e-ISSN:1307-3540

ADO Klinik Bilimler Dergisi
Journal Of Clinical Sciences

▶ Cilt/Volume:14 • Sayı/Issue:1 • 2025

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ADO Klinik Bilimler Dergisi • Journal Of Clinical Sciences

14

ADO Klinik Bilimler Dergisi
Journal of Clinical Sciences
Ankara Dişhekimleri Odası'nın bilimsel yayın organıdır.
Scientific publication of the Ankara Chamber of Dentists
Yılda üç kez yayınlanır/Published Three times a year

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27.01.2025
Cilt:14 - Sayı:1 e-ISSN:1307-3540

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YAZIM KURALLARI

Derginin yayın dili Ocak 2024 tarihinden itibaren İngilizcedir.

Yazarlardan, göndermiş oldukları makalenin daha önce yayınlanmamış, yayına kabul edilmemiş veya herhangi bir dergide değerlendirme aşamasında olmadığını beyan etmeleri istenmektedir. Herhangi bir bilimsel toplantıda sunulan özetlerin gönderim sırasında belirtilmesi zorunludur. Yazarlar, gönderim ve hakem değerlendirmesi sürecinde makalenin tüm sorumluluğunu üstlenirler. Etik beyanı gerektiren ancak ETİK KURUL Kurum adı, karar tarihi ve kimlik numarası belirtilmeyen ORİJİNAL ARAŞTIRMA MAKALELERİ değerlendirmeye alınmayacaktır. Yazarlar, tüm olgu sunumları ve gerekli tüm çalışmalar için imzalı bilgilendirilmiş onam aldıklarını belirtmelidir. Bilgilendirilmiş onamlar sisteme ayrı bir pdf dosyası olarak yüklenmelidir. Etik Beyannameler, Gereç ve Yöntem bölümünde Etik Kurul adı, karar tarihi ve kimlik numarası ile birlikte verilmeli ve sisteme ayrı bir pdf dosyası olarak yüklenmelidir. **Her makalenin benzerlik raporu ile birlikte mutlaka İngilizce proofreading sertifikasınında sisteme pdf dosyası olarak yüklenmesi gerekmektedir.**

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ADO Klinik Bilimler Dergisi, değerlendirme süreci boyunca hem hakemin hem de yazarın kimliklerinin birbirinden gizlendiği anlamına gelen çift-kör değerlendirme sürecini kullanır. Bu nedenle yazarların makale dosyalarının kimliklerini açığa çıkarmayacak şekilde hazırlamaları gerekmektedir. Editörler hakemleri derginin online sistemi üzerinden davet edecek, hakemlerin kabulü sonrasında değerlendirme süreci başlayacaktır. Hakemler dergi sistemine giriş yaparak ilgili dosyaların indirilmesi ve öneri süreci davetini kabul ederler. İncelemeler için izin verilen süre: 4 hafta olup, editöryal süreç gerektiği takdirde değiştirilebilir.

KABUL EDİLEN MAKALE TÜRLERİ

Orijinal araştırma makalesi: Başlıklar, Özet **(İngilizce ve Türkçe)**, Giriş, Gereç ve Yöntem, Bulgular, Tartışma, Sonuç, Teşekkür, Kaynaklar, Tablolar, Şekiller ve Şekil açıklamaları.

Olgu sunumu: Başlık (Uzun ve kısa), Özet **(İngilizce ve Türkçe),** Giriş, Olgu Sunumu, Tartışma, Sonuç,

Teşekkür, Kaynakça, Tablolar, Şekiller ve Şekil Açıklamaları

Teknik not: Başlık, Özet, Giriş, Sonuçlar, Kaynaklar, Tablolar, Şekiller ve Şekil açıklamaları (gerekli ise)

Editöre Mektup: Başlık, Özet, Giriş, Sonuçlar, Kaynaklar, Tablolar, Şekiller ve Şekil açıklamaları (gerekli ise)

MAKALE HAZIRLAMA

a- Her yazı normal ve düz yazı tipinde (12 punto Times New Roman), 1,5 satır aralıkla iki yana dayalı olarak yazılmalı ve tüm sayfalar orta alttan art arda numaralandırılmalıdır.

b- Her paragrafta satır girintisi kullanılmalıdır.

c- Latince terimler veya tür adlarında italik karakterler kullanılmalıdır. (örn. *in vitro, Staphylococcus aureus*).

d- Birimler ve kısaltmalarda, uygun olduğu durumlarda Uluslararası Birimler Sistemi (SI: http://www.bipm.org/en/si/) kullanılmalıdır. Yaygın olarak kullanılan birimler için kısaltma örnekleri şunlardır: yıl-y, hafta-hf, saat-sa., dakika-dk., saniye-sn., gram-g, litre-L, mikrolitre-µL, metre-m, Celsius derece-°C vb. Türkçe kısaltmalar dizini için Türk Dil Kurumu'nun internet sitesine bakmalıdır. (TDK; http://www.tdk.gov.tr).

e- Ondalık sayılarda ayırıcı olarak nokta (.) kullanılmalıdır ve rakam ile birim arasında boşluk bırakılmalıdır. (örn. 12,3 mm, 37 °C) Yüzde değeri verirken değer ile yüzde işareti arasına boşluk bırakılmamalıdır (örn. %0,2).

f- Kısaltma standart bir ölçü birimi olmadığı sürece, metinde ilk geçtiği yerde parantez içindeki kısaltmanın ardından açık bir şekilde belirtilmeli ve metin boyunca aynı kısaltma kullanılmalıdır.

g-Çalışmada kullanılan malzeme/ekipmanın kaynağı ilk bahsedildiğinde belirtilmelidir (isim, üretici, şehir, eyalet (varsa), parantez içinde ülke). Aynı ürüne ilişkin daha sonraki alıntılarda menşei belirtmeye gerek yoktur. Daha önce belirttiğiniz firmanın ürettiği başka bir üründen bahsederken sadece firmayı belirtmeniz yeterlidir.

BAŞLIK SAYFASI

Başlık sayfası aşağıdakilerden oluşmalıdır:

a- Makalenin başlığı (İngilizce ve Türkçe)

b- 5 kelimeyi geçmeyen kısa bir başlık. (İngilizce ve Türkçe)

c- Yazarların akademik dereceleri dahil tam adları. Yazarların bağlı oldukları kurum (şehir ve ülke dahil), soyadlarından sonra üst simge numarası verilerek adlar satırının altında belirtilmelidir.

d- Tüm yazarların ORCID tanımlayıcıları. Bir tane almalı veya https://orcid.org/ adresinden kendinizinkini kontrol etmelisiniz.

e- Sorumlu yazarın iletişim bilgileri (posta adresi, iş telefonu, cep telefonu numaraları ve e-posta adresi)

f- Makalenin türü (orijinal araştırma makalesi, editöre mektup, olgu sunumu…)

g- Özet ve ana metinde ayrı ayrı yer alan kelime sayısı (şekil açıklamaları, tablo başlıkları ve kaynaklar hariç), kaynak, şekil ve tablo sayıları.

h- Finansman kaynağı (hibe numarası, protokol numarası vb. belirtiniz)

i- Teşekkür (makalenin herhangi bir bilimsel etkinlikte daha önce sunulmuş olması)

j- Etik inceleme kurulu bilgilerini (tam ad, tarih ve numara) burada ve metinde belirtin. Onay belgesinin dijital kopyası, gönderim sırasında ayrı bir belge olarak sisteme yüklenmelidir.

k-Kayıt sitesi (örn., clinicaltrials.gov), kayıt numarası, kayıt tarihi ve internet bağlantısı (önerilen) dahil olmak üzere klinik araştırma kayıt bilgileri.

ÖZET ve ANAHTAR KELİMELER:

Özet, makalede yer alan bilgileri yansıtmalı ve makalenin ana metninde yer almayan bilgileri içermemelidir. Özet, şu başlıklar kullanılarak yapılandırılmalıdır: Araştırma makalesi için Amaç, Gereç ve Yöntemler, Bulgular ve Sonuç; olgu sunumları için Giriş, Vaka raporu ve Sonuç. Teknik notlar ve editörlere mektupta herhangi bir başlık bulunmamalıdır.

Özet ve anahtar kelimeler hem İngilizce hem de Türkçe olarak sunulmalıdır. Anahtar kelimeler Medical Subject Headings (MESH: www.nlm.nih.gov/mesh/MBrowser.html) ve Türkiye Bilim Terimleri (TBT; http://www.bilimterimleri.com) arasından seçilmelidir. MESH indeksi Türkçe olup alfabetik sıraya göre listelenmeli ve noktalı virgülle (;) ayrılmalıdır. Anahtar kelimeler başlık ve özetten seçilmemelidir çünkü bunlar otomatik olarak indekslenir; bunun yerine ana metinden seçilmelidir.

GİRİŞ

Ana fikir ve önemi anlatılmalıdır. Hiçbir sonuca, tartışmaya ve veriye yer verilmemelidir. Bölümün son paragrafında çalışmanın amacı açıkça belirtilmeli ve varsa araştırma hipotezi verilmelidir.

GEREÇ ve YÖNTEM

Tüm ticari ürün ve cihazların menşei açıklanmalı ve ticari isimleri ve kaynakları belirtilmelidir (isim, üretici, şehir ve ülke).

Bu bölümde etik onay belirtilmelidir (onay alınan Etik Kurul'un tam adı, onay tarihi, onay numarası yazılmalıdır). Varsa, bilgilendirilmiş onam alındığı belirtilmelidir.

Gözlemsel veya deneysel çalışmalarda katılımcıların (hastalar, kontrol grupları dahil laboratuvar hayvanları) seçimine ilişkin dahil etme ve hariç tutma kriterleri açıklanmalıdır.

Bu bölümün son paragrafında, istatistiksel analiz ayrıntılı olarak açıklanmalıdır. İstatistik terimleri ve sembolleri tanımlanmalıdır. Kullanılan bilgisayar yazılımı belirtilmelidir.

BULGULAR

İstatistiksel bulgular rapor edilmelidir, ancak bunların tartışılmasından veya yorumlanmasından kaçınılmalıdır. Gerekiyorsa tablo, grafik veya illüstrasyonlardan yararlanılmalıdır. Bu bölümde gerekli ise alt başlıklar kullanılabilir.

TARTIŞMA

Araştırmanın bulgularını tartışılmalı ve diğer çalışmalarla uyumu veya uyumsuzluğu belirtilmeli ve çalışmanın sınırlılıklarına yer verilmelidir. Giriş ve sonuç bölümlerinde verilen bilgilerin tekrarından kaçınılmalıdır.

SONUÇ

Bu bölümde yazarlar çalışmanın sonuçlarını kısaca ve net bir şekilde sıralamalı ve çalışmanın temel mesajlarını belirtmelidir. İstatistiksel ayrıntılara yer verilmemelidir.

TEŞEKKÜR

Çalışma bir hibe ya da başka bir fonla desteklenmişse bu bölümde destekleyen kuruluşun adı ya da hibe numarası verilmelidir.

ÇIKAR ÇATIŞMASI

Herhangi bir çıkar çatışması olmadığı belirtilmelidir.

KAYNAKLAR

ADO Klinik Bilimler Dergisi'nde alıntıların etiketlenmesi Vancouver sistemine göre yapılır. Kaynaklar ana metinde üst simge Arap rakamlarıyla ardışık olarak belirtilmelidir. Tam referans listesi numara sırasına göre verilmelidir.

Dergilerin başlıkları MEDLINE için İndekslenen Dergiler listesinde kullanılan stile göre kısaltılmalıdır. (http://www.ncbi.nlm.nih.gov/nlmcatalog/journals)

Yayınlanmamış veriler veya kişisel iletişimler referans olarak kabul edilmez.

Metinde alıntı yapma örnekleri:

…önceki bir çalışmada belirtildi.[1]

…önceki çalışmalarda belirtildi.[2,4-6,8]

Yılmaz[9] tarafından yakın zamanda yapılan bir araştırmada şöyle bildirildi:

Yılmaz ve Akın tarafından yakın zamanda yapılan bir çalışmada[10] şu rapor edildi:

Yılmaz ve ark.[11] tarafından yakın zamanda yapılan bir çalışmada şu rapor edilmiştir:

Standart dergi makalesi

1. Erkmen E, Şimşek B, Yücel E, Kurt A. Comparison of different fixation methods following sagittal split ramus osteotomies using three dimensional finite element analysis: Part 1: Advancement surgery-posterior loading. Int J Oral Maxillofac Surg 2005;34:551-8.

Altıdan fazla yazarlı standart dergi makalesi

2. Tüter G, Kurtiş B, Serdar M, Aykan T, Okyay K, Yücel A, et al. Effects of scaling and root planing and sub-antimicrobial dose doxycycline on oral and systemic biomarkers of disease in patients with both chronic periodontitis and coronary artery disease. J Clin Periodontol 2007;34:673-81.

Tez

3. Kayaoğlu G. Endodontik hastalık açısından Enterococcus faecalis'in Kahve ve direnç çıkışının incelenmesi [tez]. Ankara: Gazi Üniversitesi; 2007.

Kitap ve kitapta bölüm

4.Okeson JP. Management of Temporomandibular Disorders and Occlusion. 7th ed. St. Louis, Missouri: Elsevier Mosby; 2013. p. 171-174.

5. Alaçam A. Pedodontik Endodonti. Alaçam T, Editör. Endodonti. 1.baskı. Ankara: GÜ Yayınları; 1990. s.809-859.

TABLOLAR ve ŞEKİLLER

Tüm tablo ve şekiller ana metinde yer alma sırasına göre Latin rakamlarıyla ardışık olarak numaralandırılmalı ve ayrıntılı olarak tartışılmalıdır. Yazılarda tablo ve şekiller ana metnin sonunda Kaynaklar kısmından sonra verilmelidir.

Tüm şekiller yüksek kalitede JPG, PNG, PDF veya TIFF formatında olmalı ve gönderim sırasında ayrı bir belge ile yüklenmelidir. Histopatolojik görüntülerde kullanılan renklendirici ve büyütme miktarı belirtilmelidir.

Kişi görüntülerinin yer aldığı yazılarda, bunların kullanılması için yazılı izin alınmalı ve yazıyla birlikte sunulmalıdır.

Tablo hazırlanırken ADO Klinik Bilimler Dergisi'nde daha önce yayınlanmış makaleler örnek olarak alınabilir. Tüm tabloların tablonun üst kısmında bir başlığı bulunmalı ve birlikte yüklenmelidir. Kısaltmalar, istatistiksel bilgiler (p değerleri veya istatistiksel analiz yöntemi vb.) tablonun altına dipnot olarak verilmelidir. Gerektiğinde yıldız işareti veya üst simge kullanılmalıdır.

Bir yazıdaki tablo ve şekillerin toplam sayısı 6'yı geçmemelidir.

ÇIKAR ÇATIŞMASI FORMU (ICMJE FORMU)

Dosyanın tamamını indirmek için lütfen tıklayın.

TELİF HAKKI FORMU VE YAZAR SÖZLEŞMESİ

Makale dosyalarının yükleme aşamasında telif hakkı formu ve yazar sözleşmesini indirebilirsiniz.

ÖN DÜZELTME VE MAKALE İADE SÜRECİ

Sisteme yüklenen makaleler Editör Kurulu'muzun değerlendirmesi sonucu ilk olarak ön kontrole alınır. DergiPark sisteminde yazılı dergimiz yazım kuralları doğrultusunda makaleler incelenir. **Ön kontrolde 2 kez düzeltme isteği alması ve gerekli düzeltmelerin verilen süre içerisinde yapılmaması halinde, makale sorumlu yazara iade edilir ve hakem değerlendirme sürecine alınmaz.**

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HAKEMLERE TEŞEKKÜR

14. Cilt 1. Sayı için değerlendirilen taslak makaleleri bilimsel ve tarafsız gözle inceleyen ve aşağıda isimleri belirtilmiş olan hakemlerimize ve bütün danışma kurulu üyelerimize teşekkür ederiz.

Ali Cemal Tınaz

Ayşe Nurcan Duman

Canseda Avağ

Çiğdem Çetin Genç

Dilek Aynur Uğar Çankal

Elif Çelebi

Ezgi Ergezen

Gökçe Soğancı Ünsal

Hanife Altınışık

İnci Rana Karaca

Kübra Öztürk

Mehmet Kemal Tümer

Nagehan Aktaş

Nur Altıparmak

Sara Samur Ergüven

Suat Özcan

Editorial
Editörden

As the ADO Editorial Group, as we do every year, we were preparing a message to send our wishes for a happy, healthy, and joyful New Year to all our colleagues. However, with the deep sorrow of losing our dear ones and colleagues in the 'Kartalkaya hotel disaster', we would like to begin by offering our heartfelt condolences. We pray for the souls of those we lost in this tragic incident and extend our deepest sympathy to their families. We hope that 2025 will be a year filled with safe, joyful news, spent with our loved ones.

‘Our condolences'.

ADO Editör grubu olarak her yıl başında olduğu gibi tüm meslektaşlarımıza mutlu, sağlıklı, neşe dolu bir yeni yıl dileklerimizi iletmek üzere mesaj hazırlamışken 'Kartalkaya otel faciası'nda kaybettiğimiz canlarımız ve meslektaşlarımızın içimizdeki derin acısı ile öncelikle bu elim faciada kaybettiğimiz tüm canlarımıza Allahtan Rahmet ve yakınlarına başsağlığı dileyerek 2025'in hepimize daha güvenli, sevinç dolu haberler alacağımız sevdiklerimizle beraber geçireceğimiz mutlu bir yıl olmasını dileriz.

'Hepimizin Başı Sağolsun'.

Prof.Dr.Nur Mollaoğlu
Doç.Dr.Yeliz Kılınç
Doç.Dr.Sinem Akgül
Dr.Öğr.Üyesi Özgün Yıldırım

DOI: http://doi.org/10.54617/adoklinikbilimler.1507819

Original Research Article

Analyzing the Relationship Between Primary Complaint, Diagnosis, and Treatment in Patients With Temporomandibular Joint Disorders

Temporomandibular Eklem Bozukluğu Olan Hastalarda Birincil Şikayet, Tanı ve Tedavi Arasındaki İlişkinin İncelenmesi

Merve Çakır[1], Gül Merve Yalçın Ülker[1]

ABSTRACT

Aim: This study aimed to assess complaints of the patients with temporomandibular joint disorder (TMD) and diagnoses according to Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) criteria and evaluate the effectiveness of the treatment.

Material and Method: The clinical examinations of the patients with complaints of TMD were performed according to the internationally accepted Turkish version of the DC/TMD guideline. Patients' complaints, symptoms, visual analog scale (VAS) scores and diagnosis were recorded. Patients were classified into three groups: Group A, patients with pain-related TMD; Group B, patients with intra-articular TMD; and Group A-B, patients with both pain-related TMDs and intra-articular TMD. Patients received various treatments according to their examination and diagnosis. In the follow-up sessions after treatment, patients' remaining complaints and VAS scores were recorded. Descriptive statistics were performed to analyze relationship of the primary complaint, diagnose and the treatment effectiveness.

Results: The study included 127 patients (105 women and 22 men, mean age 34.5±11.2). 55 patients were in Group A, 14 patients in Group B, and 56 patients in Group A-B. Two patients were classified as 'undefined'. A statistically significant result ($p = 0.001$) was found when comparing complaints in diagnostic groups. Pain complaints were more frequent in group A, while complaints of TMJ sounds were less common in group A compared to other groups. In the relationship between treatment and diagnostic group, a statistically significant difference was found ($p<0.001$); pharmacotherapy was applied more frequently in groups A and A-B than in group B. It was determined that occlusal splint treatment differed between groups A and B. There was no significant difference between the median values of the difference in VAS scores according to the number of treatments applied. A decrease in VAS scores was observed as a result of the treatments applied.

Conclusion: For the most appropriate treatment of TMD, the complaints of the patients must first be clearly understood.

Keywords: Temporomandibular joint disorders; TMD diagnosis, TMD treatment

ÖZET

Amaç: Bu çalışmanın amacı; temporomandibular eklem düzensizliği (TMD) olan hastaların şikayetlerini ve Temporomandibular Düzensizliklerin Tanısal Kriterleri (TMD/TK) klavuzuna göre tanı alan hastaların tanılarını değerlendirmek ve tedavilerin etkinliğini değerlendirmektir.

Gereç ve Yöntem: TMD şikayeti olan hastaların klinik muayeneleri TMD/TK kılavuzunun uluslararası kabul görmüş Türkçe versiyonuna göre yapılmıştır. Hastaların şikayetleri, semptomları, VAS skorları ve tanıları kaydedilmiş ve hastalar üç gruba ayrılmıştır: Grup A, ağrıya bağlı TMD hastaları; Grup B, eklem içi TMD'li hastalar ve Grup A-B, hem ağrıyla ilişkili TMD'leri hem de eklem içi TMD'si olan hastalar. Hastalara muayene ve tanılarına göre çeşitli tedaviler uygulanmıştır. Tedavi sonrası takip seanslarında hastaların kalan şikayetleri ve VAS skorları kaydedilmiş, birincil şikayet, tanı ve tedavi etkinliği arasındaki ilişkiyi analiz etmek için tanımlayıcı istatistiksel değerlendirmeler yapılmıştır.

Bulgular: Çalışmaya 127 hasta (105 kadın ve 22 erkek, ortalama yaş 34.5±11.2) dahil edilmiştir. Grup A'da 55 hasta, Grup B'de 14 hasta ve Grup A-B'de 56 hasta bulunurken, iki hasta 'tanımsız' olarak sınıflandırılmıştır. Şikayetlerin tanı grupları ile karşılaştırılmasında istatistiksel olarak anlamlı bir sonuç ($p=0.001$) bulunmuştur. Grup A'da ağrı şikayeti daha sık görülürken, temporomandibular eklemde ses şikayeti grup A'da diğer gruplara göre daha az görülmüştür. Tedavi ve tanı grubu arasındaki ilişkide istatistiksel olarak anlamlı fark bulunmuştur ($p<0.001$); farmakoterapi A ve A-B gruplarında B grubuna göre daha sık uygulanmışken, okluzal splint tedavisinin A ve B grupları arasında farklılık gösterdiği belirlenmiştir. Tedavi sayısına göre VAS skorları arasındaki farkın medyan değerleri arasında anlamlı fark bulunmazken, uygulanan tedaviler sonucunda VAS skorlarında azalma gözlenmiştir.

Sonuç: TMD'nin en uygun tedavisi için öncelikle hastaların şikayetlerinin net olarak anlaşılması gerekmektedir.

Anahtar Kelimeler: Temporomandibular eklem düzensizliği; TMD diagnozu; TMD tedavisi

Makale gönderiliş tarihi: 01.07.2024; Yayına kabul tarihi: 16.11.2024

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INTRODUCTION

Temporomandibular disorders (TMD) include a range of clinical conditions that affect the temporomandibular joint (TMJ), masticatory muscles, and related tissues, presenting primarily as localized pain and restricted jaw movement. This type of disorder is a distinct subgroup of musculoskeletal and rheumatic disorders and is the main cause of non-odontogenic orofacial pain.[1] TMD affects 8–15% of the adult population and is more common in women than men.[2] Some studies have suggested that men and women are equally affected, but women are more likely to seek treatment.[3] The risk of TMD increases with age, with the highest prevalence between approximately 35 and 45 years old.[2] TMD is also a societal issue that can be exacerbated by a faster-paced lifestyle, constant stress, and improper masticatory function.[4]

Symptoms of TMDs include chronic orofacial pain, muscular tenderness in the jaw area, pain during jaw motions, restricted jaw movements, and joint sounds like clicking or crepitation.[5] Additional symptoms such as neck pain, ear-related disorders (such as tinnitus and hearing problems), and headaches can often be related to TMD. Studies of TMD indicate an increased risk of psychological disorders such as depression, anxiety, social phobia, poor self-confidence, and difficulty concentrating.[6]

Many facets of the etiology, diagnosis, and optimal treatment of TMDs are still unclear. There is a need for a more comprehensive investigation of the epidemiology of TMD using standardized classification systems. In 2014, the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) was developed. The guide's main feature is the use of biaxial tests, which provide diagnoses based on both physical and psychosocial/behavioral factors.[7] The modern diagnosis of TMD should be established using the DC/TMD examination protocol, as appropriate treatment is only feasible with the correct diagnosis.[4]

It is advised to record the information using the patient's language and provide a comprehensive description.[8] The patient's principal complaint is of particular clinical importance in TMD, and is typically pain; prevalence varies from 13 to 59% according to previous studies. The significance of the primary concern in initiating and guiding subsequent diagnostic and therapeutic interventions is demonstrated by Dimitroulis *et al*.,[9] who stated that "the clinician's responsibility is to establish a diagnosis based on the information provided by the patient and develop a treatment strategy that effectively addresses the patient's primary presenting symptoms."

There are many treatment options for TMD because of the wide variety of conditions that are associated with it. These include pharmacotherapy, manual therapy, physical therapy, occlusal splints, arthrocentesis, intra-articular injections, and surgical interventions.[1,5] Pain reduction, functional improvement, and increasing quality of life are the primary objectives of TMD treatment.[10] At first instance, conservative and reversible treatment options are advised; these can provide relief in over 90% of cases.[5,11]

Various pharmacological agents are used for TMD pain management. These include analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, opioids, corticosteroids, and anticonvulsants.[11] Occlusal splint therapy is used to reduce pain and the strain on the TMJ, relax the muscles, support regenerative processes in the joint, and increase the extent of mouth opening.[1,4] Manual therapy can also be used to restore range of motion and to reduce pain and local ischemia.[5]

When conservative treatment modalities are not sufficient, minimally invasive choices such as arthrocentesis and intra-articular injections can be used. Arthrocentesis removes inflammatory mediators and degradation products. Corticosteroids and sodium hyaluronate can be used for intra-articular injections.[1,4]

Estimations of the need for TMD treatment in the general population vary, leading to differences in the prevalence of TMD across studies.[12] In this study, our aim was to assess the complaints and diagnoses of patients diagnosed according to DC/TMD criteria and to evaluate the effectiveness of the treatment methods applied.

MATERIALS AND METHOD

This retrospective study included patients who were referred to the Oral and Maxillofacial Surgery Clinic of İstanbul Okan University Faculty of Dentistry Hospital between 2018 and 2020 with a diagnosis of TMD and received one or more treatment modalities.

The research was approved by the İstanbul Okan University Ethics Committee with decision number 170-7.

