' inin MRG' sinde molar diş görünümüne rastlanmıştır ve bu görüntü patognomonik olarak kabul edilmektedir (Mowafy ve ark., 2017). Joubert sendromlu hastalarda böbrek hastalıkları, solunum problemleri, göz anomalileri, polidaktili ve kas kordinasyon bozukluğu sendroma eşlik eden bulgulardandır. Yapılan bir çalışmaya göre bu hastaların en sık ölüm nedeni %37,5 oranla böbrek yetmezliğidir. 2.sırada ise %35 oranla solunum yetmezliği gelmektedir (Dempsey ve ark., 2017). Bu hastalarda göz bulgusu olarak %50 oranında retinal distrofi ve koloboma izlenmiştir (Mowafy ve ark,2017). Ayrıca yaşla birlikte anormal kas tonusundan dolayı skolyoz gelişebileceği belirtilmiştir (Parisi, 2009). Hastaların %15'inde de polidaktili bulunmuştur (Mowafy ve ark., 2017). Joubert sendromunda yüz görünümünde de belirgin değişiklikler vardır. Uzun yüz şekli, bitemporal daralma ile frontal çıkıntı, belirgin burun köprüsü ve burun ucu, pitozis, epikantal katlantı, kaş anomalileri, kalın kulak lobları, prognatizm, alt dudağın dışa dönük görünümü sendroma eşlik eden bulgulardandır (Braddock ve ark., 2007). Joubert sendromlu vakalarda oral bulgu olarak; anterior open bite ve maloklüzyon, bifid dil, fibromatöz dokular içeren dil, dilde hamartom, dudak damak yarığı, damak derinliğinde artış, belirgin alveolar sırt, ekstra frenulumlar ve yüksek çürük riski izlenmiştir (Patil ve ark., 2021). Bu olguda da düz nasal köprü, hipertelorizm, anterior openbite, bifid

dil, sublingual bölgede fibromatöz doku, opere edilmiş damak yarığı izlenmiştir (Resim 1A, 2A, 2B, 2C). Literatür bilgilerinden farklı olarak hastada hipodonti ve taurodontizm tespit edilmiştir (Resim 3). Ayrıca sert damakta derinlik artışı yerine düz ve sığ yapı görülmüştür (Resim 2B).

SONUÇ

Joubert sendromlu hastalar, yüksek çürük riski ve periodontal hastalıklar nedeniyle küçük yaşlardan itibaren diş hekimleri tarafından takip edilmelidir. Bu hastalara koruyucu diş hekimliği yöntemleri uygulanmalı ve oral hijyen eğitimleri ailesine ve mümkünse hastaya verilmelidir. Böylece ileri yaşlarda ortaya çıkabilecek derin çürüklerin, dolayısıyla tedavisi daha zor olan endodontik tedavilerin ve ileri periodontal hastalıkların önüne geçilmesi sağlanabilir. Aynı zamanda konjenital damak yarığı yönünden multidisipliner olarak pedodonti, ortodonti ve plastik cerrahi bölümlerinde erken yaşlarda tedavisi başlayıp takibi yapılmalıdır. Bu sayede anterior openbite ve malokluzyonların önüne geçilebilir. Ayrıca sendroma eşlik eden bulgulardan olan dilde hamartom ve fibromatöz dokuların ultrasonografi, MRG ile takibi yapılmalı, fonksiyonel açıdan gerekli durumlarda cerrahi işlemler uygulanmalıdır. Joubert sendromlu hastalarda solunum depresyonu olma ihtimali olduğu için genel anestezi altında tedaviye ve solunum baskılayıcı ajanlara temkinli yaklaşmak gerekmektedir. Hava yolu, dil ve damak yapısı anomalileri nedeniyle entübasyonda da zorluklarla karşılaşılabilir. Bu yüzden küçük yaşlardan itibaren oral hijyen eğitimleri ve koruyucu tedaviler daha da önem kazanmaktadır.

Hasta Onamı

Hastanın velisi bilgilendirilerek, verilerinin kullanılmasına dair onam formu alınmıştır.

Çıkar Çatışması İlişkisi

Yazarların makale ile ilgili çıkar ilişkisi oluşturabilen herhangi bir bağlantısı bulunmamaktadır.