The inclusion criterias for the study were: patients over the age of 18 with complaints of TMD symptoms including pain, joint noise, or restricted movement, and who received treatment for TMD in the relevant clinic. Exclusion criteria were: patients with signs or symptoms of systemic diseases that could potentially be related to TMD (like polyarthritis, rheumatoid arthritis, fibromyalgia), those who were examined but did not continue their treatment, and those who were under 18.

The clinical examination and anamnestic data collection were performed by trained investigators experienced in TMD management and followed the internationally accepted Turkish version of the DC/TMD guideline.[13] A form was filled out for each patient; the anamnestic section of this form included the main and secondary complaints, the patients' subjective assessment of their pain levels, and their dental and medical history. The form also included information about pain characteristics, symptoms experienced since the pain started (such as earache, decreased mouth opening, and weakness in the masticatory muscles), headache and its characteristics, the presence of joint noises, history of locking or trauma in the orofacial region, conscious oral habits (such as clenching, nail biting, gum chewing, and putting the phone between the ears and shoulder), sleep and diet patterns, and any previous treatments. Pain intensity was determined by a visual analog scale (VAS) from 1 to 10. Clinical assessments involved evaluating pain location, palpation pain, jaw mobility, movement-related pain, and TMJ sounds. Panoramic radiographs were performed for all patients. Cone-beam computed tomography (CBCT) was prescribed if there was any doubt about TMJ pathology or degenerative joint disease. Magnetic resonance images (MRI) were requested if there was persistent pain, prolonged restriction in mouth opening, or suspicion of degenerative TMD. In the follow-up sessions after treatment, patients' remaining complaints and VAS scores were recorded.

Patients were classified into three groups: Group A, patients with pain-related TMD; Group B, patients with intra-articular TMD; and Group A-B, patients with both pain-related TMDs and intra-articular TMD. Patients complaining of acute pain were initially administered medication and then re-examined to avoid intense discomfort masking accurate diagnosis.

Patients received various treatments according to their examination and diagnosis, including pharmacotherapy, occlusal splint, arthrocentesis, botox, or low-level laser therapies according to their examination and diagnosis. Treatments were given either alone or in different combinations.

Statistical analysis

Data were analyzed in IBM SPSS V23 (SPSS, Chicago, IL, USA). The normality of the data was examined using the Kolmogorov Smirnov and Shapiro Wilk tests and the Kruskal-Wallis H test was used to compare medians of skewed data. Bonferroni correction was used to compare quantitative data across multiple responses. Pearson's Chi-Squared test was used to compare categorical data according to groups, and multiple comparisons of proportions were examined with the Bonferroni corrected Z test. Results are presented as mean ± standard deviation and median (minimum–maximum), and the significance level is taken as $p<0.05$. Due to the presence of undefined values in the classification parameter, it was not included in the analysis.

RESULTS

The study included 127 patients (105 women and 22 men) who received treatment at the relevant clinic and attended follow-up sessions, out of 218 individuals who applied and were examined with complaints of TMD in 2018–2020. The mean age of the patients was 34.5± 11.2.

The complaints of 127 patients, their classification according to DC/TMD, and the treatments applied are presented in detail in Table 1.

Following examination based on the DC/TMD guideline, 55 patients were diagnosed with pain-related TMD (Group A), 14 patients with intra-articular TMD (Group B), and 56 patients with both pain-related TMD and intra-articular TMD (Group A-B). Two patients were classified as 'undefined' because they could not be diagnosed according to the guideline criteria.

Table 1. Descriptive statistics

	Frequency	Percentage
Gender		
Male	22	17.3
Female	105	82.7
Classification		
A	55	43.3
A-B	56	44.1
B	14	11
Undefined	2	1.6
Number of treatments		
1	87	68.5
2	30	23.6
3 and more	10	7.9
Treatment combinations		
Arthrocentesis	3	2.4
Arthrocentesis + Botox	1	0.8
Arthrocentesis + Laser	1	0.8
Botox	4	3.1
Pharmacotherapy	50	39.4
Pharmacotherapy + Arthrocentesis	2	1.6
Pharmacotherapy + Arthrocentesis + Botox	1	0.8
Pharmacotherapy + Botox	2	1.6
Pharmacotherapy + Occlusal splint	12	9.4
Pharmacotherapy + Occlusal splint + Arthrocentesis	7	5.5
Pharmacotherapy + Occlusal splint + Arthrocentesis + Laser	1	0.8
Occlusal splint	30	23.6
Occlusal splint + Arthrocentesis	8	6.3
Occlusal splint + Arthrocentesis + Laser	1	0.8
Occlusal splint + Botox	4	3.1
Magnetic resonance imaging		
Yes	14	11
No	113	89
Complaints ~		
Pain	98	77.8
Arthralgia	14	11.1
Joint noises	50	39.7
Sensation of sticking in the joint	1	0.8
Restriction in the mouth opening	19	15.1
Jaw lock	6	4.8
Bruxism	6	4.8
Sliding sensation in the jaw	2	1.6
Subluxation	2	1.6
Earache	8	6.3
Tinnitus	2	1.6
Treatments~		
Pharmacotherapy	75	59.1
Occlusal splint	63	49.6
Arthrocentesis	25	19.7
Laser	3	2.4
Botox	12	9.4
	Mean±S.Deviation	Median (Min-Max)
Age	34.5 ± 11.15	32 (18 - 75)
VAS before treatment	6.32 ± 2.84	7 (0 - 10)
VAS after treatment	2.89 ± 2.37	3 (0 - 10)

~ multiple response

A statistically significant result (p = 0.001) was found when comparing complaints in diagnostic groups. Pain complaints were more frequent in group A than in group B, while complaints of TMJ sounds were less common in group A compared to other groups (Table 2).

The relationship between treatment and diagnostic group was investigated and a statistically significant difference was found (p<0.001); pharmacotherapy was applied more frequently in groups A and A-B than in group B. It was determined that occlusal splint treatment differed between groups A and B (Table 2).

To evaluate the effectiveness of treatment options, VAS values at the beginning and end of treatment were examined; however, since the distribution of treatment combinations was not appropriate, a statistical comparison could not be made. There was no significant difference between the median values of the difference in VAS scores according to the number of treatments applied (single treatment or combination of treatments; p = 0.252). There was no statistically significant difference between the mean values for the difference in VAS scores according to treatments (p>0.05); however, a decrease in VAS scores was observed as a result of the treatments applied.

Table 2. Comparison of categorical parameters by classification

	Classification n (%)			
	A	A-B	B	p*
Complaints ~				
Pain	45 (83.3)[a]	44 (78.6)[ab]	7 (50)[b]	
Arthralgia	2 (3.7)	12 (21.4)	0 (0)	
Joint noises	13 (24.1)[a]	27 (48.2)[b]	10 (71.4)[b]	
Sensation of sticking in the joint	0 (0)	1 (1.8)	0 (0)	
Restriction in the mouth opening	5 (9.3)	9 (16.1)	4 (28.6)	
Jaw lock	2 (3.7)	3 (5.4)	1 (7.1)	0.001
Bruxism	4 (7.4)	0 (0)	1 (7.1)	
Sliding sensation in the jaw	1 (1.9)	1 (1.8)	0 (0)	
Subluxation	0 (0)	2 (3.6)	0 (0)	
Earache	5 (9.3)	3 (5.4)	0 (0)	
Tinnitus	1 (1.9)	0 (0)	1 (7.1)	
Treatments~				
Pharmacotherapy	36 (65.5)[a]	36 (64.3)[a]	3 (21.4)[b]	
Occlusal splint	20 (36.4)[a]	29 (51.8)[ab]	12 (85.7)[b]	
Arthrocentesis	0 (0)	19 (33.9)	6 (42.9)	<0.001
Laser	0 (0)	3 (5.4)	0 (0)	
Botox	8 (14.5)	3 (5.4)	0 (0)	

~ multiple responses; * Pearson Chi-Squared test; [a-b]: There is no difference between groups with the same letter.

DISCUSSION

TMD is a challenging issue to handle. This term refers to a group of conditions affecting the structure and/or function of the masticatory system. Patients suspected of having TMD typically present to the clinician with a large number of signs and symptoms, including pain and various issues affecting structures in the head, neck, upper quadrant, central nervous system, and musculoskeletal system. This leads to confusion and an unclear definition of what comprises TMD.[14] According to Greene & Marbach[15] and Carlsson[16], standardizing TMD studies is challenging due to the frequent comparison of studies with different experimental designs. For example, studies that utilize questionnaires are often compared to those that rely on clinical examinations. This has complicated diagnosis, treatment, and patient care.[17] Effective treatment of TMDs requires a comprehensive diagnostic procedure that considers

both the symptoms and the underlying cause of the disorder.[12] This study aimed to match the complaints, diagnoses, and efficacy of administered treatment methods. The primary aim was to improve the patient's quality of life by relieving pain. Depending on the complaints, symptoms, and clinical findings, treatments such as medication, physical therapy, occlusal splint application, and arthrocentesis were preferred together or alone.

In a study profiling symptomatic TMD patients, pain was the most common complaint.[14] In this study, pain, TMJ noises, and restricted mouth opening were the most commonly recorded complaints, consistent with studies by Yekkelam *et al*.,[12] Bagis *et al*.,[17] Progiante *et al*.,[18] and Zhang *et al*.[19] Some previous studies have specified location and type of pain; according to these reports, pain was also the most common TMD symptom, though its location varied.[14,17]

As expected, in this sample, pain was the most common complaint of the patients with pain-related TMDs. For patients who were diagnosed with intra-articular TMD, the chief complaint was TMJ sounds with or without pain. The data presented indicate pain as the main complaint. Random sampling studies[20,21] have shown that the most frequent complaint of people with TMD was joint noise, while others[14,22] that focus on people with TMD, have reported pain as the most common complaint. These results are consistent with the findings of this study, which investigated patients with TMD.

In the literature, it has been stated that several factors predispose TMD.[2] Gender and age are two of the main factors.[2,3] TMD is reportedly more common in females than males due to hormonal, emotional, postural, and functional factors.[3,17] TMD is observed over a large age range and is most common in adolescents and middle-aged individuals. The reason may be the increased levels of stress during these life periods.[2,17] In this study, approximately 80% of the patients were female, and most were middle-aged, consistent with previous studies.

The signs and symptoms of patients are the most important factor in diagnosing TMD. Pain is the main complaint in most patients with TMD, but acute inflammatory pain can make it difficult to accurately diagnose the patient.[4] Persistent pain is one of the symptoms of intra-articular TMDs[4], so in this study to differentiate acute inflammatory pain and persistent pain, non-steroidal anti-inflammatory drugs were prescribed for two weeks and then patients were re-examined for an exact diagnosis. Most patients included in the study had pain-related TMD, followed by patients with pain-related and intra-articular TMD together. In some studies[14,23], disc displacement with reduction was the most common DC/TMD diagnosis; in others[24,25], consistent with our results, pain-related TMD was the most common.

The primary objective of TMD treatment is to reduce pain, improve functionality, and improve quality of life for patients. According to the literature, reversible treatment options should be prioritized before minimally invasive treatments and non-reversible treatments are considered.[10] The treatment options in this study were determined following this guidance.

In this study, patients who had pain were first treated with pharmacotherapy including NSAIDs and muscle relaxants (if necessary) for two weeks. The effectiveness of NSAID use alone is reported in the literature, citing positive effects on inflammation and pain management; at least two weeks of treatment is required to be effective.[11]

According to the literature, manual therapy is another useful treatment method for TMD.[5,26] Manual therapy has been applied to restore a normal range of motion, minimize local ischemia, improve proprioception, dissolve fibrous adhesions, increase synovial fluid production, and reduce pain.[5] Van Grootel *et al*.,[26] state that manual therapy may be preferable as a first treatment choice in the management of pain-related symptoms. In the present study, manual therapy and exercises were recommended at the initial visit for patients who had muscle spasms, pain, and restriction in TMJ movement.

Occlusal splints are used to restore neuromuscular balance, reduce excessive loading of the joint, provide centric occlusion, eliminate posterior interference, reposition the condyles, and relax the muscles.[5,27] Occlusal splints can be used in the treatment of all TMDs, with the most important factor being the use of the correct splint. Studies have shown that occlusal splint therapy is a useful treatment method but requires long-term usage.[4,28] In our study, occlusal splint was the preferred treatment option for patients

with bruxism and/or intra-articular TMD, with patients advised to use the splint for at least six months.

When conservative treatment options are not sufficient, arthrocentesis is the first choice of non-reversible treatment method for TMDs. Arthrocentesis removes degradation products and inflammatory mediators, and patients see the effects rapidly.[4,10,29] According to Nitzan[30], the main reason for joint problems is increased friction at bone surfaces, resulting from a decrease in synovial fluid. By performing arthrocentesis, the adaptive power of the joint is restored, restoring the lubrication mechanism and eliminating the main problem. With arthrocentesis, medications including hyaluronic acid, corticosteroids, analgesics, and platelet-rich plasma can be injected into joint space. It has been determined that arthrocentesis combined with occlusal splint therapy is more effective than splint-only therapy.[4,29] In this study, patients whose intra-articular degeneration was confirmed by MRI, arthrocentesis was performed immediately or after the use of an occlusal splint, depending on symptoms. For patients who underwent immediate arthrocentesis, an occlusal splint was used afterward.

It has been previously demonstrated that VAS is an effective tool for measuring pain in adults[11], here, the effectiveness of treatment was evaluated using VAS scores. However, as the distribution of treatment combinations was not appropriate, a statistical comparison could not be made. In all treatment modalities, VAS scores showed improvement at the end of the treatment, consistent with reports in the literature.[1,4,5]

The main limitations of this study were a variety of post-operative periods between patients; the small number of patients with different diagnoses; and the lack of appropriate comparison for assessing treatment combinations.

CONCLUSION

TMD is a difficult condition for both patients and clinicians, due to its complex, multifaceted nature. For the treatment of TMD, the complaints of the patients must first be clearly understood. This should be followed by detailed clinical and radiologic examination to ensure the selection of the most appropriate treatment technique.

ACKNOWLEDGEMENT

The authors report there are no competing interests to declare.

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DOI: http://doi.org/10.54617/adoklinikbilimler.1481650

Original Research Article

Oral Cancer Knowledge and Awareness Among Dental Students in North Cyprus

Kuzey Kıbrıs'taki Diş Hekimliği Öğrencilerinde Ağız Kanseri Bilgisi ve Farkındalığı

Mujgan Firincioglulari[1]

ABSTRACT

Aim: This study assessed oral cancer awareness among undergraduate dental students at Cyprus International University Faculty of Dentistry.

Material and Method: A total of 208 dental students participated voluntarily in a questionnaire survey. The questionnaire included 18 questions on sociodemographic profile, oral cancer awareness, and knowledge. The data were analyzed with the IBM SPSS statistics 24.0 program.

Results: Sixty-nine (33.2%) of the participants were 1st-grade, 59 (28.4%) were 2nd-grade, 57 (27.4%) were third-grade, 12 (5.8%) were 4th-grade and 11 (5.3%) were 5th-grade students. The majority of the students identified smoking (81.3%) as a potential risk factor followed by alcohol consumption in second place (62%). The percentage of 5th-grade students who identified smoking as a risk factor was slightly higher than in other grades ($p>0.05$). All grades stated that smoking causes more oral cancer than alcohol. Regarding clinical signs, 62.3% reported that oral cancer can present as an abnormal mass/lump in the mouth. Still, only 52.2% of the participants recognized that oral cancer can present as a white and/or red lesion. Tobacco cessation was the most selected option for protecting from oral cancer (78.9%). Regarding oral cancer education and HPV as a cause of oral cancer, 4th and 5th graders significantly showed better knowledge ($p<0.05$). Female participants showed significantly higher knowledge about oral cancer precautions ($p<0.05$).

Conclusion: While the study revealed significant gaps in knowledge, attitudes, and awareness of dental students in North Cyprus regarding oral cancer, students were generally aware of the risk of tobacco-related oral cancer. This research emphasized the significance of enhancing educational approaches in dentistry to improve oral cancer detection and prevention.

Keywords: Awareness; Oral cancer; Survey

ÖZET

Amaç: Bu çalışmada, Uluslararası Kıbrıs Üniversitesi Diş Hekimliği Fakültesi'ndeki diş hekimliği lisans öğrencileri arasındaki ağız kanseri farkındalığının değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntem: Ankete toplam 208 diş hekimliği öğrencisi gönüllü olarak katılmıştır. Anket sosyo-demografik profil, ağız kanseri farkındalığı ve bilgisine ilişkin 18 sorudan oluşmaktadır. Veriler IBM SPSS istatistik 24.0 programıyla analiz edilmiştir.

Bulgular: Katılımcıların %69'u (%33.2) 1. sınıf, 59'u (%28.4) 2. sınıf, 57'si (%27.4) üçüncü sınıf, 12'si (%5.8) 4. sınıf ve 11'i (%5.3) 5. sınıf öğrencileriydi. Öğrencilerin çoğunluğu sigara içmeyi (%81.3) potansiyel bir risk faktörü olarak belirtmiş, bunu ikinci sırada alkol tüketimi (%62) takip etmiştir. Sigara içmeyi risk faktörü olarak tanımlayan 5. sınıf öğrencilerinin yüzdesi diğer sınıflara göre biraz daha yüksekti ($p>0.05$). Tüm sınıflar sigaranın alkolden daha fazla ağız kanserine neden olduğunu belirtmiştir. Klinik belirtilerle ilgili olarak, %62.6'sı ağız kanserinin ağızda anormal bir kitle/yumru olarak ortaya çıkabileceğini bildirdi ancak katılımcıların yalnızca %52.2'si ağız kanserinin beyaz ve/veya kırmızı bir lezyon olarak ortaya çıkabileceğini bildirmiştir. Ağız kanserinden korunmak için en çok sigarayı bırakmak (%78.9) cevabı tercih edildi. Ağız kanseri eğitimi ve ağız kanserine neden olan HPV konusunda 4. ve 5. sınıfların anlamlı düzeyde daha iyi bilgi sahibi olduğu görüldü ($p<0.05$). Kadın katılımcılar ağız kanseri önlemleri hakkında önemli ölçüde daha yüksek bilgi gösterdi ($p<0.05$).

Sonuç: Çalışma, Kuzey Kıbrıs'taki diş hekimliği öğrencilerinin ağız kanseri konusunda bilgi, tutum ve farkındalıklarında önemli boşluklar bulunduğunu gösterirken, öğrencilerin genel olarak tütüne bağlı ağız kanseri riskinin farkında oldukları gösterilmiştir. Bu araştırma, ağız kanseri tespitini ve önlenmesini geliştirmek için diş hekimliğinde eğitim yaklaşımlarının geliştirilmesinin önemini vurgulamaktadır.

Anahtar Kelimeler: Anket; Farkındalık; Oral kanser

Makale gönderiliş tarihi: 10.05.2024; Yayına kabul tarihi: 27.07.2024

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INTRODUCTION

Globally, cancer affecting the lips and oral cavity ranks as the 11th most prevalent form of cancer in men and the 17th in women.[1] Oral cancer, a frequently occurring malignant disease with substantial morbidity and mortality rates, still lacks widespread public awareness. Annually, there are 377,713 newly reported cases globally, constituting 2% of all new cancer diagnoses.[2] Over 90% of cancerous growths in the oral cavity, oropharynx, and pharynx are squamous cell carcinomas originating from oral potentially malignant disorders like leukoplakia and erythroplakia.[3] Similar to many other cancers, oral cancer primarily affects older individuals. Approximately 95% of all cases of oral cancer are diagnosed in individuals aged 40 and above.[4]

Managing aetiological factors and early identification continue to be the most impactful strategies for lowering mortality rates and minimizing the treatment's impact on patient's quality of life. Eliminating tobacco use and moderating alcohol intake could prevent around three-quarters of oral cancers.[5-7] In addition, human papillomavirus (HPV) is linked to oral-pharyngeal carcinoma, while Epstein-Barr virus and exposure to ultraviolet radiation are often associated with lip cancer.[8]

Oral cancers are typically identified in late stages (III and IV) since they often lack symptoms during earlier stages. Despite advancements in treatment in recent times, survival rates for this form of cancer remain dismal globally, with an average five-year survival rate of 50%.[9] A delay in seeking medical attention or referral can greatly impact the morbidity and mortality rates related to oral cancer. Past reports have highlighted that a primary factor contributing to these delays in referral and treatment is the lack of public awareness.[10,11]

Thus, dental practitioners must have a strong understanding of the signs and symptoms of oral cancer lesions to facilitate early and efficient diagnosis. Achieving this target will involve providing thorough theoretical and practical education on oral cancer, encompassing the identification of different malignant lesions, understanding their causative factors, and conducting precise examinations on all patients, particularly those aged 40 and above.[12] While numerous studies[13-15] have explored the awareness of oral cancer and precancerous oral lesions among undergraduate dental students, there is a lack of information regarding undergraduate dental students' awareness of oral cancer in North Cyprus. Therefore, this study aimed to assess the awareness level of dental students regarding the signs, symptoms, knowledge, and risk factors associated with oral cancer among dental students in North Cyprus.

MATERIAL AND METHOD

This descriptive survey study was conducted using Google Forms (Menlo Park, California, USA) and the link was sent via e-mails or WhatsApp (WhatsApp Inc. of Mountain View, California) groups to all dental students at Cyprus International University in May 2024.

In total, 208 dental students willingly took part in a survey, they completed themselves. Participants were encouraged to email any questions they had and were instructed to mark and complete their answers independently.

The study was approved by the Cyprus International University Ethical Review Board (EKK23-24/009/13). All activities conducted in research involving human subjects adhered to the ethical guidelines set forth by the institutional and/or national research committee, following the principles outlined in the 1964 Helsinki Declaration and its subsequent revisions or equivalent ethical criteria. A self-administered multiple-choice questionnaire, adapted from a previously tested questionnaire utilized in similar research endeavors, was employed for data collection.[13,14,16]

The questionnaire aimed to achieve two objectives: (1) to determine the prevalence of risk factors within dental students and (2) to assess their awareness of cancer. To achieve this, the questionnaire encompassed various sociodemographic factors such as age, gender, and student grade, along with inquiries about awareness regarding smoking and drinking habits, general knowledge of oral cancer, familiarity with signs/symptoms, and recognition of risk factors associated with oral cancer. Additionally, the questionnaire contained two supplemental educational inquiries, the first concerning whether healthcare providers provided education about oral cancer and the link between HPV and oral cancer. Evaluation of knowledge included three questions about aware-

ness of the relationship between alcohol and oral cancer, recognition of oral cancer signs, and understanding of behaviors that may mitigate oral cancer risk.

Statistical analysis

The data obtained from the questionnaire were analyzed using SPSS 24 (SPSS, Chicago, IL, USA) using percentage frequency analysis to analyze the class and gender distribution of the sampled dental students. Comparisons were made at a $p < 0.05$ statistical significance level with a two-by-two table Chi-square analysis to determine whether the answers to the survey questions according to gender and class level showed a statistically significant difference. In addition, multiple responses were analyzed with the Chi-square test using cross tables and custom table feature after the multiple response data set was created.

RESULTS

A total of 208 prospective dentists participated in the study, of which 59.6% were female (n=124) and 40.4% were male (n=84). Of the prospective dentists, 33.2% (n=69) were first-year students, 28.4% (n=59) were second-year students, 27.4% (n=57) were third-year students, 5.8% (n=12) were fourth-year students and 5.3% (n=11) were fifth-year students. The distribution of participating dental students is shown in Table 1.

Table 1. Characteristics of undergraduate dentistry students qarticipating in the study

		N	%
Gender	Female	124	59.6
	Male	84	40.4
Grade of student	1st year	69	33.2
	2nd year	59	28.4
	3rd year	57	27.4
	4th year	12	5.8
	5th year	11	5.3
	Total	208	100

Among the participants, 31.6% were non-smokers at present, while 36.5% reported a history of smoking. In terms of daily smoking habits, 9.1% smoked at least 5 cigarettes, 5.3% smoked between 5 to 14 cigarettes, 6.7% smoked between 15 to 29 cigarettes, and 1.4% smoked more than 30 cigarettes. Additionally, 8 students were currently using smokeless tobacco.

34.3% percent of the participants attempted to quit tobacco use within the last year. Additionally, 50.9% reported no smoking activity in their household, while 35.1% mentioned daily tobacco use within their home.

55.7% of the participants abstained from alcohol use, while the highest frequency of alcohol consumption was reported as weekly, accounting for 32%.

While 84.8% of the participants stated tobacco use as a risk factor for oral cancer, the percentage decreased to 66.8% for alcohol use.

The most commonly identified symptoms of oral cancer were an abnormal mass or lump in the mouth (61.4%) and a non-healing mouth sore (56.4%). Following these, other symptoms included white or red patches in the mouth (49.6%), difficulty with chewing or swallowing (48.7%), and a gradual change in voice quality (34.5%).

The most prevalent preventive action against oral cancer was ceasing tobacco use (78.5%). Other actions included discontinuing alcohol consumption (55.4), maintaining oral hygiene by brushing and flossing teeth twice daily (42.3%), minimizing exposure to secondhand smoke (31.5%), and informing the dentist if dentures do not fit properly (25.2%).

Overall, half of the participants reported receiving education about oral cancer from their healthcare providers, and 58.3% indicated that their healthcare provider did not inform them about the link between HPV and oral cancer.

Answers to the questions were compared according to gender and a significant difference was observed in terms of current smoking, smoked in the past, current use of smokeless tobacco products such as snuff or chewing tobacco, the past use of these products, and also in the attempts to quit using tobacco products in the last 12 months. More male students (31.34% male vs 13.6% female) answered ‘yes’ to these questions ($p<0.05$). In terms of multiple-answer questions; there was no significant difference in terms of signs of mouth cancer, but female students showed significantly better knowledge about oral cancer precautions (Table 2).

Table 2. Comparison of the answers given by dental students to the survey questions in terms of gender.

	Female (n=124)	Male (n=84)	
	Yes	**Yes**	**p [a]**
Do you currently smoke tobacco products such as cigarettes, cigars, e-cigarettes etc.?	17.90%	45.20%	**<0.001***
Have you smoked tobacco in the past?	24.80%	48.10%	**0.001***
Do you currently use smokeless tobacco products such as snuff or chewing tobacco?	1.70%	7.40%	**0.040***
Have you used smokeless tobacco in the past?	3.30%	18.20%	**<0.001***
During the past 12 months, have you tried to stop using tobacco products?	20.30%	37.80%	**0.008***
Do you know that tobacco may cause mouth cancer?	83.70%	81.50%	0.675
Do you drink alcohol?	37.10%	38.30%	0.865
Do you know that alcohol may cause mouth cancer?	62.90%	63.70%	0.903
Does your healthcare provider educate you about mouth cancer?	56.60%	45.00%	0.108
Has your healthcare provider told you that Human Papilloma Virus (HPV) can cause mouth cancer?	45.90%	37.50%	0.238
Difficulty chewing/swallowing	52.50%	46.80%	
Abnormal mass/lump in the mouth	65.60%	59.50%	
Mouth sore that does not heal	59.80%	54.50%	0.764
White/red patch in mouth	54.90%	49.40%	
Slow change in voice quality	34.40%	32.90%	
Quit tobacco use	81.80%	75.90%	
Brush and floss your teeth twice/day	44.60%	38.00%	
Telling your dentist when your denture(s) do not fit well	34.70%	15.20%	**0.036***
Avoid contact with second-hand smoke	33.90%	34.50%	
Quit alchol use	54.50%	60.80%	

a Chi-squared test, * shows statistical significance (p<0.05)

In terms of the grade level of the dental students, a significant difference was observed in the answers. The responses to the question of whether your health care provider informed you about oral cancer showed a significant difference according to the grade level, and it was observed that 4th (81.8%) and 5th (90.9%) grade dental students were more informed by their health care providers (p<0.05). Also, 5th-year students (81.8%) showed significantly more knowledge about information provided by the health care provider about the possibility of HPV causing oral cancer according to grade level (p<0.05) (Table 3).

Table 4 shows the comparison of answers between the currently smoking and non-smoker participants. As a result, the knowledge that alcohol may cause mouth cancer was significantly higher in current smokers than non-smokers (p<0.05).

Table 5 shows the comparison of answers between the currently smoking and non-smoker participants. There was a significant difference in the question of education about oral cancer by healthcare providers, as a result, alcohol users showed that they were more educated about oral cancer (p<0.05). Also, alcohol users showed significantly more knowledge about signs of oral cancer and oral cancer precautions (p<0.05).

Table 3. Comparison of the answers given by dental students to the survey questions in terms of grade.

	1st year (n=69) Yes	2nd year (n=59) Yes	3rd year (n=57) Yes	4th year (n=12) Yes	5th year (n=11) Yes	p [a]
Do you currently smoke tobacco products such as cigarettes, cigars, e-cigarettes etc.?	27.50%	18.60%	33.90%	50.00%	45.50%	0.098
Have you smoked tobacco in the past?	28.80%	28.10%	39.30%	66.70%	36.40%	0.088
Do you currently use smokeless tobacco products such as snuff or chewing tobacco?	7.60%	3.60%	0.00%	8.30%	0.00%	0.223
Have you used smokeless tobacco in the past?	9.10%	8.90%	7.30%	16.70%	10.00%	0.899
During the past 12 months, have you tried to stop using tobacco products?	23.00%	20.80%	35.70%	41.70%	20.00%	0.262
Do you know that tobacco may cause mouth cancer?	85.10%	78.90%	82.50%	83.30%	90.90%	0.852
Do you drink alcohol?	34.30%	31.00%	38.60%	58.30%	63.60%	0.148
Do you know that alcohol may cause mouth cancer?	67.20%	59.60%	56.10%	66.70%	90.90%	0.224
Does your healthcare provider educate you about mouth cancer?	52.30%	46.60%	43.90%	81.80%	90.90%	**0.012***
Has your healthcare provider told you that Human Papilloma Virus (HPV) can cause mouth cancer?	35.40%	44.80%	35.70%	66.70%	81.80%	**0.015***
Difficulty chewing/swallowing	56.30%	62.10%	39.30%	33.30%	27.30%	
Abnormal mass/lump in the mouth	65.20%	62.10%	62.50%	58.30%	81.80%	
A mouth sore that does not heal	64.10%	62.10%	42.90%	50.00%	81.80%	0.11
White/red patch in mouth	53.10%	56.90%	44.60%	58.30%	63.60%	
Slow change in voice quality	37.50%	39.70%	28.60%	25.00%	18.20%	
Quit Tobacco Use	78.10%	87.70%	75.00%	75.00%	72.70%	
Brush and floss your teeth twice/day	40.60%	38.60%	41.10%	66.70%	45.50%	
Telling your dentist when your denture(s) do not fit well	37.50%	24.60%	21.40%	16.20%	18.20%	0.149
Avoid contact with second-hand smoke	35.90%	28.10%	32.10%	50.00%	54.50%	
Quit alcohol use	60.90%	68.40%	42.90%	41.70%	63.60%	

a Chi-squared test, * shows statistical significance ($p<0.05$)

Table 4. Comparison of the answers given by dental students to the survey questions in terms of currently smoking tobacco products

		Non-smoker	**Smoker**	
		Yes f - %	**Yes f - %**	**p [a]**
Patients who are only aware that they may have cancer (Selected Yes). *Due to the filtering (selection) in the database, the numbers differ in the total frequencies.*	Do you know that tobacco may cause mouth cancer?	115 - 79.90%	53 - 89.80%	0.88
	Do you know that alcohol may cause mouth cancer?	85 - 59.00%	44 - 74.60%	0.037*
	Does your healthcare provider educate you about mouth cancer?	69 - 48.30%	36 - 62.10%	0.76
	Has your healthcare provider told you that Human Papilloma Virus (HPV) can cause mouth cancer?	60 - 42.30%	26 - 44.10%	0.813
Cancer Symptoms seen in patients (Symptoms were seen in a total of 200 patients, some patients had one symptom, some had more than one symptom) ** (Multiple response data set percentages and totals are based on respondents)*	Difficulty chewing/swallowing	75 - 53.20%	26 - 44.10%	0.124
	Abnormal mass/lump in the mouth	92 - 65.20%	34 - 57.60%	
	Mouth sore that does not heal	85 - 60.30%	31 - 52.50%	
	White/red patch in mouth	82 - 58.20%	24 - 40.70%	
	Slow change in voice quality	47- 33.30%	21- 35.60%	
	Total Symptoms	**141**	**59**	
A total of 199 patients provided information about their behaviours and measures, and a patient may exhibit a behaviour once or more than once. ** (Multiple response data set percentages and totals are based on respondents)*	Quit tobacco use	113- 80.70%	45- 76.30%	0.14
	Brush and floss your teeth twice/day	59 - 42.10%	25 - 42.40%	
	Telling your dentist when your denture(s) do not fit well	42- 30.00%	12- 20.30%	
	Avoid contact with second-hand smoke	55 - 39.30%	23.70%	
	Quit alcohol use	84 - 60.00%	30- 50.80%	
	Total behave and precautions	**140**	**59**	

a Chi-squared test, * shows statistical significance (p<0.05)

Table 5. Comparison of the answers given by dental students to the survey questions in terms of alcohol usage.

		No alcohol use	Alcohol user	
		Yes f - %	**Yes f - %**	**p [a]**
Patients who are only aware that they may have cancer (Selected Yes). *Due to the filtering (selection) in the database, the numbers differ in the total frequencies.*	Do you know that tobacco may cause mouth cancer?	102 - 79.70%	67 - 88.20%	0.121
	Do you know that alcohol may cause mouth cancer?	81 - 63.80%	48 - 62.30%	0.836
	Does your healthcare provider educate you about mouth cancer?	58 - 46.00%	47 - 61.80%	**0.029***
	Has your healthcare provider told you that Human Papilloma Virus (HPV) can cause mouth cancer?	50 - 40.00%	36 - 46.80%	0.346
Cancer Symptoms seen in patients (Symptoms were seen in a total of 201 patients, some patients had one symptom, some had more than one symptom) ** (Multiple response data set percentages and totals are based on respondents)*	Difficulty chewing/swallowing	66 - 53.20%	35 - 45.50%	**0.040***
	Abnormal mass/lump in the mouth	**88 - 71.00%**	**39 - 50.60%**	
	Mouth sore that does not heal	74 - 59.70%	42 - 54.50%	
	White/red patch in mouth	66 - 53.20%	40 - 51.90%	
	Slow change in voice quality	46 - 37.10%	22 - 28.60%	
	Total Symptoms	**124**	**77**	
A total of 200 patients provided information about their behaviours and measures, and a patient may exhibit a behaviour once or more than once. ** (Multiple response data set percentages and totals are based on respondents)*	Quit tobacco use	100 - 81.30%	59 - 76.60%	**0.009***
	Brush and floss your teeth twice/day	52 - 42.30%	32 - 41.60%	
	Telling your dentist when your denture(s) do not fit well	**41 - 33.30%**	**13 - 16.90%**	
	Avoid contact with second-hand smoke	49 - 39.80%	20 - 26.00%	
	Quit alcohol use	77 - 62.60%	37 - 48.10%	
	Totals behave and precautions	**123**	**77**	

a Chi-squared test, * shows statistical significance (p<0.05).

DISCUSSION

Oral cancer is arguably the most consequential condition that a dentist can identify. Additionally, early detection is seen as the most effective method for reducing both the mortality and morbidity associated with this disorder.[17,18] Awareness among patients and knowledge among practitioners is crucial for the early detection and prevention of oral cancer. Both dental and medical professionals play a central role in identifying oral cancer and its precancerous lesions. Therefore, this research aimed to evaluate the level of oral cancer awareness among students enrolled in the dental faculty of Cyprus International University in Cyprus.

The research revealed a gender disparity, with a predominance of female students in dental students, consistent with findings from prior studies.[13,19,20,21]

In the current survey, smoking and alcohol consumption were the most commonly recognized risk factors. These findings are consistent with the previous studies.[17,22]

Students in 4th year and 5th year were more knowledgeable about risk factors according to our results. Resembling our result, Boroumand *et al*.[23] discovered in their research with Maryland dental students that freshmen had lower awareness of oral cancer than students in higher academic years. Rahman *et al*[24] did not observe any statistically

significant correlation between risk factor knowledge scores and academic year.

According to our results; oral changes linked to oral cancer were generally recognized to a lesser extent compared to risk factors. Participants commonly identified mucosal changes such as abnormal mass/lump in the mouth, mouth sore that does not heal, and white/red patch in the mouth. As noted by Bagan *et al*.[25], the predominant clinical presentation of oral cancer in its early stages was red and white lesions, whereas, participants indicated abnormal mass/lump in the mouth in the first place. Our study revealed a reasonable awareness regarding changes in the oral mucosa associated with oral cancer. 62.6% of the students answered abnormal mass/lump in the mouth was a sign of oral cancer, and 57.1% of participants recognized a mouth sore that does not heal as a potential manifestation of oral cancer, on the other hand, this rate is troubling considering that dentists are often among the first healthcare professionals to examine the oral mucosa. Awareness of other oral cancer manifestations was lower, with 52.2% recognizing white/red patches in the mouth, 48.7% difficulty with chewing or swallowing, and 34.5% a gradual change in voice quality. Poudel *et al*.[26] conducted a study about oral cancer survey among dental students and dental surgeons, they found lower rates regarding oral cancer awareness.

In our research, 36.5% of participating dental students were former smokers, while 31.6% were current smokers. This notably high prevalence of smoking among dental students raises concerns. Notably, among those with less knowledge about the signs and precautions of oral cancer, more students were smokers than non-smokers. This study highlights a trend where smokers exhibit lower awareness of oral cancer.

Furthermore, existing literature indicates that dental students tend to perform procedures in their clinical practice that they have been consistently taught during their clinical training. It is imperative to prioritize education on oral cancer prevention and diagnosis in the dental student curriculum. By enhancing the oral cancer knowledge of graduating dental students, the pool of dental practitioners equipped with the requisite expertise to deliver appropriate oral cancer prevention and examination procedures to their patients will expand.[24]

Devadiga *et al*.[27] proposed that a teaching hospital offers an optimal setting for students to dedicate ample time and convert theoretical understanding of oral cancer into practical skills. They advocate for training students to inquire about and document oral cancer risk factors, conduct oral cancer screenings, conduct diagnostic tests for individuals at elevated risk, offer advice and referrals for alcohol and tobacco cessation, and educate patients on self-examination to recognize early signs of oral cancer.

This study has some limitations. Firstly, the questions in the survey were general questions about oral cancer awareness. Secondly, the sample size of the study is relatively small. Moreover, the survey primarily relied on closed-ended questions, potentially restricting the depth of comprehension regarding the underlying reasons for specific behaviors or attitudes and resulting in a lack of qualitative insights. A survey can be conducted in future studies by preparing more clinical questions with more participants.

CONCLUSION

While the study suggests significant gaps in the knowledge, attitudes, and awareness of dental students in North Cyprus regarding oral cancer, students are generally aware of the risk of tobacco-related oral cancer. This research emphasized the significance of enhancing educational approaches in dentistry to improve oral cancer detection and prevention.

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DOI: http://doi.org/10.54617/adoklinikbilimler.1471621

Original Research Article

Comparative Evaluation of Postoperative Edema Following Mandibular Third Molar Extraction Using Zirconia versus Carbide Burs

Mandibular Üçüncü Molar Çekiminde Zirkonyum ve Karbid Frezlerin Kullanımının Postoperatif Ödem Üzerine Karşılaştırmalı Değerlendirmesi

Ferit Bayram[1], Sardar Fattahzade[2], Gökhan Göçmen[3]

ABSTRACT

Aim: The use of zirconia burs with low thermal conductivity in the extraction of impacted mandibular third molars may improve postoperative patient outcomes. The aim of this study was to evaluate the effect of using zirconia burs on postoperative edema, trismus, and pain in impacted mandibular third molars.

Material and Method: This prospective randomized controlled study was conducted between January and July 2023 with participants who underwent impacted mandibular third molar extraction surgery at the Marmara University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery. The primary outcome measures were facial volume and surface area change measured by a mobile 3D scanning device. Postoperative maximum interincisal opening (MIO) and pain (measured by the VAS) were secondary outcome measures for this study. Age, sex, classification and position of the mandibular third molar were the demographic variables. Facial volume changes, MIO, and pain were compared within and between groups using a general linear model.

Results: A total of 40 patients aged between 18 and 45 years were included in the final analysis. Postoperative facial volume, surface area, MIO, and pain did not significantly differ between the zirconia group and the carbide bur group on days 3 and 7 ($P > 0.05$).

Conclusion: The use of zirconia burs for bone removal in mandibular wisdom tooth extraction did not result in a statistically significant difference with regard to postoperative facial edema, MIOs or pain.

Keywords (MeSH): Impacted Tooth; Mandible; Morbidity; Zirconia

ÖZET

Amaç: Gömülü mandibular üçüncü molar dişlerin çekiminde düşük termal iletkenliğe sahip zirkonya frezlerin kullanılması postoperatif hasta sonuçlarını iyileştirebilir. Bu çalışmanın amacı, gömülü mandibular üçüncü molar dişlerde zirkonya frez kullanımının postoperatif ödem, trismus ve ağrı üzerindeki etkisini değerlendirmektir.

Gereç ve Yöntem: Bu prospektif randomize kontrollü çalışma, Ocak-Temmuz 2023 tarihleri arasında Marmara Üniversitesi Diş Hekimliği Fakültesi Ağız Diş ve Çene Cerrahisi Anabilim Dalı'nda gömülü mandibular üçüncü molar diş çekimi ameliyatı için başvuran katılımcılarla yürütülmüştür. Birincil sonuç ölçütleri, mobil bir 3D tarama uygulaması ile ölçülen yüz hacmi ve yüzey alanı değişimidir. Ameliyat sonrası maksimum interinsizal açıklık (MIA) ve ağrı (VAS skoru ile ölçülen) bu çalışma için ikincil sonuç ölçütleridir. Yaş, cinsiyet, sınıflandırma ve mandibular üçüncü molar dişin pozisyonu demografik özellikleri oluşturmuştur. Yüz hacmi değişiklikleri, MIO ve ağrı, genel lineer model kullanılarak grup içinde ve gruplar arasında karşılaştırılmıştır.

Bulgular: Yaşları 18 ila 45 arasında değişen toplam 40 hasta son analize dahil edilmiştir. Zirkonya grubunda, ameliyat sonrası yüz hacmi, yüzey alanı, MIA ve 3. ve 7. günlerdeki ağrı ölçümleri, karbür frez grubundakilere kıyasla istatistiksel olarak anlamlı farklılıklar göstermemiştir ($P > 0.05$).

Sonuç: Mandibular yirmi yaş dişi çekiminde kemik çıkarılması için zirkonya frezlerin kullanılması, ameliyat sonrası yüz ödemi, MIA'lar ve ağrı açısından istatistiksel olarak anlamlı bir farka yol açmamıştır.

Anahtar Kelimeler: Gömülü diş; Mandibula; Morbidite; Zirkonyum

Makale gönderiliş tarihi: 21.04.2024; Yayına kabul tarihi: 14.08.2024

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INTRODUCTION

Impacted teeth are more commonly observed in the mandible,[1] and the incidence of mandibular third molars is greater in females than in males.[2,3] The extraction of these teeth depends on the position of the tooth and often necessitates various osteotomies in the tooth itself or the surrounding bone. Various intraoperative or postoperative complications are observed depending on the extraction of the tooth and the osteotomy performed around it. Common complications following the extraction of these teeth include swelling, trismus, and pain,[4] while rare complications include nerve damage.[5] Osteotomies in bone cause an increase in temperature,[6,7] which can harm living cells if the pressure or temperature becomes excessive,[8] and elevated temperatures can increase postoperative morbidity in individuals. Therefore, it is crucial to prevent excessive temperature increases in the bone during surgery on impacted mandibular third molars.

During the surgery of impacted third molars, various methods, such as conventional burs, piezosurgery,[9,10] and lasers,[11] are utilized in clinical settings. Among these methods, carbide burs are often preferred due to their cost-effectiveness and ease of use. However, the disadvantage of this method is the thermal changes it causes in the bone.[12] Due to this drawback of carbide burs, zirconia burs have been proposed as an alternative.[13] Zirconia is useful for osteotomy in bone due to its mechanical properties, biocompatibility, reliability, strength, and resistance to corrosion.[14] Despite the increasing advancements in the production of zirconia burs, only a limited number of studies have assessed the impact of heat increase in bone, and these studies are confined to *in vitro* conditions or dental implant osteotomies.[15,16] To the authors' knowledge, the effect of using zirconia burs on postoperative morbidity in osteotomies for the extraction of impacted mandibular teeth has not been previously investigated.

The aim of this study was to compare the postoperative morbidity following the extraction of impacted third molars using zirconia and carbide burs. To the authors' knowledge, this is the first study to undertake such a comparison. Our hypothesis is that the use of zirconia in the extraction of impacted mandibular teeth does not have a positive effect on early postoperative morbidity.

MATERIAL AND METHOD

Study Setting

This prospective randomized controlled study was conducted at the Marmara University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, between January and July of 2023. Ethical approval for this study was granted by the Ethics Committee of Marmara University School of Medicine, with approval number 09.2022.1029 dated November 29, 2022.

Inclusion criteria

Eligible participants were individuals aged between 18 and 45 years with an ASA physical status of I or II. Participants required the extraction of impacted mandibular third molars for prophylactic or orthodontic reasons and were classified as Class II according to Pell and Gregory and mesioangular according to Winter's classification. The exclusion criteria included individuals with systemic diseases or medication use affecting bone or soft tissue metabolism, pregnant or lactating women, individuals who smoked more than 10 cigarettes per day or who were alcohol dependent, and those with a history of malignancy, chemotherapy, or radiotherapy. Additionally, individuals unwilling to give informed consent were excluded from the study.

Participants and Groups

Participants were divided into two treatment groups: the zirconia group and the carbide group. Preoperative radiographic assessments were conducted using panoramic radiographs to document the type of impaction, which included mesioangular, distoangular, and horizontal classifications.

Randomization

A total of 40 patients were randomized into two groups of 20 each using a computer-generated random number sequence. The randomization process was overseen by an independent statistician and the random numbers were kept in sealed, opaque envelopes, which were opened only by the surgical team prior to each procedure.

Surgical Procedure

All surgical procedures were conducted under local anesthesia. Preoperative antisepsis was achieved using a 10% povidone-iodine solution for extraoral sites and 0.12% chlorhexidine gluconate for intraoral sites. Inferior alveolar nerve blocks and vestibular infiltration were performed using articaine hydrochloride with epinephrine for local anesthesia. An envelope flap was created to access the surgical site. The buccal and distal surfaces of the teeth were osteotomized using a bur according to the group assignment—either zirconia or carbide (Figure 1). If necessary, the impacted tooth was sectioned and then elevated for extraction. After hemostasis was achieved, the wounds were closed primarily with 3/0 silk sutures using simple interrupted sutures.

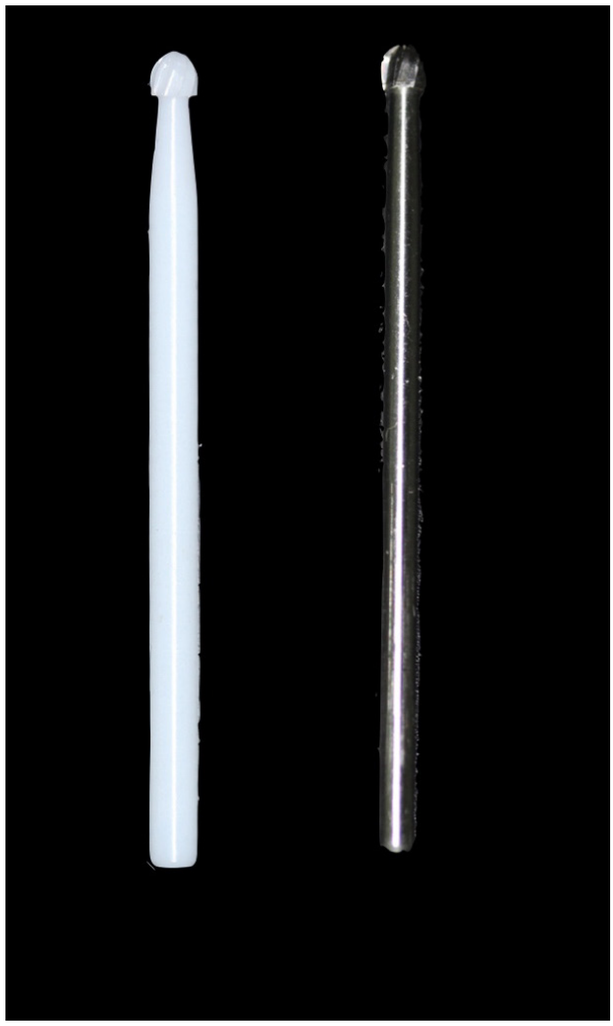

Figure 1. Zirconia bur (left) vs. Carbide bur (right) used in third molar extractions.

Outcome Measures

Changes in facial volume and surface area were measured using a mobile 3D scanning device. For this purpose, the Heges® mobile app (Marek Simonik, North Moravia, Czech Republic) on an iPhone 14 (Apple Inc., California, USA) was used at all time points (T0: preoperative, T1: postoperative 3rd day, T2: postoperative 7th day). Preoperative and postoperative data obtained were overlaid with Meshmixer (Autodesk, California, USA) software. The superimposed STL data were split in the mid-sagittal plane, leaving the side of tooth extraction, and the remaining part was discarded. Then, a line was drawn from the tragus to the lateral canthus, and the remaining part was discarded. In the remaining data, in profile view, a line parallel to the ground was drawn from the cervicomental junction, and a perpendicular line descended from the tragus to this line. The final STL data obtained at 3 different times were used for the evaluation of edema. The surface area of the remaining part in the STL data was measured in mm^2, and the facial volume was measured in mm^3 with the help of Meshmixer software (Figure 2).

To assess the restriction in mouth opening (trismus), the distance between the mesioincisal edge of the right maxillary first incisor and the mesioincisal edge of the right mandibular first incisor was measured during the patient's unassisted maximum interincisal opening. These measurements, recorded in millimeters, were documented at all time points.

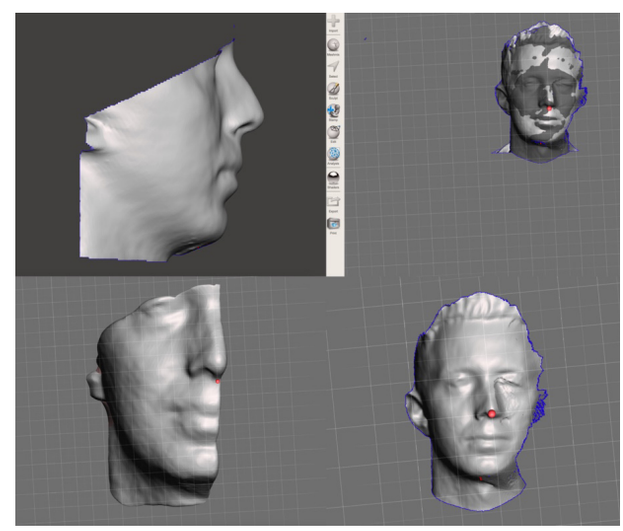

Figure 2. Preoperative and postoperative facial changes were analyzed using a mobile 3D scanner application and Meshmixer software.

To measure pain, the visual analog scale (VAS) was utilized. The VAS is a scale that ranges from 0 to 10, with endpoints defined as 'no pain at all' and 'worst possible pain'. Participants were asked to indicate their level of pain on the scale between these two endpoints. The distance from 'no pain' to the point marked by the participants represents their perceived pain level. In our study, this scale was used to assess the postoperative pain conditions of the participants.

Statistical analysis

Continuous variables were summarized using means and standard deviations, while categorical variables were described using frequencies and percentages. The fit of the distribution of the data to normal distribution was analyzed using the Shapiro–Wilk test. A general linear model (GLM) was applied to compare outcomes between groups across three time points (preoperative, third-day postoperative, and seventh-day postoperative) using SPSS version 29.0. This analysis aimed to identify significant differences in edema, mouth opening, and pain between the groups over time, with a significance level set at $p < 0.05$.

RESULTS

Demographics

This study included 40 participants. The mean age was 27.5 years, with a standard deviation of 7.2 years, indicating a young adult population. In terms of gender distribution, the sample consisted of 24 women and 16 men. The majority of the participants, 32 out of 40, were nonsmokers. The reasons for the extraction of impacted third molars were primarily prophylactic (70% of patients), while the remaining 30% were extracted for orthodontic purposes (Table 1).