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CASE REPORT/ OLGU SUNUMU

Seven-year Follow-up of A Focal Cemento-Osseous Dysplasia Associated with Mandibular First Molar: A Case Report

Mandibular Birinci Molar ile İlişkili Fokal Semento-osseöz Displazinin 7 Yıllık Takibi: Bir Olgu Sunumu

Melisa ÖÇBE[1], Şebnem ERÇALIK YALÇINKAYA[2]

ABSTRACT

Cemento-osseous dysplasia (COD) is a benign fibro-osseous lesion with replacement of normal bone tissue by fibrous connective tissue. This case report presents an asymptomatic mixed radiolucent-radiopaque lesion in the posterior mandible of a 37-year-old female patient's panoramic radiography. Clinical and radiographic evaluation led to the diagnosis of focal cemento-ossifying dysplasia (FCOD) and regular radiographic follow-up was recommended as focal COD may progress to florid COD. The lesion was followed up for seven years with three examinations. During this time, the lesion remained asymptomatic and the associated tooth remained vital. An increase in the size of the internal hyperdense content was observed in cone-beam computed tomography evaluation during the follow-up visits. The maturation process was well observed. A minimally increased expansion was also noted.

Keywords: cemento-osseous dysplasia, cone-beam computed tomography, fibro-osseous dysplasia

ÖZ

Semento-osseöz displazi (SOD), normal kemik dokusunun fibröz bağ doku ile yer değiştirdiği, iyi huylu bir fibro-osseöz lezyondur. Bu olgu raporunda 37 yaşındaki kadın hastanın panoramik radyografisinde posterior mandibulasında asemptomatik, mikst radyolüsent-radyoopak görünümlü lezyon sunulmuştur. Klinik ve radyografik muayene sonucunda fokal semento-osseöz displazi (FSOD) olduğu düşünülen lezyonun düzenli radyolojik takibi önerilmiştir. Lezyon yedi sene boyunca takip edilmiş ve radyografik olarak değerlendirilmiştir. Takip süreci boyunca asemptomatik olan lezyon ile ilişkili dişin de vital olduğu gözlenmiştir. Ayrıca, lezyonun içeriğindeki hiperdens alanın boyutunun arttığı ve ekspansiyonun minimal olarak arttığı konik-ışınlı bilgisayarlı tomografi görüntülerinde izlenmiştir.

Anahtar Kelimeler: fibroosseöz displazi, konik-ışınlı bilgisayarlı tomografi, sementoosseöz displazi

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INTRODUCTION

Cemento-osseous dysplasia (COD) is the most common benign fibro-osseous lesion of bone, in which normal bone is replaced by fibrous connective tissue, followed by calcification of the fibrous tissue with the formation of osseous and cementum-like tissue. Normal bone formation is replaced by abnormal bone or cementum (MacDonald, 2021). COD is usually seen as an incidental finding on x-ray examination. It is more likely to be observed in women (Nam et al., 2022).

Regarding lesion location in the jaw, COD can be categorised into three types: periapical, focal, and florid. Periapical COD is a mandibular dysplastic lesion occurring in the anterior region (Nelson and Phillips, 2019). Focal COD (FCOD) refers to lesions confined to one quadrant of the posterior mandible. In a more extensive form of COD, lesions can be found in more than one quadrant of the jaw and this is referred to as florid COD (Macdonald-Jankowski, 2008).

In many cases, FCOD is diagnosed incidentally during a routine dental examination. The adjacent teeth are vital. The options for treatment are assessed according to the presence or absence of symptoms. Primary FCOD is usually asymptomatic and does not require treatment. Secondarily infected COD may become symptomatic, and intervention is required if the condition becomes symptomatic (Bulut et al., 2012; Ravikumar et al., 2020).

In the osteolytic stage, it first appears as a radiolucent area. Patients may be misdiagnosed as having periapical lesions and undergo unnecessary root canal treatment or extraction. Due to bone repair through the defect, the radiographic pattern changes to a mixed pattern as the disease progresses. The lesion eventually develops into a radiopaque image with a rim of radiolucency in the mature stage. A well-defined border is present, but slight irregularity

may also be observed (Bulut et al., 2012; Cavalcanti et al., 2018; Min et al., 2018; Seifi et al., 2022).

This case report describes a 37-year-old female patient with FCOD. The lesion was followed up for seven years. The importance of follow-up and asymptomatic lesion characteristics are also reviewed.