Table 1. Descriptive statistics of the sample used

Variable	Mean	SD	n	%
Age	27.5	7.2	40	
Gender				
Female			24	60
Male			16	40
Smoking status				
Absent			32	80
Present			8	20
Indication for extraction				
Prophylactic			28	70
Orthodontic			12	30

SD: Standard deviation

Postoperative Edema

The analysis of volume changes across three specific time points—preoperative, third postoperative day, and seventh postoperative day—revealed significant temporal variations ($F = 12.24$, $p < 0.001$), suggesting substantial changes in volume over time. However, the interaction between time and the type of bur used (zirconia vs. Carbide) did not reach statistical significance ($p = 0.265$), indicating that the volume change pattern was consistent across different burs. In the surface area analysis, there were notable changes over time ($F = 8.8$, $p < 0.002$), with no significant interaction between time and material type ($p = 0.309$), suggesting consistent surface area changed regardless of the material used (Table 2).

Table 2. Comparison of volume changes, surface area changes, maximum interincisal opening, and pain between zirconia and tungsten groups at different time points

Parameter	Time Point	Zirconia	Tungsten	F	p
		Mean (SD)	Mean (SD)		
Volume Changes (mm³)				12.2	< 0.001
	Preoperative	0.031 (0.006)	0.034 (0.006)		
	3rd day	0.048 (0.118)	0.040 (0.006)		
	7th day	0.031 (0.005)	0.035 (0.005)		
Interaction (Time * Group)					0.265
Surface Area Changes (mm²)				8.8	< 0.002
	Preoperative	0.038 (0.006)	0.036 (0.006)		
	3rd day	0.040 (0.005)	0.040 (0.008)		
	7th day	0.039 (0.006)	0.037 (0.009)		
Interaction (Time * Group)					0.309
Maximum Interincisal Opening				36.2	< 0.001
	Preoperative	39.6 (1.4)	40.5 (1.3)		
	3rd day	35.5 (1.0)	35.5 (2.7)		
	7th day	39.0 (1.3)	38.1 (2.2)		
Interaction (Time * Group)					0.204
Pain (VAS)				300.1	< 0.001
	3rd day	7.5 (0.8)	7.3 (0.4)		
	7th day	1.7 (0.3)	1.5 (0.3)		
Interaction (Time * Group)					0.713

SD: Standard deviation

Maximum Interincisal Opening

Significant fluctuations were also observed in Maximum interincisal opening (MIO) across the measured time points ($F = 36.2$, $p < 0.001$). The lack of a significant interaction effect between time and group ($p = 0.204$) indicates that MIO changes were uniform across both groups throughout the study period (Table 2).

Pain

Visual Analog Scale (VAS) assessments for pain revealed dramatic changes over time ($F = 300.08$, $p < 0.001$), with no significant difference in pain reduction between the groups over time ($p = 0.713$), highlighting a uniform decrease in pain levels across all participants (Table 2).

DISCUSSION

Third molar surgery is one of the most common outpatient procedures performed by dentists,[17] and efforts to minimize associated complications are highly important. The literature suggests various recommendations for reducing complications, including the use of advanced techniques such as piezosurgery and PRF[9,18] however, many of these techniques are costly and not easily applicable to every patient in routine practice. Therefore, alternative approaches to decrease postoperative morbidity are necessary. According to our results, there were no statistically significant differences in postoperative morbidity assessed through edema, MIO, or pain parameters between the zirconia and carbide bur groups, thus supporting our hypothesis

that the type of bur used does not significantly influence early postoperative outcomes. This finding suggests that both materials are equally effective in managing postoperative morbidity within the parameters of our study.

The thermodynamic effects induced by surgical burs in bone are widely described in the literature,[19-21] with most of these studies being conducted *in vitro*.[8] However, the actual magnitude of temperature increase in the oral mucosa and jawbone under clinical conditions remains unclear.[22] Furthermore, the literature does not provide definitive conclusions about the impact of the material from which the bur is made on heat production during osteotomy.[23] Zirconia burs are considered a suitable alternative to tungsten carbide burs for superficial bone drilling with cooling fluids due to their lower wear and temperatures.[16] A meta-analysis including recent *in vitro* studies by Bento *et al*.[24] showed that zirconia burs result in significantly less temperature change than stainless steel burs. However, these *in vitro* studies lack extensive clinical support. In our study, no differences were found in postoperative morbidity between zirconia and carbide burs. These findings, combined with those of *in vitro* studies, suggest that zirconia burs may produce less heat increase, but this difference may not be clinically significant.

Accurately measuring postextraction edema is challenging due to its three-dimensional distribution. Various techniques have been employed, including Neupert *et al*.[25] five-point measurement technique. With the widespread adoption of 3D scanning technologies, assessing superficial and volumetric changes in tissues has become more straightforward and precise. 3D digital analysis, such as that of Heges®, is an objective, repeatable, and reliable method for evaluating facial swelling. In our study, we employed a unique application of this method, providing a clinically feasible alternative for routine edema measurement.[26]

This study has several strengths that support its scientific validity and relevance. The use of a randomized controlled design minimizes bias and ensures broad applicability of the results, which is crucial in the evaluation of clinical interventions. The inclusion of a homogeneous aged cohort, specifically participants aged 18 to 45 years, reduces variability due to age-related factors and focuses the findings on a demographic commonly seen in clinical settings. Furthermore, the use of three-dimensional imaging for edema assessment provides precise measurements of postsurgical swelling, providing detailed and quantifiable data. However, this study also has several limitations that should be considered. First, the design does not include the long-term effects of the materials used. The follow-up period was limited to only seven days postoperatively, which provides a snapshot rather than a comprehensive view of the healing process or late-onset complications or successes associated with the burs tested. A longer follow-up will be necessary to fully understand the effects of using zirconia versus carbide in surgical procedures. Second, while the sample size was sufficient to detect large differences, it may have been too small to detect smaller but clinically meaningful effects. This may particularly affect the ability to generalize findings to a wider population or to identify subtle differences between groups. Future studies would benefit from a larger sample pool to increase the robustness and applicability of the findings.

CONCLUSION

In conclusion, this study found that both zirconia and the more economical and widely used carbide were similar in terms of postoperative morbidity in the extraction of impacted mandibular third molars seven days after surgery, regardless of the bur used. Supported by a randomized controlled design and three-dimensional imaging, these findings highlight the applicability of both materials in clinical settings. Nonetheless, the short follow-up period and limited sample size call for further research to assess long-term outcomes and validate these results across a broader population. Extending the follow-up duration beyond seven days may provide a more comprehensive understanding of potential delayed complications or benefits. Moreover, future studies should also consider directly measuring intraoperative temperature to better analyze its impact on postoperative morbidity.

ACKNOWLEDGEMENT

None

CONFLICT OF INTEREST

None

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DOI: http://doi.org/10.54617/adoklinikbilimler.1520506

Original Research Article

Influence of Background Color And Target Tooth Shade on Shade Matching Accuracy

Arka Plan Rengi ve Hedef Diş Renginin Renk Seçim Doğruluğu Üzerine Etkisi

Taygun Sezer[1], Aygül Yaprak[2]

ABSTRACT

Aim: This study analyzed the effect of background color and target tooth shade on visual shade matching.

Material and Method: Twenty prosthodontists performed visual shade matching on four different backgrounds (green, gray, white, black) using the Vita Classical shade guide. Two identical shade guides were used for shade matching. One of them was blinded so that the color codes on it could not be identified. Each observer matched all 16 shade tabs using the second shade guide on four different backgrounds. The effects of background and target tooth shade factors on shade matching accuracy were analyzed with the Pearson's Chi-squared test. P<0.05 was considered statistically significant.

Results: The background significantly affected shade matching accuracy (p=0.006). The correct match percentages were 79.7%, 74.7%, 69.7%, and 68.8% on gray, black, green, and white backgrounds, respectively. More accurate matching was achieved on the gray background than the green and white backgrounds. The target tooth shade significantly affected shade matching accuracy (p<0.001). The correct matching rates by target shade tab were obtained as follows: A1 (75%), A2 (55%), A3 (63.8%), A3.5 (81.3%), A4 (81.3%), B1 (96, 3), B2 (75%), B3 (78.8%), B4 (71.3%), C1 (63.8%), C2 (70%), C3 (58.8%), C4 (86.3%), D2 (96.3%), D3 (45%), and D4 (73.8%).

Conclusion: Background color and target tooth shade significantly affected visual shade matching accuracy.

Keywords: Color perception; Dental aesthetic; Dental prosthesis; Prosthesis coloring

ÖZET

Amaç: Bu çalışma, arka plan renginin ve hedef diş renginin görsel renk seçimi üzerindeki etkisini analiz etti.

Gereç ve Yöntem: Yirmi protetik diş tedavisi uzmanı, Vita Classical renk skalasını kullanarak dört farklı arka plan (yeşil, gri, beyaz, siyah) üzerinde görsel renk seçimi gerçekleştirdi. Renk seçimi için iki özdeş renk skalası kullanıldı. Bunlardan birisi üzerindeki renk kodları belirlenemeyecek şekilde kapatıldı. Her gözlemci, ikinci renk kılavuzunu kullanarak 16 renk tonunun tamamını dört farklı arka plan üzerinde eşleştirdi. Arka plan ve hedef diş rengi faktörlerinin renk seçim doğruluğu üzerindeki etkileri Ki-kare testi ile analiz edildi. P<0.05 istatistiksel olarak anlamlı kabul edildi.

Bulgular: Arka plan, renk seçim doğruluğunu önemli ölçüde etkiledi (p=0.006). Doğru eşleşme yüzdeleri gri, siyah, yeşil ve beyaz arka planda sırasıyla %79.7, %74.7, %69.7 ve %68.8 idi. Gri arka planda, yeşil ve beyaz arka planlara göre daha doğru eşleştirme elde edildi. Hedef diş rengi renk seçim doğruluğunu önemli ölçüde etkiledi (p<0.001). Hedef renk sekmesine göre doğru eşleşme oranları şu şekilde elde edildi: A1(%75), A2(%55), A3(%63.8), A3.5(%81.3), A4(%81.3), B1(96.3), B2(%75), B3(%78.8), B4(%71.3), C1(%63.8), C2(%70), C3(%58.8), C4(%86.3), D2(%96.3), D3(%45), D4(%73.8).

Sonuç: Arka plan rengi ve hedef diş rengi görsel renk seçim doğruluğunu önemli ölçüde etkiledi.

Anahtar Kelimeler: Dental estetik; Dental protez; Protez renklendirmesi; Renk algısı

Makale gönderiliş tarihi: 22.07.2024; Yayına kabul tarihi: 08.12.2024
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INTRODUCTION

In dentistry, it is essential to combine factors such as aesthetics, function, and longevity to achieve an acceptable restoration. One of the most important aesthetic parameters is the restoration color. The first step in obtaining restorations that look like natural teeth is shade matching. Tooth shade matching can be performed with visual methods, instrumental methods, or a combination of the two techniques.[1–3]

Visual shade matching using shade guides is the most common method of determining tooth color.[4] Visual shade matching is affected by factors such as background color,[5–8] light source,[5,9–11] shade guides,[12–14] age,[12,15] gender,[15–17] experience,[16,18,19] surface properties of the object,[20] color training,[21,22] and vision defects.[23] The background refers to the surface upon which samples are placed along with the environment extending for about 10° from the edge of the stimulus in all directions (ISO TR 28642/2011).[6]

Adjacent teeth, dental restorations, gingiva, lips, and rubber dams may become the background during shade matching. Shade determination may be negatively affected due to the color contrast between these structures and the target tooth.[24] As the color contrast between the background and the target tooth increases, the background's effect on visual perception also increases. Therefore, one should remove the makeup and the rubber dam before shade matching.[25] Dazzling clothes, glasses or items that distort visual perception should be avoided.[26] Although the effect of background on shade matching is generally considered important, few studies have identified and measured its effects.[5–8] Liberato *et al*.[8] reported less difference between visual and instrumental shade matching made with a gray background than with no background. Dudea *et al*.[6] found that white and black backgrounds had the best results, followed by gray and red backgrounds, with blue backgrounds producing the worst results. Another study reported that shade matching performed on a pink background resulted in higher accuracy than on a blue background.[5]

This study aimed to analyze the effect of background color and target tooth shade on visual shade matching. The null hypotheses of the study were that visual shade matching would not be affected by background color (1) and target tooth shade (2).

MATERIAL AND METHOD

This study was reviewed and approved by Erciyes University Clinical Research Ethics Committee (Approval number: 2023/823). Twenty prosthodontists, comprising ten women and ten men aged between 25 and 40, were included in the study. All participants signed an informed consent form. Similar to previous studies, the participants' color discrimination abilities were verified using the Ishihara Color Vision Test (Shinobu Ishihara, Tokyo, Japan) which is an acceptable test for screening color vision deficiencies.[6,27]

Visual shade matching was performed on four different backgrounds (green, gray, white and black) using two identical shade guides (Vita Classical, Vita Zahnfabrik, Bad Sackingen, Germany) consisting of 16 shade tabs (A1-D4). The colors of the shade tabs were measured using a spectrophotometer (SpectroShade Micro II, Niederhasli, Switzerland) to verify the identity of the shade guides. The original color codes on one shade guide were visible, while on the other shade guide, which served as the target tooth, they were covered and numbered from 1 to 16. Before the shade matching, the participants were reminded of the following color scheme of the VITA classic shade guide as described in the user manual: A1-A4, reddish brownish; B1-B4, reddish yellowish; C1-C4, grayish shades; D2-D4, reddish gray. For shade matching, a shade tab with the color code covered was removed from the shade guide, which served as the target tooth, and placed against the background. Observers were asked to determine the shade of the target tab using the shade guide with the original codes visible on it (Figure 1A-D). This procedure was applied for all shade tabs on the target guide in a random order.

In this study, 25x25 cm color fabrics were used as backgrounds. Each observer made a total of 64 shade matches by determining the shades of 16 shade tabs in the target shade guide against 4 different backgrounds. Thus, 1280 shade matches were performed by 20 participants. Shade matching was performed between 10:00 and 14:00 under natural light. To prevent errors due to eye fatigue, a waiting time of 30 seconds was applied after each shade matching and 20 minutes before moving to the next background. In addition, the background sequence was rotated for each observer to avoid

fatigue or habituation bias. For example, one observer performed shade matching on green, gray, white and black backgrounds, while the next observer performed shade matching on black, green, gray and white backgrounds, respectively. This cycle continued for each participant.

Data were analyzed in SPSS 22.0 (IBM Corp. Armonk, NY, USA). For each of the 16 VITA Classical shade tabs, the percentage of correct matches was calculated. The effects of background and target tooth shade factors on shade matching accuracy were analyzed with Pearson's Chi-squared test. $P<0.05$ was considered statistically significant.

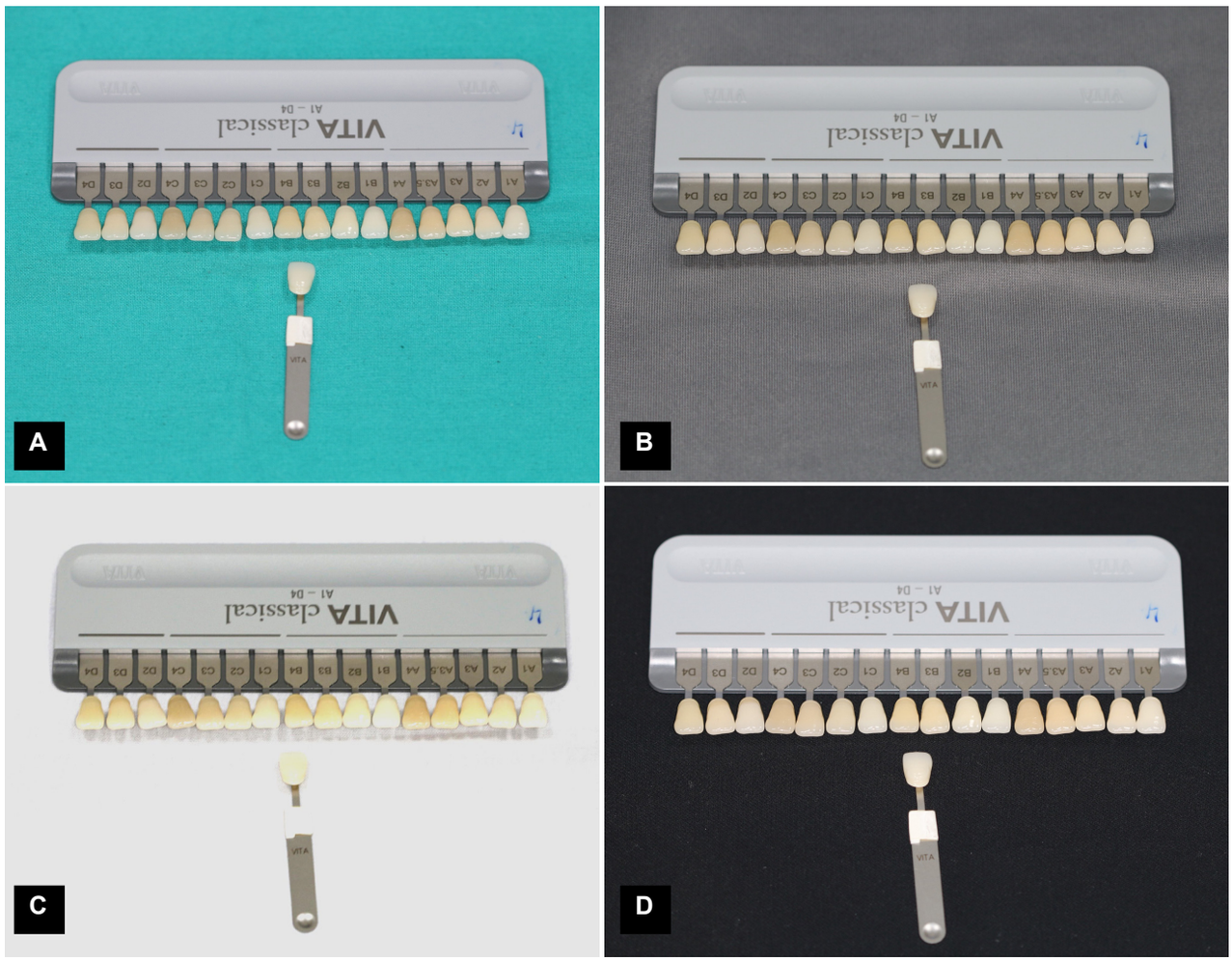

Figure 1.
A. Shade matching on a green background
B. Shade matching on a gray background
C. Shade matching on a white background
D. Shade matching on a black background

RESULTS

Table 1 shows the correct matching rates and the comparison of shade matching accuracy across backgrounds. When the target tooth shades were analyzed separately, the results of the Chi-square test showed that the correct match rate of Tab B1 was statistically lower on white backgrounds than on other backgrounds (χ^2=9.35, p=0.025). No significant differences were observed between the backgrounds in the correct matching rates of the other shade tabs. Considering the correct matching rates of all shade tabs, the effect of background on shade matching accuracy was found to be statistically significant (χ^2=12.47, df = 3 (4x2 table), p=0.006). Percentages of correct shade matching were 79.7%, 74.7%, 69.7% and 68.8% for gray, black, green and white backgrounds, respectively. Pairwise comparison results showed significantly more accurate matches on gray backgrounds than on green or white backgrounds (Table 1).

Rates for correct matching by target shade tab were as follows: A1 (75%), A2 (55%), A3 (63.8%), A3.5 (81.3%), A4 (81.3%), B1 (96.3%), B2 (75%), B3 (78.8%), B4 (71.3%), C1 (63.8%), C2 (70%), C3 (58.8%), C4 (86.3%), D2 (96.3%), D3 (45%), D4 (73.8%). Target tooth shade affected shade matching accuracy (χ^2=119.41, df = 57 (20x4 table), p<0.001). Table 2 shows the rates of shades matched by participants to each target tab. Tab A1 was matched as C1 in 17.5% of cases. Tab A2 was matched as A3 in 31.3% of cases and Tab A3 was matched as A2 in 16.3% of cases. Tab A3.5 and A4 were matched as each other in 11.3% of cases. Tab B2 was matched as A1 in 12.5% of cases. Tab B3 was matched as A3 in 10% of cases. Tab B4 was matched as B3 in 23.8% of cases. Tab C1 was matched as A1 in 27.5% of cases. Tab C2 was matched as C3 in 13.8% of cases. Tab C3 was matched as C4 in 13.8% of cases. Tab D3 was matched as A3 in 28.8% of cases. Tab D4 was matched as B3 in 15% of cases.

Table 1. Comparison of shade matching accuracy across backgrounds. N(%); shows the frequency and percentage of correct shade matching

	Background color					
	Black	**White**	**Gray**	**Green**	**Total (n=1280)**	**P***
Target tab (n=20)						
A1	15 (75)	15 (75)	16 (80)	14 (70)	60 (75)	0.912
A2	9 (45)	8 (40)	13 (65)	14 (70)	44 (55)	0.154
A3	14 (70)	12 (60)	14 (70)	11 (55)	51 (63.8)	0.691
A3.5	16 (80)	17 (85)	17 (85)	15 (75)	65 (81.3)	0.825
A4	15 (75)	16 (80)	17 (85)	17 (85)	65 (81.3)	0.825
B1	20 (100)[a]	17 (85)[b]	20 (100)[a]	20 (100)[a]	77 (96.3)	0.025
B2	16 (80)	15 (75)	17 (85)	12 (60)	60 (75)	0.292
B3	15 (75)	15 (75)	17 (85)	16 (80)	63 (78.8)	0.844
B4	15 (75)	12 (60)	17 (85)	13 (65)	57 (71.3)	0.308
C1	10 (50)	13 (65)	16 (80)	12 (60)	51 (63.8)	0.255
C2	18 (90)	12 (60)	15 (75)	11 (55)	56 (70)	0.067
C3	11 (55)	10 (50)	13 (65)	13 (65)	47 (58.8)	0.707
C4	17 (85)	18 (90)	17 (85)	17 (85)	69 (86.3)	0.957
D2	19 (95)	19 (95)	20 (100)	19 (95)	77 (96.3)	0.792
D3	12 (60)	7 (35)	11 (55)	6 (30)	36 (45)	0.154
D4	17 (85)	14 (70)	15 (75)	13 (65)	59 (73.8)	0.520
Total (n=320)	239 (74.7)[a, b, c]	220 (68.8)[c]	255 (79.7)[b]	223 (69.7)[a,c]	937 (73.2)	0.006

*Pearson Chi-square; a-cDifferent superscript lowercase letters in the same row indicate significant differences among backgrounds (p<0.05).

Table 2. Frequencies and percentages of shades matched to target tabs

	Matched shade n(%)																
	A1	A2	A3	A3.5	A4	B1	B2	B3	B4	C1	C2	C3	C4	D2	D3	D4
Target tab																
A1	60 (75)	0 (0)	0 (0)	0 (0)	0 (0)	6 (7.5)	0 (0)	0 (0)	0 (0)	14 (17.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
A2	1 (1.3)	44 (55)	25 (31.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.3)	0 (0)	2 (2.5)	7 (8.8)	0 (0)
A3	0 (0)	13 (16.3)	51 (63.8)	0 (0)	0 (0)	0 (0)	0 (0)	7 (8.8)	1 (1.3)	0 (0)	1 (1.3)	1 (1.3)	0 (0)	0 (0)	6 (7.5)	0 (0)
A3,5	0 (0)	0 (0)	0 (0)	65 (81.3)	9 (11.3)	0 (0)	0 (0)	0 (0)	5 (6.3)	0 (0)	0 (0)	0 (0)	1 (1.3)	0 (0)	0 (0)	0 (0)
A4	0 (0)	0 (0)	0 (0)	9 (11.3)	65 (81.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (7.5)	0 (0)	0 (0)	0 (0)
B1	1 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	77 (96.3)	0 (0)	0 (0)	0 (0)	2 (2.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
B2	10 (12.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	60 (75)	0 (0)	0 (0)	6 (7.5)	3 (3.8)	0 (0)	0 (0)	1 (1.3)	0 (0)	0 (0)
B3	0 (0)	0 (0)	8 (10)	0 (0)	0 (0)	0 (0)	0 (0)	63 (78.8)	6 (7.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2.5)	1 (1.3)
B4	0 (0)	0 (0)	1 (1.3)	2 (2.5)	1 (1.3)	0 (0)	0 (0)	19 (23.8)	57 (71.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
C1	22 (27.5)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2.5)	4 (5)	0 (0)	0 (0)	51 (63.8)	1 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
C2	1 (1.3)	3 (3.8)	1 (1.3)	0 (0)	0 (0)	0 (0)	2 (2.5)	1 (1.3)	0 (0)	0 (0)	56 (70)	11 (13.8)	0 (0)	2 (2.5)	2 (2.5)	1 (1.3)
C3	0 (0)	1 (1.3)	6 (7.5)	6 (7.5)	0 (0)	0 (0)	0 (0)	3 (3.8)	1 (1.3)	0 (0)	2 (2.5)	47 (58.8)	11 (13.8)	0 (0)	2 (2.5)	1 (1.3)
C4	0 (0)	0 (0)	1 (1.3)	4 (5)	3 (3.8)	0 (0)	0 (0)	0 (0)	2 (2.5)	0 (0)	0 (0)	1 (1.3)	69 (86.3)	0 (0)	0 (0)	0 (0)
D2	1 (1.3)	1 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	77 (96.3)	0 (0)	0 (0)
D3	0 (0)	4 (5)	23 (28.8)	1 (1.3)	0 (0)	0 (0)	0 (0)	7 (8.8)	1 (1.3)	0 (0)	1 (1.3)	6 (7.5)	0 (0)	0 (0)	36 (45)	1 (1.3)
D4	0 (0)	0 (0)	1 (1.3)	0 (0)	0 (0)	0 (0)	0 (0)	12 (15)	2 (2.5)	0 (0)	4 (5)	1 (1.3)	0 (0)	0 (0)	1 (1.3)	59 (73.8)

DISCUSSION

This study analyzed the effect of background color and target tooth shade on visual shade matching. The first and second null hypotheses were rejected because the results of the study showed that shade matching accuracy was affected by the background color and target tooth shade.

The color systems of most restorative materials are based on the Vita Classical shade guide, a comprehensive guide used in dental practices and laboratories.[28,29] It was used in this study because it is one of the most frequently used shade guides in visual shade matching and is generally accepted as the gold standard.[30] The oral cavity, contraster, or rubber dam becomes the background during shade matching in dental practice. The gray background used in this study represents the neutral area, the white background represents the teeth, the black background represents the contraster, and the green background represents the rubber dam. Equal numbers of male and female observers were included in this study. However, the effect of gender on shade matching accuracy was not analyzed as it would not have any clinical significance.

The results of this study are consistent with previous studies in showing that background color affects visual shade matching accuracy.[5–8] Sasaki *et al*.[7] reported that the incisal areas of teeth are particularly affected by the background and recommended that dentists and dental technicians use the same background color to obtain correctly colored restorations.In this study, shade matching accuracy was ranked against gray, black, green and white backgrounds. Statistically more accurate shade matching was achieved on gray backgrounds than on green or white backgrounds, while no significant difference was found in other pairwise comparisons. The gray background is considered neutral and has a relaxing effect on the eye.[1] Liberato *et al*.[8] showed that a gray background under natural light improves visual shade matching accuracy.The results of this study agree with that result that the shade matching accuracy is higher for a gray background than for other colors. Dudea *et al*.[6] found that neutral gray, white, black and red backgrounds had statistically similar shade matching accuracy, with the blue background having a worse result than the other

backgrounds. As a result, they suggested that shade matching against blue rubber dams should be avoided.[6] The results of the present study are similar to the findings of Dudea *et al*., in that there is no statistically significant difference between gray and black backgrounds, and that the rubber dam color, green, gives worse results than these two colors. However, the white background in this study has the lowest shade matching accuracy, which differs from the results of Dudea *et al*.[6] Differences in the shade matching accuracy of the backgrounds between the studies may be due to variations in the light source and other operator-dependent differences. In this study, shade matching was performed under natural light, whereas Dudea *et al*. used D65 and D50 light sources. The use of artificial light sources has been reported to improve visual shade matching accuracy.[5,8] Although the fact that no light source was used in the present study is a limitation, shade matching was carried out at the same time each day to minimize differences in ambient light.

Limited information is available on the effect of target tooth shade on visual shade matching. Dudea *et al*.[6] reported that darker and more chromatic tabs in the VITA Classical shade guide (A3.5, B3, B4 and D4) were more frequently mismatched but the shades chosen by participants in the mismatched cases were not reported. However, incorrectly matched shades can be clinically informative. The correct matching rate for the A2, C3, and D3 target tabs notably low across all backgrounds, including the gray background, which demonstrated the highest overall accuracy. It was observed that adjacent tabs were incorrectly matched with one another. For example, in this study, Tab A2 was matched as A3 in 31.3% of cases (Table 2). This finding may stem from the limitations of human visual perception. The most important color parameter affecting visual shade matching is the value. Similar value levels of adjacent tabs may lead to incorrect matching. A clinician determining the shade of a target tooth may need to reconsider the possibility that the correct shade matches and adjacent tab.

The strength of this study is that its results are based on a total of 1280 shade matches performed by 20 prosthodontists. On the other hand, the limitations of this study are that shade matching was performed under natural light, and the clinical experience of the participants was not evaluated. Further clinical studies including different shade guides, different background colors, and controlled light sources are needed.

CONCLUSION

Within the limitations of this study, the following conclusions were reached:

1-Visual shade matching accuracy was affected by background color. Correct shade matching percentages were 79.7%, 74.7%, 69.7%, and 68.8% for gray, black, green, and white backgrounds respectively,
2-Target tooth shade affected shade matching accuracy. The correct matching rates by target shade tab were obtained as follows: A1 (75%), A2 (55%), A3 (63.8%), A3.5 (81.3%), A4 (81.3%), B1 (96.3%), B2 (75%), B3 (78.8%), B4 (71.3%), C1 (63.8%), C2 (70%), C3 (58.8%), C4 (86.3%), D2 (96.3%), D3 (45%), D4 (73.8%).

CONFLICT OF INTEREST STATEMENT

We have no conflict of interest.

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DOI: http://doi.org/10.54617/adoklinikbilimler.1289053

Original Research Article

Evaluation of COVID-19 Awareness and Concerns of Patients Admitted to Dentist

Diş Hekimine Başvuran Hastaların COVID-19 Farkındalık ve Endişelerinin Değerlendirilmesi

Şükrü Kolay[1], Esra Mavi[2]

ABSTRACT

Aim: This study aimed to examine the level of knowledge among adult patients admitted to Sivas Cumhuriyet University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, regarding the Coronavirus Disease-2019 (COVID-19) pandemic and their concerns regarding the transmission of COVID-19 during dental visits.

Material and Method: The data were obtained through face-to-face interviews. According to the sample size formula with an unknown population ($n = t^2PQ/d^2$), 385 people were taken into the sample. Frequency and percentage (%) distribution were used to define the research data. The variables were analyzed according to Pearson Chi-Squared analysis.

Results: 70.7% of the 229 female participants and 77.8% of the 153 male participants were vaccinated against COVID-19 ($p>0.05$). 84.7% of 72 people with chronic diseases and 71% of 310 people without chronic diseases were vaccinated against COVID-19 ($p<0.05$*). 73.9% of 272 people with COVID-19 concern and 72.9% of 107 people without COVID-19 concern were vaccinated against COVID-19 ($p>0.05$). 77.2% of the 228 women surveyed and 63.6% of the 154 men surveyed were concerned about COVID-19 ($p<0.05$*). 75% of the 72 people with chronic diseases and 71% of the 310 people without chronic diseases were concerned about COVID-19 ($p>0.05$).

Conclusion: The safest way to gain immunity to end the pandemic and return to our normal workflow is by getting vaccinated. Age, gender, education, the presence of chronic diseases, and COVID-19 concern can also affect vaccination rates against COVID-19.

Keywords: COVID-19; Dentists; Pandemics; SARS-CoV-2

ÖZET

Amaç: Bu çalışmada, Sivas Cumhuriyet Üniversitesi, Diş Hekimliği Fakültesi, Ağız Diş ve Çene Cerrahisi Anabilim Dalı'na başvuran erişkin hastaların Coronavirüs Hastalığı-2019 (COVID-19) pandemisi hakkındaki bilgi düzeylerinin ve diş hekimi ziyaretleri sırasında COVID-19'un bulaşmasına ilişkin endişelerinin incelenmesi amaçlanmıştır.

Gereç ve Yöntem: Veriler yüz yüze görüşmeler yoluyla elde edilmiştir. Evreni belli olmayan örneklem hacmi formülüne göre ($n=t^2PQ/d^2$), 385 kişi örnekleme alınmıştır. Araştırma verilerinin tanımlanmasında frekans ve yüzde (%) dağılımı kullanılmıştır. Değişkenler Pearson ki-kare testi ile analiz edilmiştir.

Bulgular: 229 kadın katılımcının %70.7'si ve 153 erkek katılımcının %77.8'i COVID-19'a karşı aşılıydı ($p>0.05$). Kronik hastalığı olan 72 kişinin %84.7'si, kronik hastalığı olmayan 310 kişinin ise %71'i COVID-19'a karşı aşılıydı ($p<0.05$*). COVID-19 endişesi olan 272 kişiden %73.9'u, COVID-19 endişesi olmayan 107 kişiden ise %72.9'u COVID-19 aşılıydı ($p>0.05$). Ankete katılan 228 kadının %77.2'si, ankete katılan 154 erkeğin ise %63.6'sı COVID-19 konusunda endişeliydi ($p<0.05$*). Kronik hastalığı olan 72 kişinin %75'i, kronik hastalığı olmayan 310 kişinin ise %71'i COVID-19 konusunda endişeliydi ($p>0.05$).

Sonuç: Pandemiyi bitirmek ve normal iş akışımıza dönmek için bağışıklık kazanmanın en güvenli yolu aşı olmaktır. Yaş, cinsiyet, eğitim, kronik hastalıkların varlığı ve COVID-19 endişesi de COVID-19 aşısının kabul oranlarını etkileyebilir.

Anahtar Kelimeler: COVID-19; Diş Hekimi; Pandemiler; SARS-CoV-2

Makale gönderiliş tarihi: 30.04.2023; Yayına kabul tarihi: 18.07.2024

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INTRODUCTION

Throughout the history of humanity, numerous pandemics have occurred, spreading across international borders and causing widespread mortality and health issues.[1] In December 2019, an outbreak of pneumonia with an unknown origin was first reported in Wuhan, China.[2] The World Health Organization (WHO) defined a global emergency on January 30, 2020, due to the new coronavirus outbreak.[3] Subsequently, on March 11, 2020, the WHO declared the outbreak as a pandemic due to the rapid and exponential increase in the number of individuals affected by the virus worldwide.[4] The WHO named the virus as Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), and the disease as Coronavirus Disease-2019 (COVID-19).[5] Today, the COVID-19 pandemic caused by SARS-CoV-2 continues, and as of 17 June 2023, 768.187.096 confirmed cases and 6.945.714 deaths have been reported worldwide since the beginning of the epidemic.[6]

The origin of the SARS-CoV-2 virus is still debated and investigated. Although it has not been fully clarified yet, the comparative analysis of genomic data suggests that the epidemic is a zoonotic transmission from animal to human.[7] COVID-19 disease can be transmitted by exposure to an infected person at a distance of fewer than 2 meters and for longer than 15 minutes, by inhaling the aerosol produced by coughing and sneezing by an infected person, and by direct contact with infected objects.[8] Common symptoms observed in COVID-19 cases include fever (92.8%), cough (69.8%), dyspnea (34.5%), myalgia (27.7%), pharyngalgia (17.4%), headache (7.2%), diarrhea (6.1%), sore throat (5.1%), and runny nose (4%).[9]

In order to protect against COVID-19, interpersonal social distance should be maintained, and masks should be used indoors and in cases where social distance cannot be achieved.[10] Hands should be washed with soap and water, and alcohol-containing hand disinfectants should be used in cases where soap and water are not available.[11] The use of masks has been recommended to protect against respiratory tract epidemics since the 14th century.[12] Hand hygiene plays a critical role in reducing the transmission of SARS-CoV-2, and it is advisable to avoid touching the eyes, mouth, and nose before thoroughly washing hands.[13]

The development and dissemination of vaccines is a potential solution to the epidemic.[1] An effective vaccine against the disease offers a safe pathway towards achieving herd immunity.[14] As of June 17, 2023, The WHO reported a total of 13.398.054.518 vaccine doses administered.[6] Re-infection is observed in COVID-19 and seasonal coronaviruses. This suggests that vaccines may not provide lifelong protection against COVID-19, and additional doses may be necessary to enhance and sustain immunity.[15]

COVID-19, caused by SARS-CoV-2, has had a significant impact on dentistry. Aerosols, the main mode of transmission of SARS-CoV-2, are inherent in dental procedures. Aerosols are droplets smaller than 5 µm that can remain in the air for a long time. These fine particles have the ability to penetrate deeply into the bronchioles and play a crucial role in viral infections.[16] SARS-CoV-2 can be found in saliva, nasopharyngeal secretions, and blood. Bioaerosols generated within the dental clinical setting pose a risk for cross-infection through inhalation, contact with the eyes, or contamination of work surfaces.[17] Although the most effective device for preventing the transmission of SARS-CoV-2 in dental settings remains unclear, it is prudent to approach dental procedures with the assumption that all patients may be infected.[18]

MATERIAL AND METHOD

Ethics committee approval was obtained from the Sivas Cumhuriyet University Non-Interventional Clinical Research Ethics Committee dated 26.05.2021 and numbered 2021-05/42. The study's budget was covered by the researchers.

Based on prior research, we developed a self-administered questionnaire to determine sociodemographic factors, as well as COVID-19-related knowledge, awareness, attitudes, behaviors, and worries.[19-20] The questionnaire used in the study consisted of three parts. The first part collected sociodemographic information (4 question), the second part included questions related to COVID-19 awareness (7 question), and the third part (13 question) focused on the concerns regarding dental visits and the transmission of COVID-19. The questions were assessed by seven field experts. They assigned ratings to each item as follows: (A) The item represents the feature, (B) It should be slightly

Table 1. Questionnaire form consisting of 24 questions

Questions
1- How old are you?
18-29 30-39 40-49 50-59 60 or more
2- Gender
Female Male
3- Education Level
Primary school Middle school High school University
4- Do you have a chronic disease?
Cardiovascular disease (cardiovascular diseases, blood pressure, etc.) Diabetes Respiratory system disease (COPD, asthma, tuberculosis, etc.) Other No
5- According to the World Health Organization, tick the most common symptoms of COVID-19. (You can tick more than one option in this question)
Fever Dry cough Tiredness Fever, Dry cough Fever, Tiredness Dry cough, Tiredness Fever, Dry cough, Tiredness Participants who are unable to respond to common symptoms of COVID-19
6- According to the Ministry of Health of the Republic of Turkey, mark the ways of transmission of COVID-19 disease. (You can tick more than one option in this question)
Inhalation of droplets produced by coughing and sneezing By taking the hands to the nose, mouth and eyes after touching the surfaces with the virus. Inhalation of droplets produced by coughing and sneezing and by taking the hands to the nose, mouth and eyes after touching the surfaces with the virus. Participants who cannot respond to the transmission routes of COVID-19
7- According to the Ministry of Health of the Republic of Turkey, mark the ways of protection from COVID-19 disease. (You can tick more than one option in this question)
Mask use Social distance Hand cleaning Mask use, Social distance Mask use, Hand cleaning Social distance, Hand cleaning Mask use, Social distance, Hand cleaning Participants who could not mark their way of protection from COVID-19
8- Have you had the COVID-19 disease?
Yes No
9- Have you been vaccinated against COVID-19? (If your answer to this question is "Yes", proceed to question 12.)
Yes No
10- If your answer to the previous question is 'No', what is the reason?
My turn has not come I do not believe that vaccines protect from COVID-19 I'm worried about the side effects of vaccines Vaccines contain harmful substances Other
11- What is the biggest factor that negatively affects your COVID-19 vaccination?
Personal factors The influence of the people around me What I read/heard on social media What I read/heard in the news Other
12- Does the COVID-19 disease worry you?
Yes No
13- Does the fear of COVID-19 prevent you from going to the dentist?
Yes No
14- What is your reason for applying to the surgery clinic?
Tooth extraction Jaw pain Implant Abscess Other
15- Would you apply to the surgery clinic if your situation was not urgent?
Yes No
16- Are you worried about the risk of COVID-19 transmission in the area you are waiting for dental treatment?
Yes No
17- Were you worried about the risk of contracting COVID-19 during your dental treatment?
Yes No
18- Do you think it is possible to meet someone infected with COVID-19 in the waiting room or clinic?
Yes No
19- Does the dentist show symptoms of cold, flu or coronavirus despite wearing a mask, does it increase your anxiety about COVID-19?
Yes No
20- Does the patient who had dental treatment in the next seat at the same time as you show symptoms of a cold, flu or coronavirus increase your anxiety about COVID-19?
Yes No
21- If you feel the risk of contracting COVID-19 in the clinic or waiting room, will you leave the clinic?
Yes No
22- All of the instruments used before tooth extraction are cleaned and packaged as sterile. After each patient, the dentist chair is cleaned with disinfectant. The clinic is occasionally ventilated. Do you think these measures are sufficient in terms of the risk of COVID-19 transmission?
Yes, enough No, insufficient
23- Would you recommend the surgery clinic to your relatives during the COVID-19 pandemic period?
Yes No
24- What are your suggestions and thoughts on minimizing the risk of transmission of COVID-19 in the surgical department where your treatment is performed?

corrected, (C) It should be highly corrected, and (D) The item does not represent the feature. The Davis technique was used to assess the content validity study (CVI) (CVI = (A + B)/n, n = the total number of experts).[21] In line with the experts' suggestions, some items were corrected. The CVI values varied from 0.86 to 1. It was accepted that all twenty four items had sufficient content validity because their CVI values were greater than 0.80.[22] A total of 24 questions were included in the questionnaire (Table 1). The purpose of the study was explained to the participants, and written consent was obtained. Participants were also assured of the confidentiality of their information and were informed that their participation was voluntary. When $\alpha = 0.05$, $P = 0.50$, $Q = 0.50$, $d = \pm 0.05$, 385 people were sampled according to the sample volume formula ($n = Z^2PQ/d^2$), the universe of which is unclear. A pilot research with 10 patients who were not included in the study was done to clarify the questions.

The research was conducted between July 1, 2021 and December 31, 2021, on adult patients aged 18 and over seeking treatment at Cumhuriyet University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, covering a period of 6 months. A total of 385 questionnaires were included in the study.

Statistical Analysis

The data were entered into the SPSS (22.0) package program. Frequency and percentage (%) distributions were used to describe the research data. The data obtained from the open-ended questions was categorized and evaluated. The variables were analyzed using Pearson Chi-Squared analysis. The statistical significance level was 0.05.

RESULTS

The percentage and frequency distributions of the participants' responses to the questionnaire questions are presented in Table 2.

According to the results of the study, 60% of 145 people aged 18-29, 71.6% of 102 people aged 30-39, 85.7% of 77 people aged 40-49, 94.6% of 37 people aged 50-59, 95.2% of 21 people over the age of 60, received the COVID-19 vaccine ($p<0.05$*) (Table 3). 70.7% of the 229 female participants and 77.8% of the 153 male participants were vaccinated against COVID-19 ($p=0.13$). 85.9% of 78 primary school graduates, 70% of 50 middle school graduates, 62.7% of 110 high school graduates, 76.8% of 142 university graduates were vaccinated against COVID-19 ($p<0.05$*)(Table 4). 84.7% of 72 people with chronic diseases and 71% of 310 people without chronic diseases were vaccinated against COVID-19 ($p<0.05$*)(Table 5). 73.9% of 272 people with COVID-19 concern and 72.9% of 107 people without COVID-19 concern were vaccinated against COVID-19 ($p=0.842$). 77.2% of the 228 women surveyed and 63.6% of the 154 men surveyed were concerned about COVID-19 ($p<0.05$*)(Table 6). 75% of the 72 people with chronic diseases and 71% of the 310 people without chronic diseases were concerned about COVID-19 ($p=0.494$).

Table 2. Distribution of answers to the questionnaire

Questions	n	%
1		
18-29	145	37.7
30-39	103	26.8
40-49	78	20.3
50-59	38	9.9
60 or more	21	5.5
2		
Female	230	59.7
Male	155	40.3
3		
Primary school	78	20.4
Middle school	50	13.1
High school	112	29.2
University	143	37.3
4		
Cardiovascular disease (cardiovascular diseases, blood pressure, etc.)	24	6.2
Diabetes	11	2.9
Respiratory system disease (COPD, asthma, tuberculosis, etc.)	8	2.1
Other	29	7.5
No	313	81.3
5		
Fever	65	16.9
Dry cough	25	6.5
Tiredness	50	13
Fever, Dry cough	36	9.4
Fever, Tiredness	34	8.8
Dry cough, Tiredness	13	34
Fever, Dry cough, Tiredness	120	31.2
Participants who are unable to respond to common symptoms of COVID-19	42	10.9
6		
Inhalation of droplets produced by coughing and sneezing	96	24.9
By taking the hands to the nose, mouth and eyes after touching the surfaces with the virus.	64	16.6
Inhalation of droplets produced by coughing and sneezing and by taking the hands to the nose, mouth and eyes after touching the surfaces with the virus.	184	47.8
Participants who cannot respond to the transmission routes of COVID-19	41	10.6
7		
Mask use	25	6.5
Social distance	25	6.5
Hand cleaning	10	2.6
Mask use, Social distance	16	4.2
Mask use, Hand cleaning	10	2.6
Social distance, Hand cleaning	4	1
Mask use, Social distance, Hand cleaning	287	74.5
Participants who could not mark their way of protection from COVID-19	8	2.1
8		
Yes	76	19.8
No	308	80.2
9		
Yes	281	73.6
No	101	26.4
10		
My turn has not come	20	19.8
I do not believe that vaccines protect from COVID-19	7	6.9
I'm worried about the side effects of vaccines	36	35.6
Vaccines contain harmful substances	3	3
Other	35	34.7
11		
Personal factors	26	25.7
The influence of the people around me	19	18.8
What I read/heard on social media	7	6.9
What I read/heard in the news	13	12.9
Other	36	35.6
12		
Yes	274	71.7
No	108	28.3
13		
Yes	90	23.7
No	290	76.3
14		
Tooth extraction	288	74.8
Jaw pain	31	8.1
Implant	41	10.6
Abscess	5	1.3
Other	20	5.2
15		
Yes	113	29.4
No	272	70.6
16		
Yes	173	44.9
No	212	55.1
17		
Yes	130	33.9
No	254	66.1
18		
Yes	264	68.8
No	120	31.3
19		
Yes	231	60
No	154	40
20		
Yes	272	70.6
No	113	29.4
21		
Yes	293	77.1
No	87	22.9
22		
Yes, enough	344	90.8
No, insufficient	35	9.2
23		
Yes	314	83.1
No	64	16.9
24		
There should be an appointment, the density in the waiting room should be eliminated and social distance should be increased in the waiting room.	19	34.5
More emphasis should be placed on cleanliness	14	25.5
Care should be taken to ventilate the environment	3	5.5
Cleanliness, mask and social distance should be taken care of	17	30.9
Between the patients should be covered with a screen or a cabin should be built.	1	1.8
PCR test or vaccination must be required at the entrance	1	1.8

Table 3: Distribution of vaccination rates according to age

Have you been vaccinated against COVID-19?					
Age	**Yes**		**No**		**p value**
	n	**%**	**n**	**%**	
18-29	87	60	58	40	<0.001*
30-39	73	71.6	29	28.4	
40-49	66	85.7	11	14.3	
50-59	35	94.6	2	5.4	
60 or more	20	95.2	1	4.8	
Total	281	73.6	101	26.4	

*p<0.05

Table 4. Distribution of vaccination rates according to educational status

Have you been vaccinated against COVID-19?					
Education Level	**Yes**		**No**		**p value**
	n	**%**	**n**	**%**	
Primary school	67	85.9	11	14.1	0.003*
Middle school	35	70	15	30	
High school	69	62.7	41	37.3	
University	109	76.8	33	23.2	
Total	280	73.7	100	26.3	

*p<0.05

Table 5. Distribution of vaccination rates according to chronic disease state

Have you been vaccinated against COVID-19?					
Chronic Disease	**Yes**		**No**		**p value**
	n	**%**	**n**	**%**	
Yes	61	84.7	11	15.3	0.02*
No	220	71	90	29	
Total	281	73.6	101	26.4	

*p<0.05

Table 6. Distribution of the relationship between COVID-19 anxiety and gender

Does the COVID-19 disease concern you?					
Gender	**Yes**		**No**		**p value**
	n	**%**	**n**	**%**	
Female	176	77.2	52	22.8	0.004*
Male	98	63.6	56	36.4	
Total	274	71.7	108	28.3	

*p<0.05

DISCUSSION

Dentistry is a healthcare field that involves proximity to the oral environment, which harbors opportunistic and pathogenic microorganisms that can result in cross-contamination and infection. The probability of exposure to these microorganisms during dental procedures is high because these procedures are invasive.[23] The risk of cross-infection with SARS-CoV-2 may increase among dental staff and patients, due to the unique characteristics of dental practices such as face-to-face communication, exposure to body fluids such as saliva, blood, and aerosols.[24] Studies have shown that dentistry is unprepared for respiratory system disease transmitted by aerosols, droplets and contact.[25]

In this study, the participation rate in the survey decreased with advancing age. The group that showed the highest willingness to participate and did not refuse the survey was the younger population. We believe that this trend can be attributed to factors such as a decrease in literacy rates with age, increased reluctance to participate in the study, decreased tolerance for study requirements, and the occurrence of hearing and vision problems associated with aging. Additionally, it was observed that women were more willing to participate in the survey compared to men.

People's rejection of vaccines began in 1976 with the advent of the first vaccine to protect against smallpox.[26] False information can be spread through news sources as if it were true. This may cause hesitation in accepting the vaccine. Distrust of modern medicine and government institutions is another source of vaccine hesitancy. However, it is important to note that anti-vaccine individuals constitute a minority, and approximately 80% of the global population agrees that vaccines are safe.[27] Among the respondents in this study, 26.4% reported not being vaccinated. The majority of those who were not vaccinated (35.6%) expressed concerns about the potential side effects of vaccines. This result supports that many people are not aware of the effectiveness of the vaccine and are afraid of side effects.[28] Furthermore, 38.6% of the study participants who were not vaccinated cited negative influences from people in their social circle, as well as information they read or heard in the news and on social media, as reasons for their decision.

A statistically significant difference was observed between the likelihood of getting a COVID-19 vaccine and age. The vaccination rate tends to increase as the age of the participants in the survey increases. As age increases, the likelihood of severe illness increases.[29] We think that this is the reason why the vaccination rate increases with age.

One of the risk factors that increase the likelihood of contracting severe COVID-19 is the male gender.[30] However, interestingly, this study found that women expressed statistically higher levels of concern about COVID-19 compared to men. In our study, the rate of vaccination of men was higher than that of women. However, there was no statistically significant difference between getting the COVID-19 vaccine and gender.

A statistically significant difference was found between the level of education and getting a COVID-19 vaccine. In this study, the rate of COVID-19 vaccination showed an inverse correlation with the level of education. These results support the data that people who hesitate about vaccination are more likely to be educated.[27] We believe that with the increase in education levels, people's questioning levels of the vaccine have increased and they are more cautious about the vaccine.

In this study, it was observed that individuals with chronic diseases have higher rates of COVID-19 vaccination compared to those without chronic diseases. People with chronic diseases are more likely to have severe COVID-19.[31] It is for this reason that people with chronic diseases pay more attention to vaccination than others. However, no statistically significant relationship was found between the presence of chronic diseases and COVID-19 anxiety in this study. There is no difference in terms of COVID-19 concern between those with chronic diseases and those without.

In this study, no statistical relationship was found between those with COVID-19 anxiety and those without, in terms of receiving the COVID-19 vaccine. Having or not having an individual's COVID-19 concern does not affect their tendency to get vaccinated. Although COVID-19 is quite common, some people may not respond to its symptoms, transmission methods, or prevention strategies, suggesting a lack of concern about the infection and its consequences.