CASE REPORT

The patient's informed consent was obtained for all clinical and radiographic examinations and for the presentation of this lesion.

A 37-year-old female patient was referred to the Outpatient Clinic of Marmara University, Faculty of Dentistry, Department of Oral and Maxillofacial Radiology, without any systemic diseases or daily medication use.

Intraoral examination revealed minimal expansion of the buccal aspect of the left mandibular first molar. There was no discolouration of the oral mucosa.

A radiolucent area with thickening of the molar root was noted as an incidental finding on panoramic radiography. The lesion was located at the apex of the left mandibular first molar and was surrounded by a radiolucent halo (Fig 1a). A detailed cone beam computed tomography (CBCT) scan revealed that the lesion involving left mandibular first molar was not completely hypodense, but was mixed and fused to the root (Fig. 1b). CBCT reconstruction showed destruction of the buccal cortical bone plate with minimal expansion. No root resorption or tooth displacement was observed. The dimensions of the lesion were determined to be as follows: 7.03 mm x 7.62 mm x 8.36 mm (Fig. 1c, d). The associated teeth were vital.

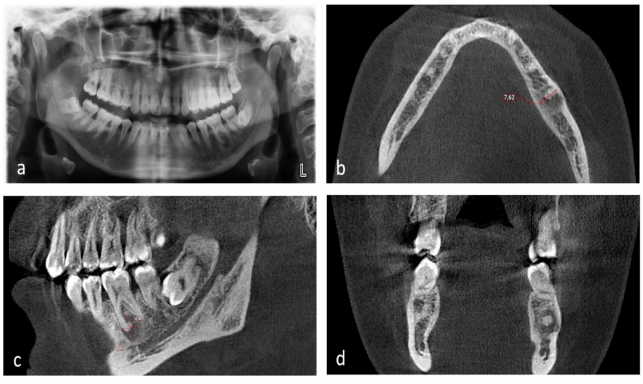

Figure 1: a. Panoramic radiography of the patient (year 2015) with a well-defined radiolucent lesion in the apex of the left mandibular first molar, **b**. CBCT showed minimal expansion in the axial plane and thinning of the buccal cortical plate, **c.** Hyperdense internal content adjacent to the molar root in sagittal plane, **d.** Thinning of the buccal cortical plate can be observed in coronal plane.

The preliminary diagnosis was hypercementosis associated with FCOD (MacDonald, 2021). Lesion was subjectively asymptomatic and the vitality test results, it was decided that no surgical or endodontic treatment was required. The patient was advised to be followed up radiologically.

The patient did not appear at the recommended time. The patient's second visit was five years after the first visit and the clinical and radiological examinations revealed a thicker mass at the apex of the left mandibular first molar. (Figure 2a). A hypodense area with radiolucent contents was observed in CBCT sections, centrally within the lesion (Fig 2b). The dimensions of the lesion were measured as follows: 7.35 mm x 8.79 mm x 8.88 mm and were compared with the initial CBCT measurements. A slight increase in size was noted (Fig. 2c, d). The lesion was still asymptomatic and the tooth was still vital. The patient was recommended for further follow-up.

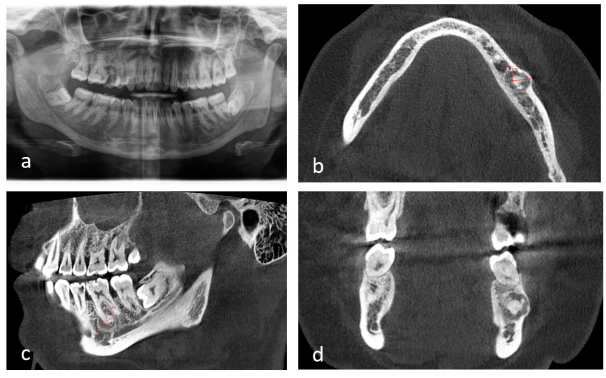

Figure 2: a. Panoramic radiography of the second follow-up session (year 2020), **b**. A well-defined mixed lesion was observed. The internal opaque contents were observed to be thicker compared to the initial radiograph, **c**. Minimally increased dimensions of the lesion, **d**. CBCT showed minimally increased expansion in the axial plane (Fig. 2b) and coronal plane and thinning of the buccal cortical plate in the axial and coronal planes.

Two years after the second visit, clinical and radiological evaluation showed a still asymptomatic, mixed (Fig. 3a), hypodense-hyperdense (Fig. 3b, c) lesion with minimally increased extent (Fig. 3d). Hyperdense enhancement was observed (Fig. 3c, d). The tooth was still vital. The dimensions of the lesion were as: 8.68 mm x 9.88 mm x 9.70 mm (Fig. 3b, c). Follow-up of the patient will be continued.

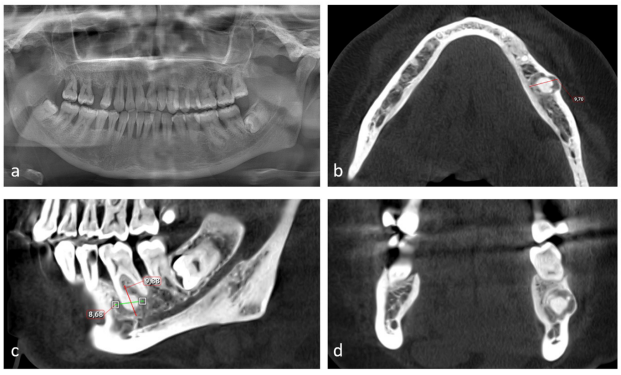

Figure 3: a. Panoramic radiography of the third follow-up session (year 2022), **b.** Increased hyperdense content and expansion in the buccal plate, **c.** Minimally enlarged dimensions of the lesion. No signs of infection. Lesion is not in close relation with mandibular canal. **D.** Coronal plane shows hyperdense lesion surrounded by hypodense area in the left mandibular first molar region with thinning of the buccal cortical plate.

DISCUSSION

COD is a non-neoplastic, mostly asymptomatic, reactive group of fibro-osseous lesions that occur in the tooth-bearing region of the jaw bone (Kato et al., 2020; Thakur et al., 2021). It is not clear what causes or contributes to COD, but the periodontal ligament is thought to play a role. A variety of factors may also be causative, including occlusion, caries, periodontal disease, infection, hormonal imbalances, and systemic diseases (Salvi et al., 2020). Women in their fourth or fifth decade have a predilection for this lesion (Min et al., 2018; Ravikumar et al., 2020).

This case presents a painless lesion of the root of the mandibular first molar in a female patient. As previously reported by Macdonald-Jankowski, FCOD is an incidental finding in the majority of cases (Macdonald-Jankowski, 2008). This case was also an incidental finding. In a previous report, Kawai et al. showed that of 54 patients, 59% had at least one symptom of inflammation, including pain, swelling, purulent discharge and tenderness on palpation (Kawai et al., 1999). Prevention of secondary infection requires good oral hygiene during follow-up. This is essential to maintain the asymptomatic state (Nam et al., 2022). If secondary infections occur as a result of inadequate endodontic treatment or tooth extraction, or for any other reason, these lesions may become symptomatic. When symptomatic, surgical excision is required (Ravikumar et al., 2020). Furthermore, poor healing, bone infection, or osteomyelitis have been reported to occur with any surgery that involves surgical excision of cemento-osseous dysplasia or extraction of the adjacent tooth. Because of the difficulty in managing these lesions, clinicians generally recommend observation rather than intervention (Kato et al., 2020; Thakur et al., 2021). In this case, the patient has had no complaints for seven years and no infection has been detected. The patient was followed up from 2015 to 2022 to ensure that the tooth remained asymptomatic.

Several reports have presented FCODs as well-defined mixed lesions (Macdonald-Jankowski, 2008; Cavalcanti et al., 2018; Min et al., 2018; Seifi et al., 2022). However, the radiological appearance of the lesion varies according to the stage of lesion maturation. The early or osteolytic stages are characterised by a well-defined radiolucency. Proliferative, immature FCOD lesions have a hypodense appearance, whereas later stages have a hyperdense content (Thakur et al., 2021). Accordingly, early lesions may be misdiagnosed as periapical cysts or rarefying osteitis (Salvi et al., 2020; Thakur et al., 2021). In the intermediate or cementoblastic stage, there is a characteristic radiolucent rim around the radiolucent area. The mixed appearance in further levels of the lesion may be confused with chronic sclerosing osteomyelitis, cemento-ossifying fibroma, odontoma and osteoblastoma. In the final stage, the tissue becomes more mature and osteosclerotic. This stage is characterised by sclerotic radiopacity with poorly defined borders (Summerlin and Tomich, 1994; Su et al., 1997; Alsufyani and Lam, 2011; Salvi et al., 2020). As the lesion progresses, the ratio of fibrous connective tissue to mineralised tissue ratio decreases. A thick curvilinear structure is formed by the bony trabeculae as they mature. In the final radiopaque stage, the individual trabeculae fuse to form lobular masses composed of relatively acellular and disorganised cemento-osseous sheets (Ohkura, 2001; Cho et al., 2007; Oh et al., 2019; Olgac et al., 2021; Gumru et al., 2021).