The disease is spread by infected, symptomatic or asymptomatic individuals. Dentists, who come into contact with numerous patients, have the potential to act as vectors for the transmission of SARS-CoV-2 among patients.[32] Given the nature of their profession, every dental examination and procedure carries a risk of virus transmission. Therefore, in the early stages of the epidemic, non-urgent health appointments and procedures were postponed or canceled to minimize the risk. Some patients, being aware of this risk, also chose to cancel their appointments voluntarily.[33] According to the study, 70.6% of the participants stated that they would not visit a dental clinic unless their condition was urgent. 77.1% of the participants stated that they would leave the clinic if they felt the risk of contracting COVID-19 in the clinic or waiting room. Having dental treatments done safely by people who are concerned about COVID-19 will help ensure the continuity of oral and dental health. For this purpose, the intensity in the waiting room should be eliminated by working with carefully planned appointment schedules, a screen should be used in the clinic to reduce the contact of patients with each other, and the treatment of patients should be carried out in separate rooms.

44.9% of the participants, while in the waiting room, and 33.9% while undergoing dental treatments, expressed concerns about COVID-19 transmission. The small size of the waiting room, the presence of patient companions in the waiting room, the inability to control congestion, the lack of social distancing among people, and the inadequate ventilation system in the waiting room are factors that we believe contribute to these concerns. In the clinic, we believe that the requirement for patients to remove their masks during dental treatments and the absence of any barriers between dental units, apart from a screen, to prevent patient contact, further heighten anxiety regarding COVID-19 among the participants.

The fact that the dentist exhibits symptoms of a cold, flu, or coronavirus despite wearing a mask also increases anxiety regarding COVID-19 in 60% of the participants. This concern can cause patients to avoid dental treatment. Therefore, if the doctor shows any signs of illness, their contact with patients should be minimized. Individuals who display symptoms in the adjacent dental unit raise anxiety about COVID-19 in 70.6% of the study participants. For this reason, it is necessary to remotely solve the problem of the patient who may be a COVID-19 case or a potential COVID-19 case or to postpone the appointment. If the situation is urgent or cannot be postponed, the patient should be considered high risk to infect others. Arranging the patient's visit as the last appointment of the day can be considered.[34]

The best method of protection for both dentists and patients is to raise awareness, avoid unnecessary contact with individuals suspected of having COVID-19, utilize personal protective equipment, and adhere to precautions such as frequent hand washing. Consequently, it is crucial for dentists to implement necessary precautions to prevent COVID-19 transmission and ensure patients' continued adherence to dental treatments.

CONCLUSION

Since dentists are a professional group that works in close proximity to the oral environment, they may be exposed to COVID-19 and may serve as a vector that can carry SARS-CoV-2 to patients. Patients have concerns regarding COVID-19 transmission in both waiting rooms and the clinic. It is important to eliminate the intensity in the waiting room by working by appointment. In addition, reducing patients' contact with each other can reduce patients' concerns. Postponing the treatment of patients with COVID-19 symptoms is also very important to protect both the healthcare workers and the patients who come to the clinic.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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DOI: http://doi.org/10.54617/adoklinikbilimler.1539716

Original Research Article

Maxillary Labial Frenum Types in Children and Effects on the Oral Cavity: A Cross-Sectional Study

Çocuklarda Maksiller Labial Frenum Tipleri ve Ağız Boşluğu Üzerindeki Etkileri: Kesitsel Bir Çalışma

Taibe Tokgöz Kaplan[1], Mihriban Gökcek Taraç[2]

ABSTRACT

Aim: This study evaluated the maxillary labial frenum (MLF) types and their effects on children's diastema, caries, and gingival health.

Material and Method: The study included 500 children (50.2% girls, 49.8% boys) aged 3-14. MLF types were classified according to the Mirko classification, and the gingival index score was performed according to the Löe-Silness classification. Dentition periods, the presence of anterior caries, and diastema widths were saved. Data were analyzed by Chi-square test, and Kruskal-Wallis-H test in SPSS software.

Results: There was no statistically significant difference between the genders regarding MLF types. The most common frenum type was gingival type frenum (48%), followed by papillary type (30%) and papillary penetrating type (16%). The gingival frenum type was significantly higher in the older age group. Among the 291 patients with diastema, the papillary penetrating type was significantly higher in those with 2-4 mm diastema. A significant correlation was found between frenum type and caries between the anterior teeth.

Conclusion: Frenums can cause gingival recession, midline diastema, dental caries, and gingival disease.

Keywords: Gingival health; Frenum attachment; Maxillary anterior caries; Maxillary labial frenum; Midline diastema

ÖZ

Amaç: Frenulum, dudak ve yanağı alveolar prosese bağlayan; boyut, şekil ve yapışma açısından değişiklik gösterebilen bir mukoza kalıntısıdır. Maksiller labial frenulum (MLF) ağız boşluğunda birçok dental veya gingival malformasyonla ilişkilidir. Bu çalışmanın amacı, çocuklarda labial frenulum tiplerini ve diastema, çürük ve dişeti sağlığına etkilerini değerlendirmektir.

Gereç ve Yöntem: Çalışmaya 3-14 yaş arası 500 çocuk (%50.2 kız, %49.8 erkek) atılmıştır. MLF tipleri Mirko sınıflamasına göre sınıflandırılmış; gingival indeks skoru Löe-Silness sınıflamasına göre yapılmıştır. Dişlenme dönemleri, anterior dişler arasında çürük varlığı ve diastema genişlikleri kaydedilmiştir. Veriler SPSS yazılımında Ki-kare testi ve Kruskal-Wallis-H testi ile analiz edilmiştir.

Bulgular: MLF tipleri açısından cinsiyetler arasında istatistiksel olarak anlamlı bir fark bulunmamıştır. En yaygın frenulum tipi gingival tip frenulum (%48) olurken, bunu papiller tip (%30) ve papiller penetran tip (%16) takip etmiştir. Gingival frenum tipi ileri yaş grubunda anlamlı olarak daha yüksekti. Diasteması olan 291 hastada, papiller penetran tip, 2-4 mm diasteması olanlarda anlamlı olarak daha yüksekti. Frenulum tipi ile ön dişler arasında çürük varlığı arasında anlamlı korelasyon bulundu.

Sonuç: Frenulumlar dişeti çekilmesi, orta hat diasteması, diş çürükleri ve dişeti hastalıklarına neden olabilir.

Anahtar Kelimeler: Gingival sağlık; Frenulum bağlantısı; Maksiller anterior çürük; Maksiller labial frenulum; Orta hat diasteması

Makale gönderiliş tarihi: 27.08.2024; Yayına kabul tarihi: 25.12.2024

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INTRODUCTION

The frenum is a mucosal membrane remnant, usually triangular, connecting the lip and cheek to the alveolar process. It is seen in the mandibular and maxillary vestibular mucosa in the midline and premolar region.[1,2] The maxillary frenum histologically contains elastic fibers, collagen tissue components, striated muscle fibrils, blood vessels, nerves, and minor salivary glands.[3,4] The frenum is a dynamic and variable structure that can vary in size, shape, and attachment position at different stages of growth and development.[5,6] The frenum attachment point, which is smaller, thicker, and more cervical in infants, moves apically with the eruption of the deciduous incisors, the development of the maxillary sinus, and the increase in the alveolar vertical dimension.[3]

Sewerin described eight types of frenum according to their morphological characteristics: simple frenum, simple appendicular frenum, nictum labial frenum, nodule frenum, nodule labial frenum, bifid labial frenum, persistent tectolabial frenum, and double frenum.[7] In the classification by Mirko *et al*.[8] the frenum is divided into four types according to its anatomical position: mucosal, gingival, papillary, and papillary penetrating. Many clinicians have accepted Mirko's classification and is still in use.[5,8] The frenum is at the mucogingival margins in the mucosal type, at the attached gingival margin in the gingival type, at the gingival papilla margin in the papillary type, and within the gingival papilla in the papillary penetration type.[8,9]

Maxillary labial frenum (MLF) is associated with many dental or gingival malformations, especially in children, as it has different types, thickness and morphology in the oral cavity.[5,10,11] Abnormal positioning of the MLF may cause midline diastemas between the central incisors, making orthodontic treatment difficult and/or causing relapses after orthodontic treatment.[9,12,13] In babies, the labial frenum may negatively affect sucking and feeding.[14,15] Kotlow *et al*.[14,16] reported that the labial frenum damaging the gingival margin may prevent the patient from brushing their teeth and cause dental plaque accumulation, deterioration of oral hygiene, and caries formation. Additionally, when the junction of the labial frenum is towards the gingival margin, it may cause the marginal gingival papilla to stretch and gingival recession. As a result, it may contribute to the formation and progression of periodontal diseases, especially in adults,[8,17] and may adversely affect the fit and retention of dental prostheses.[5]

Some of the effects of MLF in the oral cavity have been evaluated in the literature, but no study evaluating all possible effects together has been reported. In this study, all of the conditions that may occur in the mouth according to the type of MLF are presented together. This study aimed to evaluate the MLF types in children aged 3-14 years in the period of primary, mixed, and permanent dentition and its surroundings and to determine its relationship with the midline diastema between frenum and anterior teeth, the presence of caries and periodontal health status. The study hypothesis was that there is a positive relationship between labial frenum and the presence of diastema and caries, and a negative relationship with gingival health in children.

MATERIAL AND METHOD

This is a cross-sectional epidemiological study conducted at Karabuk University Faculty of Dentistry. It was conducted under the principles of the Declaration of Helsinki. The Ethics Committee of Karabuk University Human Research granted approval (Approved by decision number 2023/1254, decision date 27.02.2023). In addition, "informed consent" was obtained from the legal representatives of all children participating in the study.

The study included 500 systemically healthy children between the ages of 3 and 14 who were admitted to the Karabuk University, Department of Pediatric Dentistry. Exclusion criteria were children with orofacial anomalies, trauma to the frenum region, history of surgical intervention in the maxillary labial region, and medication (antiepileptic, calcium channel blocker, immunosuppressive drug) known to cause gingival enlargement. In addition, the study did not include children with incomplete eruption of both deciduous/permanent central incisors.

An 11 years experienced pediatric dentist performed the intraoral examination of the patients under reflector light. The examiner evaluated the MLF types, gingival health of the teeth in the relevant region, caries on the mesial surfaces of the anterior region teeth, and the width of the midline diastema, if any.

MLF types were recorded according to the classification of Mirko *et al*.[8] Frenum attachment point was always examined with the lip gently stretched away from the alveolar process in the almost horizontal direction. In this classification, four types of frenal attachment are defined with detailed criteria as follows (Figure 1):

- Mucosal (Figure 1a): Frenal fibers are attached over the mucogingival junction
- Gingival (Figure 1b): Frenal fibers are attached to the gingival barrier
- Papillary (Figure 1c): Frenal fibers are expanded to interdental papilla
-Papillary penetrating (Figure 1d): Frenal fibers cross the alveolar process and extend to papilla palatin

Figure 1. Frenum types

Gingival health was scored according to the gingival index defined by Löe and Silness,[1] and the highest gingival score in the relevant region was recorded. The score was recorded as 0 if there was no inflammation, discoloration, and bleeding; 1 if there were mild surface changes, mild inflammation, and discoloration but no bleeding; 2 if there was moderate inflammation, redness, edema, pressure, and bleeding by probing; 3 if there were severe inflammatory changes, severe redness and edema, spontaneous bleeding tendency and ulceration. Frenum class and the highest gingival score of the region were recorded.

Caries between the anterior region teeth were recorded as present/absent. To determine the width of the midline diastema, the diastema value was recorded by measuring the widest part of the diastema with a digital caliper on the plaster model prepared by taking measurements. The patient's age, dentition period, gender, and sibling relationship were evaluated. The frenum examinations of children who came to the clinic with their siblings were evaluated and recorded based on their siblings' MLF types.

Data analysis

Statistical analyses were performed using SPSS (v. 22.0) software. Fisher's exact test was used to evaluate the relationship between frenum types and dentition types. The relationship between frenum types and age, gender, and the presence of caries and the relationship between gingival index scores and dentition types and frenum types were evaluated with the Chi-squared test. In addition, the Kruskal-Wallis-H test was used to evaluate the relationship between frenum types and diastema values since the data were not normally distributed. Additionally, the compatibility between siblings' frenum types was evaluated using a Kappa analysis.

RESULTS

A total of 500 children (50.2% girls, 49.8% boys) aged 3-14 years were included in the study. The results were presented in 3 groups: a group of participants aged 3-5 years, a group of participants aged 6-9 years, and a group of participants aged 10-14 years. 1.8% of the participants were 3 years old, 9.2% were 4 years old, 16.8% were 5 years old, 18.2% were 6 years old, 13.4% were 7 years old, 12.6% were 8 years old, 9.4% were 9 years old, 6.4% were 10 years old, 7% were 11 years old, 4% were 12 years old, 2.4% were 13 years old, and 0.8% were 14 years old. Among the participants, 159 (31.8%) were in primary dentition, 282 (56.4%) were in mixed dentition, and 59 (11.8%) were in permanent dentition. The most common frenum type in all dentition periods was gingival type frenum (48%), followed by papillary type (30%) and papillary penetrating type (16%). The least common frenum type in all dentition periods is the mucosal type (6%) (Figure 2). However, the most common period in which gingival type frenum was statistically significant was found to be the mixed dentition (p=0.01-0.05). In addition, the relationship between frenum types and age group was found to be statistically significant (p=0.01-0.05); gingival type frenum was most common in the 10-14 age group, and the other three frenum types were seen in the 6-9 age group.

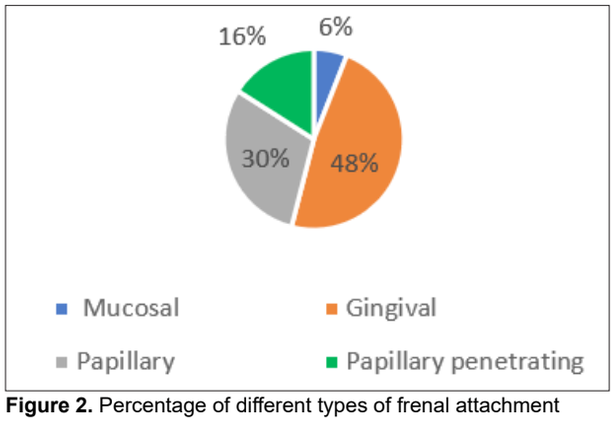

Figure 2. Percentage of different types of frenal attachment

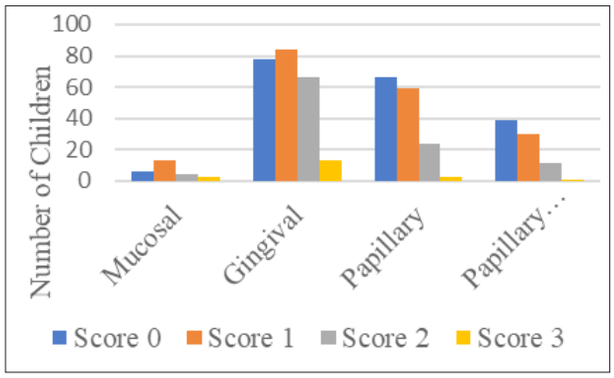

Figure 3. Gingival index scores related to frenum types

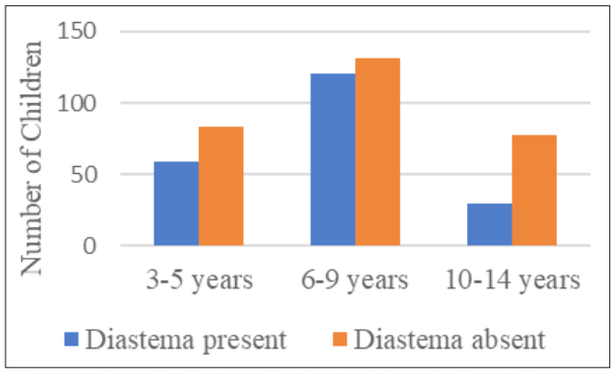

Figure 4. Age distribution of patients with and without diastema

The distribution of frenum types according to gender was not statistically significant (p = 0.4). The gingival index score was statistically significantly higher in mixed dentition (p = 0.00). Scores 0, 1, and 2 were most frequently seen in mixed dentition. Score 3 was seen least frequently in all dentition types. In addition, the gingival index score was significantly higher in gingival type frenum (p = 0.02). Scores 0, 1, and 2 were most frequently in the gingival frenum type. Score 3 was the least frequent of all frenum types (Figure 3).

291 participants (50.2% boys and 49.8% girls) did not have diastema. The age distribution of patients without diastema is given in Figure 4. No significant association was found between frenum types in patients without diastema. (p = 0.16). While gingival type frenum was the most common in 62.9%, papillary, mucosal, and papillary penetrating type frenum were seen, respectively (Figure 5).

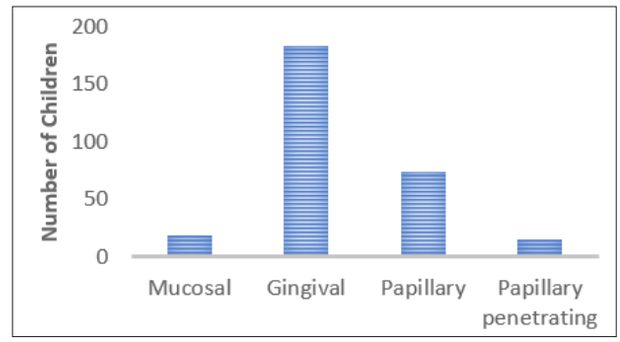

Figure 5. Type of frenum in the group without diastema

The presence of midline diastema was detected in 209 of the participants (50.7% girls and 49.2% boys). The age distribution of patients with midline diastema is given in Figure 4. When the age distribution of patients with diastema was evaluated, it was found that diastema was most commonly seen in the 6-9 age range. The distribution of midline diastema width ranges of patients with diastema for both sexes was as follows: 43.1% of patients (46% boys and 54% girls) had diastema widths between 0 and 1 mm. In 34.4% of the patients (54% boys, 46% girls), diastema widths between 1 mm and 2 mm were included. Diastema width between 2 mm and 3 mm was observed in 17.7% of the patients (48% boys, 52% girls). Diastema width of 3 to 4 mm inclusive was observed in 4.8% of the patients (28% boys, 72% girls). Due to the small group of patients with diastema width of 0-1 mm and 3-4 mm, the measured widths of diastema have been divided into the following two groups for statistical analysis: I — width of diastema 0-2 mm (small diastema); II — width of diastema 2-4 mm (large diastema). The mean midline diastema width of all participants was 0.62 ± 0.8. A statistically significant association was observed between frenum type and midline diastema width (p <0.005). Mucosal, gingival, and papillary frenum types were more common in patients with 0-2 mm diastema, while papillary penetrating frenum type was statistically significantly more common in patients with 2-4 mm diastema. Mucosal frenum was

observed in 5.1% of those with diastema, gingival frenum in 47.8%, papillary frenum in 29.5%, and papillary penetrating frenum in 17.6% (Figure 6). There was no statistically significant association between the presence of maxillary anterior caries and frenum type (p = 0.058). The most common frenum type was the gingival type in both caries and non-caries patients. It was observed that the MLF types of 31 children who came to the clinics with siblings were not statistically compatible according to the Kappa agreement test (K: 0.29). In addition, it was concluded that the diastema values were not similar by the Spearman Correlation test (p=0.88).

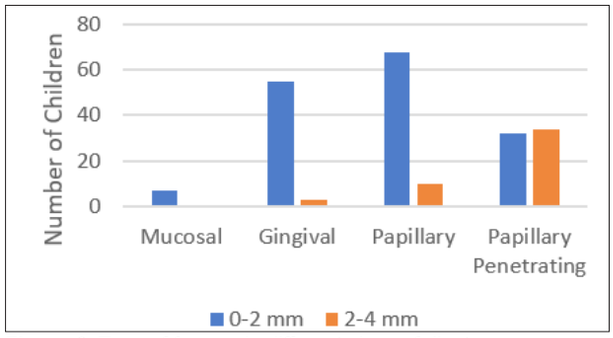

Figure 6. Type of frenum in different sizes of diastema

DISCUSSION

The MLF is a dynamic and frequently changing complex structure subjected to changes in shape, size, and position at different stages of growth and development. Since these changes in the frenum affect other oral structures, the child's health, aesthetics, oral hygiene habits, and social life can also be affected. Therefore, this study aimed to determine the MLF types of pediatric patients aged 3-14 years living in Karabuk province and to evaluate the relationship between labial frenum type and gingival health, dental caries, and diastema. The study included children with deciduous and mixed dentition between the ages of 3 years, when deciduous teeth are complete, and 14 years, when permanent teeth are complete (excluding wisdom teeth).

No case without labial frenum was found in the 500 patients whose MLFs were analyzed in this study. Cases without MLF are usually seen in patients with craniofacial defects.[18] In the deciduous and permanent dentition, the most common type of frenum was the gingival frenum. Similar findings were found in many studies.[6,9,19] On the other hand, there are also studies in which the mucosal frenum type is the highest.[8,20,21] Findings may vary according to the number of participants, age distribution.

In the literature, many studies have reported no significant association between frenum type and gender.[9,22] Divater *et al.*[23] reported no significant relationship between gender and frenum, but there was a significant difference according to age. Children with gingival type frenum were found to be the oldest, and children with papillary-type frenum were found to be the youngest among all groups. Similarly, in the present study, in agreement with the literature, no statistically significant correlation was found between MLF type and gender, whereas a statistically significant correlation was found between MLF type and age. Gingival type frenum was statistically significantly higher in the 10-14 age group, the oldest group among the participants. The other three types of frenum were seen in the 6-9 age group. In a study conducted on a Turkish population aged 2-65, no significant difference was found between gender and MLF, whereas a significant difference was found in age groups. Gingival and mucosal types of frenum were seen in the 2-6 age group, and gingival type frenum was seen in all participants aged 7 years and older.[3] Boutsi *et al.*[9] in a study performed on 226 children aged 1-18 years, a significant correlation was found between MLF type and age, and it was reported that children with mucosal type frenum were the oldest and children with papillary penetrating type frenum were the youngest. However, many studies have not reported a statistical correlation between MLF types and age.[8,18,20] Díaz-Pizán *et al.*[24] reported that in a large cohort of 1355 children in the deciduous dentition, the frenum attachment can move from a more coronal to a more apical position. However, a movement in the opposite direction was never detected. In conclusion, it is possible that the frenal attachment migrates apically with age, with or without a statistically significant difference. The frenum's apical migration depends on the alveolar process's coronal growth. This is also supported by the findings of this study.

Frenum may cause mucogingival problems.[5,8] In cases where the frenum attachments extend to the free gingiva, lip-cheek movements will be restricted, plaque and calculus accumulation will increase and

will lead to gingival recession and periodontal pocket formation over time.[5] In a study examining the effects of frenum level on oral structures, it was reported that the mandibular labial frenum was ineffective in plaque and gingivitis formation, while the maxillary frenal connection affected plaque retention and the degree of gingivitis.[25] Divater *et al*.[23] reported that oral hygiene status was worse in patients with papillary penetrating type frenum. Since lip movements will be limited in individuals with papillary penetrating frenum, gingival index scores are expected to be higher. In this study, the gingival index score was found to be lowest in mucosal type frenum and significantly higher in gingival type frenum (p=0.02). This may be due to the fact that 48% of the participants had gingival frenum. The findings are consistent with those of Taran *et al*.[19] who studied Turkish children. In addition, in the present study, the gingival index score was statistically significantly higher in the mixed dentition type (p<0.001). Although frenum type is an important predisposing factor, oral hygiene skills of the child are more effective on gingival index. Today, oral hygiene habits in children cannot be fully established due to the increase in pathogenic microflora in the mouth due to the increase in refined sugar and ready-to-eat food consumption, the busy work schedule of parents and the lack of tooth brushing support that makes children responsible at an early age. Therefore, caries risk and gingival index scores increase.

In many publications, the impact of oversized upper lip frenum on diastema formation was described. Regarding attachment type, papillary (27.6 to 62.5%) and penetrating papillary penetrating (47.1 to 100%) attachments were associated with the occurrence of diastemas.[13,26,27] Rathod *et al*.[22] found that this attachment type was more prevalent in women and that the occurrence of diastemas was more common in this group. Placek reported that in the group of people without diastema, only 2% of the papillary type frenum and no papillary penetrating type were observed.[8] On the other hand, there are studies that reported no specific relationship between diastema and frenum type, and there are also studies finding a significant association between gingival type frenum and mucosal type frenum and diastema.[22] In the study of Chaulagain *et al*.[21] in 102 patients in whom the relationship between frenum and diastema was investigated, 98% of those with diastema had mucosal type frenum; in the study of Kılınç *et al*.[18], gingival type frenum was detected in 55.2% of 1023 patients with a diastema between the ages 2 and 65. Sekowska *et al*.[13] reported predominantly mucosal (34.6%) and gingival type (30.8%) frenum types in the small diastema (≤ 2 mm) group. Additionally, no mucosal type was observed in the large diastema (> 2 mm) group, and papillary type (34.6%) and papilla-penetrating type frenum were predominant. The findings in the presented study support the literature; it was found that frenum type was effective on diastema width. In this study, mucosal and papillary type frenum along with gingival type (62.9%) were observed predominantly in the patient group with small diastema (≤ 2 mm). In comparison, papillary and papillary-penetrating frenum (78.8%) was observed in the large diastema (> 2 mm) group. seen together. Mucosal frenum was not seen in those with large diastema.

When the age distribution of patients with diastema was evaluated, it was found that diastema was most commonly seen in the 6-9 age range. This age range is the mixed dentition period and is the beginning of the period when both deciduous and permanent teeth are in the mouth simultaneously. In the mixed dentition period, it is normal to see a "midline diastema" approximately 1-3 mm wide between the permanent upper central incisors. Because the permanent canines compress the roots of the permanent upper incisors in the mesial direction, the crowns of these teeth are slightly inclined distally. As a result, midline diastema occurs. In 1975, Broadbent called this situation the "ugly duckling stage" and explained this stage as a transitional stage in dental development.[28] It has been reported that midline diastema will close after the canine teeth emerge.[28] In the presented study, diastema was most frequently seen in the 6-9 age group; diastema width can be checked by following patients until their canine teeth erupted. Díaz-Pizan *et al*.[24] suggested that frenal types change with age and craniofacial growth. Therefore, the decision to perform early frenal interventions in children should be postponed until the eruption of permanent teeth. In children, interinsisal diastemas are wider and tend to decrease with age.[26,24,27] In many individuals, the closure of diastemas occurs between 14 and 19 years of age.[11,24] So, considering

the child's age, the need for frenectomy will be eliminated with the movement of the frenum attachment apically over time.

Limited publications are investigating the relationship between the type of MLF and caries.[14,18] It is stated that babies with labial frenum-type papillary and papillary penetration will have milk accumulation between their teeth after breastfeeding due to the structure of the frenum. This will increase the risk of caries. Additionally, it is said that in children with papillary frenum or with papillary penetration frenum, the thick fibrous structure of the frenum may restrict the normal function and mobility of the upper lip and cause early dental caries.[14,16] On the other hand, there is a study reporting that there is no relationship between the degree of MLF attachment and restriction in lip movements and difficulty in breastfeeding.[29] In a previous study, dental caries were detected between the maxillary incisors of children with primary and permanent teeth. The existing decayed teeth and the type and morphology of the MLF were examined, and although a higher rate of caries was detected in deciduous teeth than in permanent teeth, no statistically significant result was found between frenum type and dental caries.[18] In the present study, the most common frenum type in patients with or without caries between anterior teeth was a gingival type. However, no statistically significant relationship was found between the presence of maxillary anterior caries and frenum type. In addition, the association between siblings with MLF was evaluated in this study. In the literature, studies on siblings with midline diastema have generally focused on the prevalence and etiology of maxillary midline diastema in siblings.[30] It has been reported that 78% of patients with a diastema between the maxillary anterior teeth had at least one family member (mother, father, or sibling) with diastema.[30] In this study, when the relationship between siblings and MLF was evaluated with Kappa statistics, no significant relationship was found between frenums and diastemas in 31 siblings presenting to the clinic. Similarly, Kılınç *et al*.[18] did not find a significant correlation in their study.

A major limitation of this study is that our sample consisted of a small number of children from a geographically limited area and they may not be representative of the entire population. For a better evaluation, a larger sample and data obtained from wider geographies are required. A multicenter study conducted in different regions makes it possible to determine the malocclusion status, treatment needs, and periodontal health map by determining the potential effects on the frenum and the related oral cavity. Additionally, longitudinal studies should be conducted to assess changes over time and potential causal relationships, and potential clinical implications should be explored in detail through further research.

CONCLUSION

Frenums are associated with various issues such as oral hygiene, midline diastemas, gingival health, and the need for orthodontic treatment and may cause pathologies. Therefore, every dentist should carefully examine the frenum during intraoral examination, especially in pediatric patients. The clinician should follow the patient for a long time to prevent unnecessary surgical intervention, taking into account that the attachment of the frenum of the examined child may shift to a more apical position with increasing age, and the morphology of the frenum may change with age.

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DOI: http://doi.org/10.54617/adoklinikbilimler.1563570

Original Research Article

Effect of Different Irrigation Needle Tips on Apically Extruded Irrigant of Over-instrumented Root Canals

Taşkın Prepare Edilmiş Kök Kanallarında Farklı İrigasyon Uçlarının Apikalden Taşan Solüsyon Miktarına Etkisi

Safa Hazım Yahya Alqassab[1], Ozgur Genc Sen[2]

ABSTRACT

Aim: This study evaluated the effect of various irrigation needle types on the amount of apically extruded irrigant in teeth with both intact and disrupted apical constrictions.

Material and Method: A total of 40 mandibular teeth were examined under a dental operating microscope to determine the apical foramen, and the specimens were divided into two groups (n = 20). In one group (intact apical foramen group), the teeth were instrumented 0.5 mm short of the apical foramen, while in the other, the instrumentations were done 0.5 mm beyond the apical foramen (over-instrumented group). An open-tip needle and three different types of side-vented closed-tip needles were used for final irrigations. All specimens were irrigated with each needle type using a randomized crossover design. The extruded irrigants were collected in plastic containers with floral foam inserts, which were weighed before and after irrigation to determine the amount of extrusion by subtracting initial weights from final weights. Statistical analysis was conducted using repeated measures of two-way ANOVA and Tukey's post hoc tests.

Results: In the over-instrumented group, all needle types resulted in significantly higher extrusion compared to the intact apical foramen group (p=0.001). Among the needles, the double-side-vented needle produced the least extrusion in the intact group, while the open-tip needle produced the most. In the over-instrumented group, the one-side-vented needle resulted in the least extrusion, with the open-tip needle again causing the most (p=0.001).

Conclusion: Within the limitations of this study, the one-side-vented needle is recommended for irrigation procedures in over-instrumented teeth. Since NaOCl can cause severe toxic effects when in contact with tissue, even in minimal amounts, the statistical differences found in this study may also be of clinical importance.

Keywords: Apical foramen; Irrigation; Root canal preparation; Safety; Tooth apex

ÖZET

Amaç: Bu çalışmada, apikal daralımı bozulmuş ve bozulmamış dişlerde kullanılan farklı tipte irigasyon iğnelerinin apikalden taşan solüsyon miktarına etkisi değerlendirilmiştir.

Gereç ve Yöntem: 40 mandibular dişin apikal foramenleri dental operasyon mikroskobu altında belirlendi ve örnekler iki gruba ayrıldı (n=20). Gruplardan biri (sağlam apikal foramen grubu) apikal foramene 0.5 mm mesafede, diğeri ise (taşkın preparasyon grubu) apikal foramenin 0.5 mm ilerisinden taşkın olarak enstrümante edildi. Her bir preparasyon grubunun final irrigasyonunda biri açık uçlu ve üçü kapalı uçlu (yandan delikli) olmak üzere dört farklı iğne kullanıldı. Tüm örnekler, randomize çapraz tasarım kullanılarak tüm iğne tipleri ile ayrı ayrı irrige edildi. İşlemler esnasında apikal bölgeye taşan solüsyonlar, plastik kaplara yerleştirilmiş çiçek süngerleri içerisinde toplandı. Taşan solüsyon miktarları, kapların başlangıç ağırlıklarının son ağırlıklarından çıkarılmasıyla hesaplandı ve kaydedildi. İstatistiksel değerlendirmeler için Tekrarlanan İki-Yönlü ANOVA ve Tukey post-hoc testleri kullanıldı.

Bulgular: Taşkın enstrümantasyon yapılan gruplarda, kullanılan iğnelerden bağımsız olarak, sağlam apikal foramene sahip dişlere göre önemli ölçüde daha fazla irrigan ekstrüzyonu gerçekleşti. Sağlam apikal daralıma sahip irigasyon gruplarında ekstrüzyon miktarı çift delikli kapalı uçlu iğnede en az, açık uçlu iğne grubunda en fazlaydı. Taşkın enstrümantasyon yapılmış gruplarda, en az ekstrüzyon tek delikli iğne grubunda, en fazla ise açık uçlu iğne grubunda gözlendi.

Sonuç: Bu çalışmanın sınırlamaları altında, taşkın enstrümantasyon yapılmış dişlerdeki irigasyon işlemleri için tek delikli kapalı uçlu iğnenin kullanımı önerilebilir. NaOCl'nin minimal miktarları bile doku ile temas ettiğinde ciddi toksik etkiler oluşturabildiğinden, bu çalışmada elde edilen istatistiksel farkların, klinik olarak da önem taşıyabileceği söylenebilir.

Anahtar Kelimeler: Apikal foramen; Diş apeksi; Güvenlik; Kök kanal preparasyonu; Yıkama

Makale gönderiliş tarihi: 10.10.2024; Yayına kabul tarihi: 25.12.2024

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INTRODUCTION

Ensuring a balance between cleaning efficacy and patient safety is crucial during root canal irrigation. Although irrigation is essential for disinfecting the root canal system, it carries risks of tissue damage, chemical irritation, nerve injury, and potentially severe complications such as allergic reactions.[1,2]

The apical constriction, the narrowest portion of the root canal near the apex, is traditionally regarded as the endpoint for root canal treatment procedures. However, certain conditions, including root resorption, developmental anomalies, or iatrogenic errors, can disrupt or eliminate the apical constriction.[3,4] In these situations, the clinician faces challenges in controlling the flow of irrigants and preventing their extrusion beyond the apex.

The design of irrigation needles, including factors such as taper, diameter, and tip type, influences the flow dynamics and may contribute to irrigant extrusion.[5,6] A clear understanding of the relationship between needle design and apical extrusion allows for the optimization of irrigation protocols to enhance treatment outcomes and ensure patient safety. By selecting the appropriate needle based on clinical factors such as root canal anatomy, the degree of apical disruption, and the type of irrigant used, the risk of extrusion and its associated adverse effects can be minimized.

This study evaluates the effect of four different irrigation needles on the amount of apically extruded irrigant in teeth with intact or disrupted apical constrictions. The null hypothesis is that final irrigation with different types of needles does not affect the amount of solution extruded from the apex in teeth with or without an intact apical constriction.

MATERIAL AND METHOD

Ethical Approval

This study's protocol was approved by the Non-Invasive Clinical Research Presidency of Van Yuzuncu Yıl University (date: 21/01/2022, approval number: 2022/01-11).

Teeth Selection and Chemomechanical Preparations

A total of 40 recently extracted single-rooted human mandibular incisor teeth with single canals and mature roots were collected from the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Van Yuzuncu Yıl University. Teeth exhibiting caries, previous restorations, prior root canal treatments, crown or root fractures, root curvature, or cracks were excluded. Radiographic imaging was used to ensure the absence of internal or external resorption or calcification on the buccal and proximal surfaces. The teeth were cleaned and scaled using ultrasonic scalers to remove calculus and soft tissue debris. Following cleaning, each tooth was inspected under an operating microscope to confirm the presence of a single apical foramen. The specimens were then stored in physiological saline until further use in the experiment.

A diamond fissure bur (Bosphorus, Türkiye) with a high-speed handpiece. Working lengths were determined by inserting a #10 K-file (Dentsply Maillefer, Ballaigues, Switzerland) into the canal until the file was visible at the apical foramen under ×16 magnification using a dental operating microscope. The apical foramen's distance to the reference point was recorded for each tooth.

In Group 1, the root canals of 20 teeth were prepared 0.5 mm short of the apical foramen. The preparation was performed using TruNatomy (Dentsply Sirona, Maillefer, Ballaigues, Switzerland) endodontic files, following the manufacturer's recommendations. Continuous rotation at 500 RPM with a torque setting of 1.5 N/cm was used with the sequence of instruments: an orifice modifier (20/.08), a glider (17/.02), and a prime file (26/.04). The files were cleaned after three in-and-out motions, and apical patency was maintained using a #10 K-file throughout the procedure. If a file failed to reach the working length, it was removed from the canal and cleaned, the canal was re-irrigated, and the file was then reinserted for another pass until the working length was reached.

During the instrumentation, each canal was irrigated with 5 mL of 5% NaOCl (sodium hypochlorite, Microvem, Turkey). Canal preparation was considered complete when the file easily reached the required length. Afterward, the smear layer was removed by irrigating with 3 mL of 5% NaOCl, 3 mL of 5% ethylenediaminetetraacetic acid

(EDTA, Microvem, Turkey), and 3 mL of distilled water. The canals were dried using absorbent paper points (Pearl Dent Co., Ltd., Vietnam).

In Group 2, the remaining 20 teeth were instrumented 0.5 mm beyond the apical foramen using the aforementioned procedures.

Experimental Set-Up

The set-up for collecting the extruded irrigant was based on the model of Myers and Montgomery[7] and Altundaşar *et al.*[8] adapted by Genc Sen and Kaya.[9] Floral foam was fitted into a 25-mL cylindrical polystyrene container (Figure 1).

The foam and container (without the lid) were weighed three times using an analytical balance (Sartorius Basic, Sartorius AG., Gottingen, Germany) with an accuracy of 10^{-4} g. The average weight was recorded as the initial weight (W0).

A hole was prepared in the center of the container's lid, and the root was inserted into the hole with its apical part embedded in the foam (Figure 2a, c). The space between the root and the hole was sealed using a light-curing glass ionomer cement (Ionoseal, VOCO GmbH, Cuxhaven, Germany) to prevent leakage (Figure 2b, c). A 27 G dental needle was inserted and fixed into the lid to equalize the internal and external pressures. Finally, the root was isolated using a rubber dam (Figure 2d).

Final Irrigation Procedures

All samples were assigned to irrigation groups using a randomized crossover design. Each sample in Group 1 (the intact apical foramen group; n = 20) was irrigated separately with four different needle types as outlined below:

Group 1A: A 30 G closed-tip, one-side-vented needle (Kerr-Hawe irrigation probe, KerrHawe SA, Biggio, Switzerland) was used.
Group 1B: A 30 G closed-tip, double-side-vented needle (C-K Blunt, CK Dental, Gyeonggi-Do, Korea) was used.
Group 1C: A 30 G flat, open-tip needle (Ultradent Navitip, Ultradent Products Inc., South Jordan, UT, USA) was used.
Group 1D: A two-side-vented, conical plastic needle (TruNatomy, Dentsply Sirona, Maillefer, Ballaigues, Switzerland) was used.

Similarly, each sample in the subgroups of Group 2 (over-instrumented foramen group; 2A, 2B, 2C, and 2D; n=20) was sequentially irrigated using the same needles as Group 1.

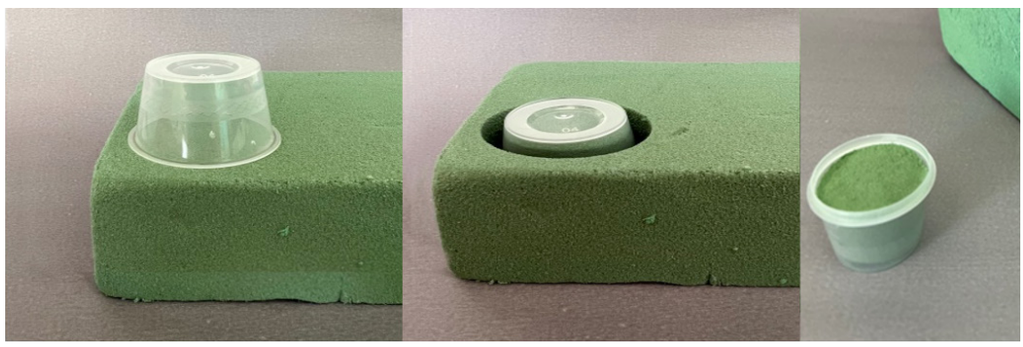

Figure 1. Fitting procedure of the floral foam into the cylindrical container.

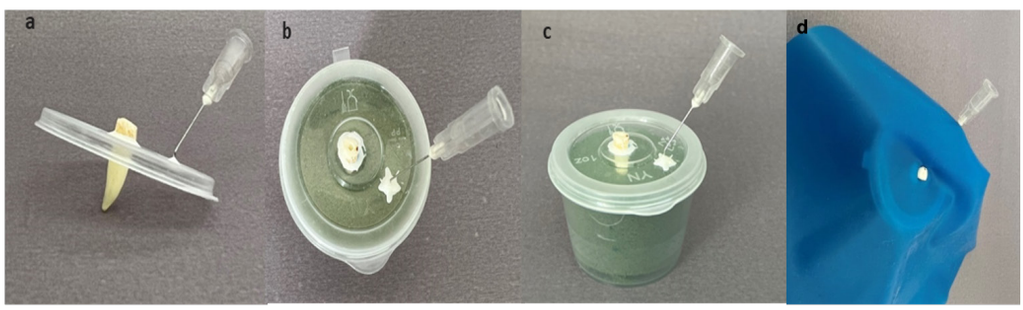

Figure 2. a) Lid with the root and needle b) side view of the experimental setup c) Top view of the experimental setup. d) Rubberdam-isolated setup

For each irrigation group, 5 mL of distilled water was injected into the root canal using a Luer-lock syringe connected to the selected needle. Irrigation was performed 2 mm from the apical foramen at a 5 mL/min flow rate. During irrigation, the needle was continuously moved with a vertical amplitude of 1–2 mm to ensure effective delivery of the irrigant.

After completing the final irrigation procedure, the lid (with the attached root and pressure equalization needle) was separated from the container. Each container, including the floral foam and the extruded irrigant, was weighed three times using the analytical balance. The average of these measurements was recorded as the final weight (W1). The exact amount of extruded irrigant was calculated by subtracting the initial weight from the final weight (W1-W0).

Statistical Analysis

The normality assumption of the variables was tested with the Kolmogov-Simirnov test. After the normality test, the Scheirer–Ray–Hare test was used to compare two-factor levels. Descriptive statistics were presented as mean, standard deviation, median, IQR, minimum, and maximum values for the non-normal distributed variable. The Dunn multiple comparison test was used to determine different subgroups. Statistical significance level was considered as 5% and SPSS (ver: 21) and R statistical program was used for all statistical computations.

RESULTS

The graphical representation of the amount of extruded irrigants is given in Figure 3. Mean values, standard deviations (SD), minimum-maximum (min-max) ranges, medians, and inter-quarter ranges (IQR) for the apically extruded irrigants were shown in Table 1.

In teeth with intact apical constrictions, no significant differences in apically extruded irrigant were observed between the one-side-vented, double-side-vented, and TruNatomy needle groups ($p > 0.05$). However, significant differences were found between the double-side-vented and TruNatomy needles ($p < 0.05$), and the open-tip needle group extruded significantly more irrigant than all other groups ($p= 0.001$). The order of extrusion was: Double-side-vented < One-side-vented < TruNatomy < Open-tip.

In over-instrumented teeth, all needle types resulted in significantly greater irrigant extrusion compared to intact apical constrictions. The one-side-vented needle group extruded significantly less irrigant than all other groups ($p = 0.001$). No significant differences were observed between the double-side-vented and TruNatomy groups ($p > 0.05$). The open-tip needle extruded the greatest amount of irrigant, significantly more than all other groups ($p = 0.001$). The order of extrusion was: One-side-vented < Double-side-vented = TruNatomy < Open-tip.

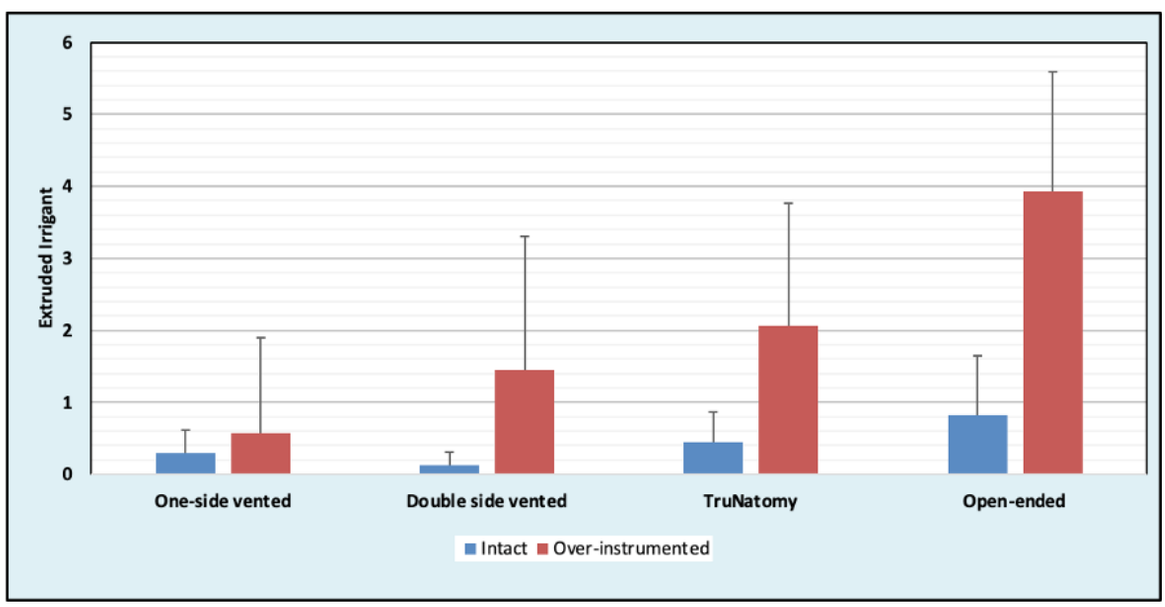

Figure 3. Graphical representation of the amount of extruded irrigants' median and standard deviation values according to the experimental groups.

Table 1. Mean values, standard deviations (SD), minimum-maximum (min-max) ranges, medians, and inter-quarter ranges (IQR) for the apically extruded irrigant (in grams) with different types of needles.

	Intact				Over-instrumented				
	Mean±SD	**Min Max**	**Median**	**IQR**	**Mean±SD**	**Min Max**	**Median**	**IQR**	**p**
One-side-vented	0.328±0.246 **bc**	0.048 0.986	0.295	0.316	0,814± 0.639 **c**	0.155 1.937	0.571	1.322	**0.001**
Double-side-vented	0.198±0.151 **c**	0.031 0.642	0.132	0.172	1,607± 0.9 **b**	0.433 3.785	1.450	1.085	**0.001**
TruNatomy	0.471±0.315 **b**	0.060 1.111	0.454	0.411	1,951± 0.87 **b**	0.609 3.140	2.062	1.699	**0.001**
Open-ended	0.899±0.643 **a**	0.096 2.904	0.829	0.822	3,550± 1.179 **a**	1.064 4.850	3.928	1.665	**0.001**
p			**0.001**			**0.001**			

a, b, c: ↓ different lowercases in the same column indicate significant differences among needle types ($p<0.05$).

DISCUSSION

This study investigated the amounts of apically extruded irrigants during final irrigation using different needle types in root canals with preserved apical constrictions and those with disrupted apical constrictions due to over-instrumentation. The null hypothesis was rejected as the over-instrumented groups were associated with significantly greater irrigant extrusion, and significant differences were observed between needle types.

In this study, the groups and methodology were designed using a crossover design, which mitigates issues arising from anatomical variations and facilitates more standardized measurements through repeated assessments on the same samples. Irrigation was performed with all needle types in 20 teeth prepared with intact apical constrictions and in an additional 20 teeth that were over-instrumented, allowing for a more reliable measurement of the extrusion caused by different needles on the same samples.

Previous studies on irrigant extrusion have embedded extracted human teeth in various materials, such as water, gel, putty silicone, and floral foam, to simulate periapical tissues.[10] In this study, floral foam was selected, consistent with its use in earlier research,[8,11] with slight modifications made by placing the foam in a plastic container. This adjustment was implemented to address the foam's delicate structure, which is prone to crumbling and wear. This approach effectively prevented any potential weight loss in the foam during the experimental procedures.[9]

The apical foramen is reportedly located 2–3 mm from the anatomical apex, but its precise location cannot always be accurately determined by radiographs. Consequently, disruption of the apical constriction during root canal preparation or instrumentation is common. Conditions such as an open apex or disrupted apical constriction caused by internal or external resorption, immature roots, and proximity to the maxillary sinus (covered by a thin membrane) complicate the identification of this critical anatomical landmark. These factors can increase the likelihood of irrigant extrusion through the disrupted or open apical constriction.[12] In this study, to reliably assess the effects of apical disruption, one group of samples had standardized apical disruptions, while the other group's apices remained intact.

Several factors influence the amount of irrigant extrusion during positive-pressure irrigation, including the flow rate of the irrigant solution, the needle's size and insertion depth, and the type of needle used.[6] Boutsioukis *et al.*[13] reported a direct relationship between flow rate and irrigant extrusion, indicating that greater extrusion occurs as flow rate increases. Various flow rates for irrigation are recommended in

the literature. To achieve adequate irrigant exchange within the canal, it is suggested that a flow rate of 0.01–0.26 mL/s be used at a distance of 1 mm from the working length.[14] This rate should be adjusted depending on the diameter of the needle. Chang *et al*.[15] recommended a flow rate of 0.06 mL/s for passive irrigation with a 30 G needle, while Gopikrishna *et al*.[16] suggested 0.09 mL/s. In the present study, a 0.08 mL/s flow rate was used to balance effective irrigant exchange with minimizing extrusion, considering clinical safety and practicality.

The most common needle sizes used in conventional needle irrigation range between 27 and 30 G.[17] In our research, a 30 G needle was selected because it is considered a standard irrigation needle that can reach the apical part of the canal and enhance cleaning and debridement while simultaneously providing space for irrigation replacement even in minimally prepared root canals.

Boutsioukis compared various 30 G needle designs and found that an open-tip needle tip could fully replace the irrigant in a canal when placed 2 mm from the working length whereas a side-vented closed-tip needle tip required to be inserted 1 mm from the working length to achieve the same purpose.[18] In this study, the insertion depth of the needles was standardized at 2 mm from the apical foramen. This approach helped control for the effect of insertion depth, which significantly influences the amount of irrigant solution extruded, and allowed a clear assessment of the specific impact of needle types on the apically extruded irrigant.

This study observed no significant difference in the amount of extruded irrigant between single-vented and double-vented side needles in teeth with intact apical constrictions. However, the double-side-vented needle exhibited the lowest extrusion among all needle types, likely due to reduced solution pressure from its dual exit points. Similarly, Silva *et al*.[19] reported lower extrusion levels with the double-side-vented needle, aligning with our findings.

The TruNatomy needle is a 30 G plastic, side-vented needle with a 4% taper, designed to provide effective cleaning of complex canals while minimizing the risk of extrusion due to its closed end. To the best of our knowledge, there is no study in the literature comparing TruNatomy with other types of needles in terms of irrigant extrusion. In this study, no significant difference was observed between the one-side-vented needle and TruNatomy in terms of the amount of irrigant extruded from teeth with intact apical constrictions. In over-instrumented teeth, the extruded irrigant amounts were similar in double-side-vented needles and TruNatomy. Moreover, TruNatomy was associated with less extrusion compared to open-tip needles regardless of the instrumentation level of the teeth. Therefore, it can be a safer alternative against open-tip needles.

In this study, the highest irrigant amount was extruded when an open-tip needle was used in teeth with intact apical constriction and over-instrumentation. This result can be attributed to the fact that open-ended needles create higher apical pressure due to direct periapical access, increasing the risk of irrigant and debris extrusion. Similar to our results, Boutsioukis *et al*.[20] reported that the irrigant tends to eject more strongly from the open-tip needle and causes greater extrusion than the closed-tip one. The same results were supported by Kalhoro *et al*.[21], who reported that the incidence of extrusion by open-tip needles (62%) was higher than by closed-tip side-vented needles (24%). In addition, Altundasar *et al*.[8], Psimma *et al*.[22], Fikirli *et al*.[23], and Chang *et al*.[24] also found similar results despite differences in the gauge of needles or apical preparation size.

In this study, the amount of irrigant extruded from over-instrumented teeth was higher in all needle groups compared to teeth with preserved apical constrictions. This outcome aligns with reports suggesting a direct relationship between over-instrumentation—resulting in apical constriction deterioration—and increased irrigant extrusion.[9,25] Tinaz *et al*.[25] also examined the effect of different instrumentation techniques on the extrusion of materials from teeth with disrupted apical constrictions, though without simulating periapical tissues. Their findings similarly indicated greater extruded amounts in these teeth, consistent with the results of this study.