Early detection of the lesion and a detailed clinical and radiological examination are essential to make a correct initial diagnosis, leading to the decision to perform a biopsy, a total excision or a follow-up (Seifi et al., 2022). According to the review by Alsufyani and Lam (Alsufyani and Lam, 2011), the majority of cemento-osseous dysplasia cases were diagnosed in the mixed radiolucent-radiopaque stage (72.0%), and the internal radiopacities were described as dense and cementum-like (61.4%). This case represents a mixed stage after the initial osteolytic period. Furthermore, the maturing process was consistent with that reported in the literature and all stages of maturation have been presented (Kawai et al., 1999; Cho et al., 2007; Oh et al., 2019; Olgac et al., 2021).

Previous studies have shown that cortical plate expansion and thinning are common findings in periapical and florid cemento-osseous dysplasia, but rare in FCOD (Bulut et al., 2012; Cankaya et al., 2012; Rao et al., 2014; Cavalcanti et al., 2018; Kato et al., 2020; Thakur et al., 2021). Additionally, the most common age, gender, region and suggested / applied treatments of FCOD were presented in Table 1. In the present case, a minimal amount of expansion was observed in the buccal cortical plate of the mandible. A minimal thinning of the buccal cortical plate was also noted. Tooth extraction or surgery was not required due to the asymptomatic nature and minimal changes of the lesion. Surgery was considered unnecessary as long as the patient cooperated and the lesion was asymptomatic. The lack of histopathology may seem to be limiting, but the long-term observation nature of this case may have prevented the patient from above-mentioned complications (Drazić and Minić, 1999; Galgano et al., 2003; Cankaya et al., 2012; Bhandari et al., 2012; Rao et al., 2014). The patient is being followed-up.

CONCLUSION

FCOD is a benign fibro-osseous bone lesion, and most cases are asymptomatic. This case report has demonstrated a long follow-up in accordance with the principle of "first do no harm" and a complete process of maturation of the FCOD.

Table 1: Selected previous studies and case reports.

Author(s)	Year	Country	Case(s)	(Mean) Age	Sex (%)	Location	Treatment/ Suggestions
Su et al.	1997	USA	247	38	Female (86.6%)	Posterior mandible (61.5%)	Inadequate information
Dražić and Minić	1999	Yugoslavia	1	19	Male	Posterior maxilla	Biopsy / Radiological follow-up
Ohkura	2001	Japan	51	52	Female (86.2%)	Posterior mandible (2/3 of total cases)	Radiological follow-up
Galgano et al.	2003	Italy	1	47	Female	Anterior mandible	Excision / Radiological follow-up
Cho et al.	2007	Korea	33	55.9	Female (84.8%)	Mandible	Inadequate information
Bulut et al.	2012	Turkey	1	24	Female	Posterior mandible	Excision / Radiological follow-up
Cankaya et al.	2012	Turkey	1	69	Female	Posterior mandible	Excision / Radiological follow-up
Bhandari et al.	2012	India	1	25	Female	Posterior mandible	Biopsy / Radiological follow-up
Rao et al.	2014	India	1	47	Female	Posterior mandible	Excision / Radiological follow-up
Oh et al.	2019	Australia	29	35.7	Female (89.6%)	Posterior mandible	None / Radiological follow-up
Olgac et al.	2020	Turkey	83	40.36	Female (89.2%)	Posterior mandible	Biopsy / Radiological follow-up
Gumru et al.	2021	Turkey	55	46.84	Female (92.7%)	Posterior mandible (98.2%)	None / Radiological follow-up
Seifi et al.	2022	Iran	1	28	Male	Posterior mandible	Excision / Radiological follow-up
Ocbe and Yalcinkaya	2023	Turkey	1	37	Female	Posterior mandible	None / Radiological follow-up

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CONFLICT OF INTEREST

None

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