CONCLUSION

Within the limitations of this study, the following conclusions were drawn:

Irrigation of teeth instrumented to 0.5 mm short of the working length, as well as those over-instrumen-

ted by 0.5 mm, resulted in measurable quantities of apical irrigant extrusion across different needle types. The amount of irrigant extruded from teeth with apical disruption was consistently higher than that from teeth with intact apical constrictions, regardless of the needle type used. Therefore, it is evident that the integrity of the apical constriction plays a more critical role in apical irrigant extrusion than the specific irrigation needle employed.

In teeth with intact apical constrictions, the double-side-vented closed-tip needle resulted in the least amount of extruded irrigant. In contrast, the open-tip needle resulted in the highest amount. Therefore, a double-side-vented needle is recommended for irrigating teeth with intact apical constrictions. Given its statistical similarity to the double-side-vented needle, the one-side-vented closed-tip needle can be considered a secondary option. Conversely, open-tip needles should be avoided whenever possible.

In the over-instrumented teeth group, the one-side-vented needle extruded the least amount of irrigant, whereas the open-tip needle extruded the greatest amount. Therefore, one-side-vented needles should be preferred for irrigating apically disrupted teeth, as they demonstrated greater safety, while open-tip needles should be avoided.

Within the limitations of this study, the lateral single-vented closed-tip needle may be recommended for irrigation procedures in over-instrumented teeth. However, there is a notable scarcity of literature addressing the irrigation procedures applicable to over-instrumented teeth. Further research is warranted to clarify methods and materials, particularly by exploring different needle sizes and flow dynamics.

ACKNOWLEDGMENTS

We gratefully acknowledge Prof. Dr. Sıddık Keskin for performing statistical analyses. This article is derived from Safa Hazım Yahya Alqassab's PhD thesis.

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DOI: http://doi.org/10.54617/adoklinikbilimler.1532576

Case Report

Conservative Management of Mural Subtype Unicystic Ameloblastoma in Young Patient: A Case Report with One Year of Follow Up

Genç Hastada Mural Alt Tip Unikistik Ameloblastomun Konservatif Tedavisi: Bir Yıllık Takipli Bir Olgu Sunumu

Aydın Onur Gerçek[1], Selen Adiloğlu[1], Alper Aktaş[1]

ABSTRACT

Introduction: Ameloblastoma is a benign tumor primarily found in the jawbone. Unicystic ameloblastoma, first categorized in 1977, comprises four distinct types and is considered a less aggressive variant of ameloblastoma. Marsupialization, a conservative surgical approach, involves creating an open pocket by suturing the edges of a lesion to facilitate fluid drainage and promote healing.

Case Report: This case report details the surgical management of a 13-year-old boy diagnosed with unicystic ameloblastoma and an impacted left mandibular third molar, who was referred to the Oral and Maxillofacial Surgery Department at Hacettepe University during the COVID-19 pandemic due to a radiolucent lesion surrounding the impacted tooth, which caused facial asymmetry. The treatment plan included the extraction of the second molar, a biopsy, and marsupialization. During the one-year follow-up, no recurrence was noted.

Conclusion: Marsupialization, which involves creating an open pocket by suturing the edges of a lesion to the oral cavity or sinuses for fluid drainage, is a conservative treatment approach particularly suitable for young patients. This method preserves the growth potential of the bone, improves aesthetic outcomes, and protects vital structures. In this case, due to the COVID-19 pandemic, conservative treatment under local anesthesia was preferred, with enucleation performed after marsupialization. Such approaches address clinical needs effectively and support patients' psychological well-being during challenging periods like pandemics.

Keywords: Ameloblastoma; COVID-19; Jaw neoplasms

ÖZET

Giriş: Ameloblastoma, çene kemiğinde sıklıkla görülen benign bir tümördür. İlk olarak 1977 yılında tanımlanan unikistik ameloblastoma, dört farklı alt tipe sahip olup ameloblastomanın daha az agresif bir varyantı olarak kabul edilmektedir. Marsupyalizasyon, kist epitelinin bir bölümünün cerrahi olarak çıkarılması ve kistin ağız mukozasına açılması yoluyla drenajı kolaylaştırarak iyileşmeyi teşvik eden konservatif bir cerrahi yaklaşımdır.

Vaka raporu: 13 yaşında bir erkek çocuk, yüz asimetrisine neden olan gömülü alt çene üçüncü molarını çevreleyen radyolusent bir lezyonla Hacettepe Üniversitesi Ağız, Diş ve Çene Cerrahisi Anabilim Dalı'na başvurdu. Uygulanan tedavi protokolü, ikinci molar dişin çekilmesi, biyopsi yapılması ve marsupyalizasyon prosedürünü içermiştir. Bir yıllık takip sürecinde herhangi bir rekürrens tespit edilmemiştir.

Sonuç: Marsupyalizasyon, kistik yapıların drenajı için lezyonun kenarlarının ağız boşluğuna veya sinüslere dikilmesiyle sıvı drenajı için açık bir cep oluşturulmasını içeren konservatif bir tedavi yaklaşımıdır ve özellikle genç hastalar için uygundur. Bu yöntem, kemiğin büyüme potansiyelini korurken estetik sonuçları iyileştirir ve hayati yapıların korunmasını sağlar. Bu vakada, COVID-19 pandemisi nedeniyle lokal anestezi altında konservatif tedavi tercih edilmiş ve marsupializasyonun ardından enükleasyon uygulanmıştır. Bu tür yaklaşımlar, klinik gereksinimleri etkin bir şekilde karşılarken, pandemiler gibi zorlu dönemlerde hastaların psikolojik olarak kendilerini idame etmeleri daha kolay olacaktır.

Anahtar Kelimeler: Ameloblastom; COVID-19; Çene neoplazileri

Makale gönderiliş tarihi: 22.08.2024; Yayına kabul tarihi: 23.12.2024

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INTRODUCTION

Unicystic ameloblastoma (UA), first described in 1977, is characterized by a single well-defined cavity and is classified into subtypes based on histopathological characteristics. The 5th edition of the World Health Organization (WHO) classification of ameloblastoma, published in 2022, delineates five distinct categories of this odontogenic tumor: conventional ameloblastoma, unicystic ameloblastoma, extraosseous/peripheral ameloblastoma, adenoid ameloblastoma, and metastasizing ameloblastoma.[1] It is generally less aggressive compared to conventional ameloblastoma.[2] UA constitutes approximately 5-15% of all ameloblastoma cases and predominantly occurs in younger individuals, typically during the second to third decades of life, in contrast to the solid form, which is more commonly observed in the fourth decade. Clinically, UA are often characterized by well-defined, unilocular or multilocular radiolucent lesions, frequently associated with impacted teeth, particularly in the posterior mandible.[3] The mandibular to maxillary UA ratio is reported to be 13:1.[4] The classification of unicystic ameloblastomas includes three histological types: luminal, intraluminal, and mural, which have implications for their biological behavior and treatment outcomes.[5]

Many experts consider radical surgery, which involves the removal of solid or multicystic ameloblastoma with 1 cm safe margins and resection of adjacent soft tissue, to be the most effective treatment option, followed by subsequent reconstruction.[6] Some authors propose an alternative approach that combines conservative surgery with long-term follow-up, particularly in cases where patient compliance is favorable and there is a low risk of adjacent structure involvement.[7] Conservative surgery encompasses techniques such as marsupialization and enucleation or curettage, with or without additional methods like cryotherapy, thermal or chemical cauterization, radiotherapy, or chemotherapy.[8,9] Historically, recurrence rates after enucleation and curettage of UA have been reported to be between 10% and 20%.[2] However, there remains insufficient evidence and a lack of consensus regarding the most effective treatment strategies.

Marsupialization can mitigate the adverse effects associated with definitive treatment. It aids in preserving the inferior alveolar nerve, lowers the risk of pathological fractures, and eliminates the necessity for a bone graft. Nevertheless, its effect on mandibular unerupted anomalies remains uncertain, with recurrence rates varying from 4.5% to over 50%.[10]

During the COVID-19 pandemic, the management of benign lesions in the maxillofacial region underwent significant changes due to the need for heightened infection control measures and the prioritization of urgent cases. The pandemic led to a re-evaluation of surgical practices, particularly for benign lesions, which are often elective procedures.[11] Despite healthcare restrictions during the COVID-19 pandemic, head and neck tumor surgery has remained one of the most actively pursued surgical treatment areas.[12] In this context, marsupialization performed under local anesthesia appeared to be a practical option, reducing exposure risks while effectively managing the lesion. This case report discusses the surgical management of ameloblastoma during the COVID-19 pandemic. A 13-year-old boy underwent marsupialization, a conservative surgery for an unerupted left mandibular third molar.

CASE REPORT

A 13-year-old male patient with facial asymmetry in the left mandibular angular region, attributed to an impacted left mandibular third molar, was referred to the Oral and Maxillofacial Surgery Department at Hacettepe University. Written informed consent for the surgical procedures and the publication of this case report was obtained from the patient and their legal guardians. The patient reported no systemic diseases. Upon examination, expansion was observed in the left mandibular angle area, extending into the retromolar region. An unerupted left mandibular third molar was identified, with no accompanying pain or ipsilateral paresthesia.

A panoramic radiograph revealed a well-defined, solitary radiolucent lesion in the region of the left lower third molar. This lesion extends from the distal root of the second molar to the left ascending ramus and is associated with an unerupted third molar. Cone beam computed tomography (CBCT) scans indicated a cystic lesion encircling the impacted lower left wisdom tooth, displacing the inferior alveolar nerve (Figure 1).

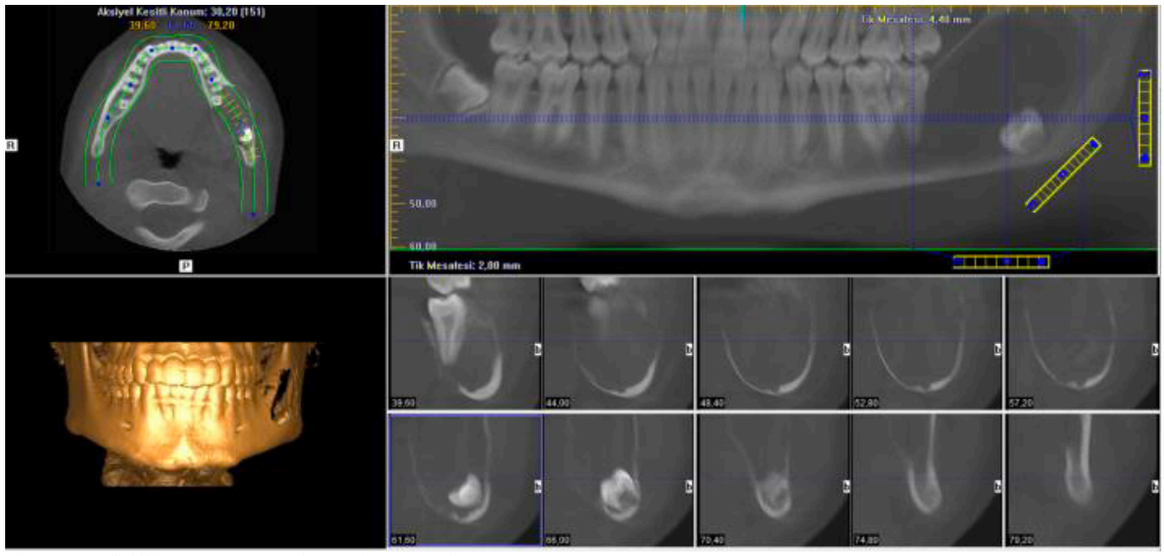

Figure 1. CBCT radiograph of the patient with thin buccal and lingual bone wall.

The lower left second molar exhibited incomplete root formation and lacked sufficient bone support. The lower left third molar was positioned at the jaw angle. An incisional biopsy was conducted, leading to a diagnosis of mural type UA following histopathological examination. The initial step of marsupialization involved surgically removing a portion of the cystic wall to alleviate the intracystic pressure on the overlying bone and mucoperiosteum, thereby creating a clear bone outline of the lesion (Figure 2). The second molar and the impacted third molar teeth were extracted at this stage to minimize postoperative complications and reduce the risk of fracture formation. A medicated gauze dressing, infused with petrolatum and 3% Bismuth Tribromophenate, was used to pack the large lesional cavity, ensuring continuity between the marsupialized lesion and the oral environment (Figure 3). After confirming the epithelialization of the cyst wall, the drain was removed.

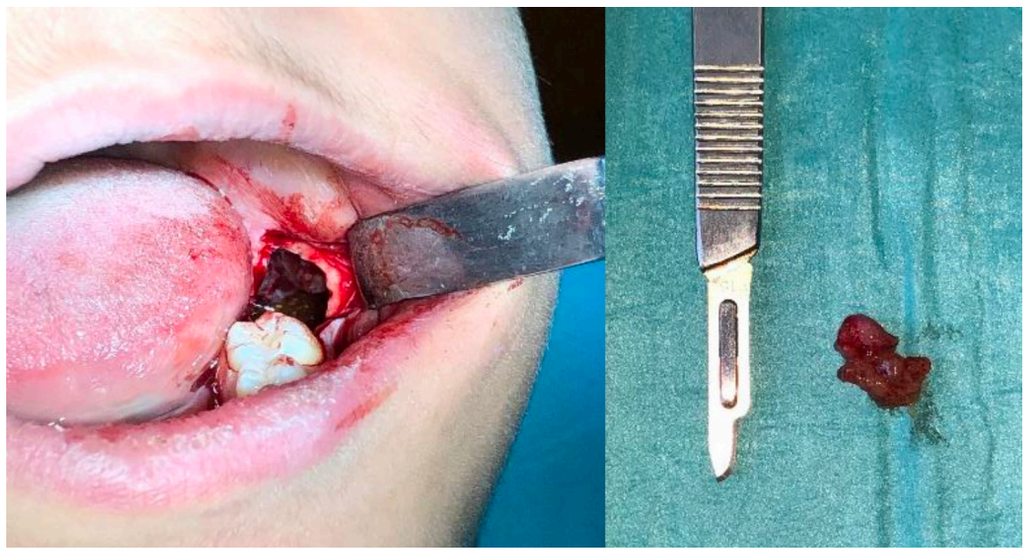

Figure 2. Removal of part of the cystic wall.

Figure 3. Dressing with fine-mesh gauze containing petrolatum and 3% Bismuth Tribromophenate.

Figure 4. The lesion diminished in size and new bone formation was seen.

Post-operatively, the patient was prescribed a course of antibiotics (amoxicillin-clavulanate, 1000 mg twice daily) for one week to prevent infection and nonsteroidal anti-inflammatory drugs (deksketoprofen, 25 mg two times daily) for five days to manage pain and inflammation. Antiseptic mouth rinses (chlorhexidine gluconate 0.12%) were recommended twice daily to maintain oral hygiene. The patient was scheduled for a month of follow-up appointments and daily management following the surgery, after which the frequency would shift to weekly check-ups. The parents were advised to ensure proper hygiene of the oral cavity by regularly irrigating the lesion until the definitive operation could be done.

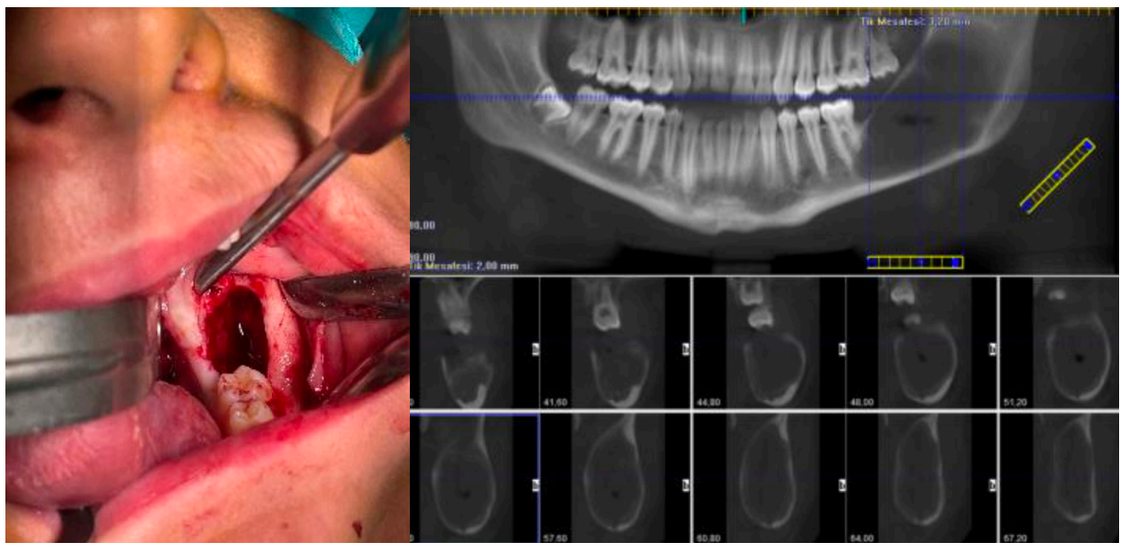

Figure 5. Six months of follow-up with a clear bony outline.

Cone-beam computed tomography was performed six months after marsupialization. The nerve was located within the lesion cavity, surrounded by a radiopaque border, with no paresthesia or complaints reported. The lesion showed a reduction in size on radiographs, and new bone formation was observed (Figure 4). The patient's enucleation was performed after six months of follow-up, achieving a clear bony outline. The final biopsy supported the first biopsy results (Figure 5). During the assessment, we evaluated wound healing, ipsilateral paresthesia of the lower lip, bone formation, and restoration of normal bone contour, along with monitoring for any potential lesion recurrence. Enucleation was performed for six months postoperatively, and no recurrence was observed during the one-year follow-up. By the final follow-up stage, a normal mandibular bony contour was achieved, accompanied by complete remodeling (Figure 6).

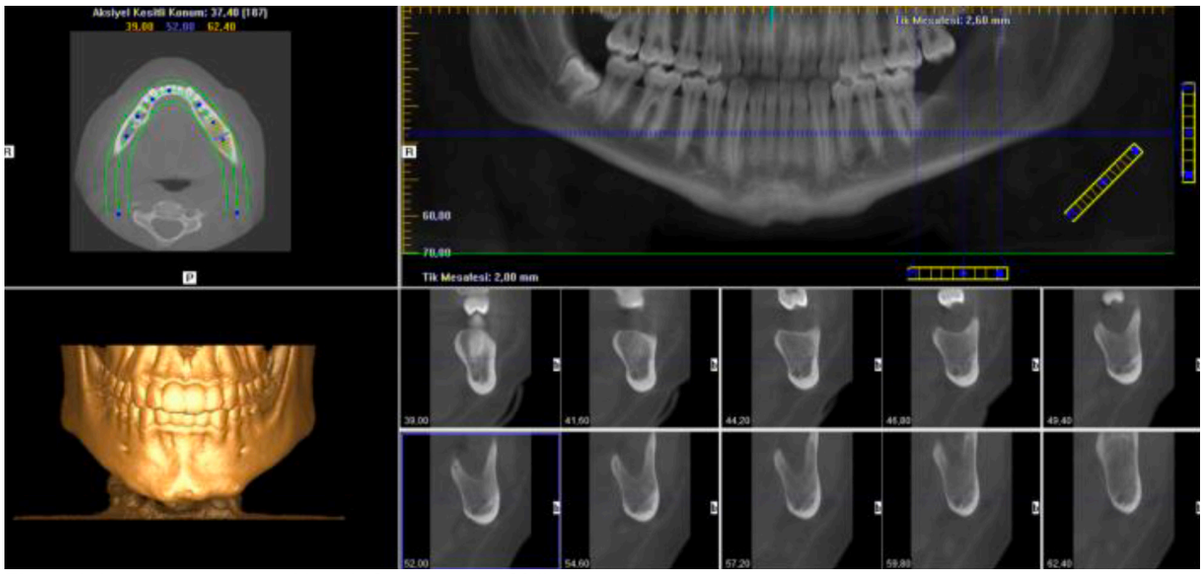

Figure 6. Improvement was achieved after one year of follow-up.

DISCUSSION

Unicystic ameloblastomas are benign but potentially aggressive tumors that usually occur in the mandibular region and expand within the bone. Marsupialization is a widely accepted procedure for the treatment of large mandibular cystic lesions.[13] It is a good alternative treatment for cases that cannot be treated under general anesthesia.

The treatment of UA by marsupialization is a subject of controversy; some consider it to be too radical, while others feel it is too conservative. Various treatment options have been employed for UA, including segmental or marginal resection, though more conservative treatments have also been commonly reported.[8] While enucleation and curettage are the most common procedures, some clinicians prefer marsupialization performed in a two-stage surgery to preserve vital structures.[13,14] Studies indicate that marsupialization can be an effective initial treatment, especially in cases where complete excision may pose a higher risk of complications or where the cyst is large enough to warrant a more conservative approach.[15,16] In the present case, our treatment of choice was marsupialization due to the patient's young age, aesthetic expectations, and desire to protect vital structures. One of the issues that should be considered in such patients is the possibility of recurrence. Marsupialization was preferred because it provided advantages regarding lesion control during the period when the operating room was closed due to COVID-19.

Many studies have demonstrated that the possibility of recurrence after resection is minimal.[8,17] A study comparing the recurrence rates of four different treatment options for unicystic ameloblastoma yielded the following results: 3.6% for jaw resection, 30.5%

for enucleation followed by the application of Carnoy's solution, and 16% for marsupialization, with or without additional second-line treatments. The findings indicated that jaw resection had the lowest recurrence rate, followed by enucleation with Carnoy's solution. In contrast, enucleation alone demonstrated the highest recurrence rate. Additionally, the effectiveness of marsupialization could not be fully evaluated since most cases necessitated a second stage of surgery.[6,8] Luminal UA typically indicates a less aggressive tumor type and has a better prognosis. In contrast, mural types often result in higher recurrence rates in children.[18] It is important to remember that significant complications can arise after resection, leading to disfigurement, dysfunction, and psychological distress, particularly in young patients.[17] When aggressive surgery is considered, especially in young patients, the possible psychological effects should be taken into consideration. Our treatment decision was made based off the patient's age, the specific type of ameloblastoma (mural), the high risk of complications associated with the size of anatomical formations, and the restricted access to general operating rooms during the pandemic.

Limited by deficiencies and inaccuracies, previous case reports of young patients with UA treated with marsupialization call for an updated and more comprehensive approach.[19] It is advisable to consider the following points when making decisions for young patients: 1) ongoing facial growth, variations in bone physiology (such as a higher percentage of cancellous bone, increased bone turnover, and reactive periosteum); 2) challenges in initial diagnosis; and 3) the dominance of pre-erupted teeth in unicystic ameloblastoma cases. Given these factors, we opted for marsupialization combined with close monitoring, with the objective of initiating early intervention in the event of recurrence.

In younger patients, UA can be effectively treated through enucleation with bone curettage. However, some surgeons have used alternative adjuvants to reduce the recurrence rate in this treatment. Recurrence rates have been reported, especially in cysts with osseous perforation.[20] While Lau and Samman recommended[8] Carnoy's solution after enucleation, Khare *et al*.[21] tried an alternative variation that would allow faster ossification of the gap with an osteoperiosteal flap. Re-entry surgery with cryotherapy using liquid nitrogen following enucleation is a promising treatment option for large UA lesions. This method may aid in preventing tumor recurrence, as discussed by Ogunsalu *et al*.[22] In the case report by Paulo *et al*.[23] enucleation following marsupialization is considered an effective option for ameloblastomas located in the ramus, as this condition is a benign, slow-growing jaw neoplasm that originates from odontogenic epithelium. A conservative approach in children not only yields favorable aesthetic results but also helps preserve their craniofacial development. This treatment preference is consistent with the evidence found in the existing literature and takes the patient's age into account.

In some instances, adjunctive therapies may be considered post-surgery to minimize the risk of recurrence. These can include cryotherapy, thermal or chemical cauterization, and, in rare cases, radiotherapy or chemotherapy.[24] The identification of the BRAF-V600E driver mutation in mandibular ameloblastomas and other mutations has prompted the search for targeted therapies for jaw ameloblastomas.[25] Attempts to treat ameloblastomas with BRAF inhibitors (BRAFi), alone or in combination with mitogen-activated protein kinase (MEK) inhibitors (MEKi), have been reported as a last-line treatment.[26] BRAF-targeted therapy was effectively used for the first time in a neoadjuvant protocol for a small group of young patients with unicystic, mural-type ameloblastoma.[27] In the study conducted by Hirschhorn *et al*.[28] the first comprehensive histomorphologic findings on BRAF-targeted ameloblastomas were presented, highlighting the effect of BRAFi on the inflammatory response by activating tumor-infiltrating lymphocytes and cytotoxic lymphocytes while downregulating immunosuppressive factors to create an anti-tumor environment.

UA is seen in young patients with multiple impacted teeth. In these cases, these impacted teeth are usually removed during surgery along with the tumors to prevent their recurrence.[29] In order to reduce the number of operations during the COVID-19 pandemic, we chose to extract the second molar and wisdom tooth by performing an incisional biopsy during marsupialization.

During the challenging work conditions of the pandemic era, the conservative management of large cys-

tic jaw lesions through decompression followed by surgery has led to high levels of patient satisfaction and decreased the necessity for extensive surgical procedures. The average reduction rate observed was 80.8%, with no recorded instances of recurrence.[30] In consideration of the young patient's well-being and psychological welfare, we chose to perform enucleation followed by marsupialization to mitigate long-term effects.

CONCLUSION

Marsupialization is a highly effective conservative treatment option for unicystic ameloblastoma, particularly in young patients, where preserving vital anatomical structures and supporting craniofacial growth are critical. Based on the findings of this case report, patient selection criteria should emphasize age, lesion type, and the potential impact on facial aesthetics and function.

Long-term follow-up is essential for monitoring bone regeneration and detecting potential recurrences. Regular imaging, such as CBCT, and careful clinical evaluations are recommended to ensure successful outcomes. Additionally, integrating minimally invasive techniques like marsupialization during limited healthcare resources, such as the COVID-19 pandemic, can provide a practical and patient-centered approach. This case highlights the importance of tailoring treatment strategies to individual patient needs and balancing effective lesion management with the preservation of quality of life.

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