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Evaluation Quality of YouTube Videos About Post Core Restorations

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Abstract

Background: The aim of this study is to evaluate the 'post core 'videos on YouTube.
Materials and Methods: YouTube videos were searched with the world 'post core ' and first 50 videos were examined. The language is not English and Turkish videos and insufficient videos were not included in the study. Criteria such as the definition of post core, indications, contraindications, information about the process, cost, expertise required, post cementation, crown preparation, measurement and describing the tools used were used when evaluating the content of the videos. Each criterion was scored between 0-3 by two researchers. According to this rating, the videos were separated into three different (low, medium, high) quality groups.
Results: 31 of the first 50 scanned videos were included in the study. When the distributions were evaluated according to the video uploaders, it was seen that the most videos were uploaded by medical personnel. (n=15, 48.38%) The distribution of videos according to quality groups was found to be 22.58% at a poor level, 74.19% at a moderate level and 3.22% at a high level of quality.
Conclusion: Most videos have been found to be moderately functional. Analysis according to the quality content, it was found that the significant difference in the crown preparation and GQS values of the videos. ($p<0.05$)

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Keywords: Internet, post core, social media, video.

Introduction

In dentistry, in the restoration of the crown part of the tooth that has lost a large part of the crown, root canal support is provided to the restoration with post-core materials (1,2).

Post-core restorations consist of two main parts. It consists of a canal post placed at least 2/3 of the length of the root canal and a core substructure supported by this structure. The core and post merge and form a truncated tooth shape is created. A retantion area is created for permanent restoration (3). Patient education and motivation are very important in dental treatments. As in all treatments, physicians make a lot of effort to inform patients and involve them in the treatment during post core treatment. The information given is usually not properly understood by the patient (4). Then patients try to access this information by using various internet tools. With the Covid pandemic, there has been an increase in the rate of online access to information by the society(5). Getting information about health online has become increasingly popular and YouTube has become almost the first source of reference in this regard. According to Alexa.com, which conducts various statistical research on social media use, YouTube is the second most visited website worldwide, and the fact that it has become one of the most popular mass media of the last decade has attracted great interest from the academic world (6). In addition, the usefulness of websites in conveying health- related information to patients has been proven by various studies (7,8).

However, in this platform where video sharing is facilitated and videos are not produced according to any standard, the accuracy of the information is questionable (9). Easy access to information on social media may lead to some dangers. Some content that provides information about various diseases or shares patient experiences may lead people to alternative treatment options. Therefore, the usefulness of videos is being examined by researchers. The aim of this study was to evaluate the

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content of relevant videos in English and Turkish by typing 'post core 'into the search engine on YouTube.

Materials and Methods

Data Collection Instruments

In order to find Turkish and English videos about post core on YouTube, a search was conducted on January 6,2023 by typing 'post core'in the search bar without using any of the search filters such as number of views, upload date and without changing the default settings. For each video the link, video duration, number of views and the name of the channel on which the video was broadcast were recorded. Since publicly available data were used in the study, ethics committee approval was not applied.

The first 50 videos accessed by two researchers were evaluated. Some criteria were used to evaluate the video content. These criteria were determined according to the criteria in previous studies (9) and important stages of the treatment. Accordingly, the videos were evaluated in terms of definition of post core, indications, contraindications, information about the procedure, cost, need for expertise, post cementation stage, crown preparation, measurement and instruments used. Each criterion was scored between 0 and 3 by the observers. The definitions in this scoring are.

'0: no information or incorrect information, 1: insufficient information,2: sufficient information and 3:detailed information'. The videos were categorized into groups according to the upload sources as uploads by health personnel and institutions, television channels, new agencies, individuals and other users. Videos whose narrative language was not in English or Turkish, videos with more than half (more than five) of the criteria zero, repetitive videos ,videos that were not suitable in terms of content and advertising videos were excluded from the evaluation.(19 videos) The length of the video durations varied between 1 and 44 minutes and the number of views varied between 2800 and 999100.

The null hypothesis of this study is that there is no difference in the evaluation criteria of the post core videos that can be watched on YouTube in terms of uploader source and usefulness level.

Data Analysis

The data obtained in this study were analyzed with SPSS 21 program. Since the data were not normally distributed, Kruskal Wallis H Test was used for comparisons between three or more groups. The relationship between categorical data was analyzed by Chi-Square analysis. Spearman -correlation analysis was used for the relationship between variables. The agreement between two observation scores was examined by 'intraclass' correlation. Descriptive statistical method was used to evaluate the study data. The significance level was set at 0.05.

Results

The relationship between the usefulness groups and the scoring values of the evaluation criteria was analyzed using the Kruskall Wallis H test (Table 1).

Table 1. Scoring distribution according to evaluation criteria and usefulness level

		Group					Kruskall Wallis H Test		
		n	Average	Median	Minimum	Maximum	ss	Rank Avg.	H	p
Observer 1 Points	1=Health Institution	7	1.57	1.00	1.00	3.00	.79	14.64	0.235	0.889
	2=Healthcare Personnel	15	1.73	2.00	0.00	3.00	1.10	16.27		
	3=Other User	9	1.78	2.00	1.00	3.00	.83	16.61		
	Total	31	1.71	2.00	0.00	3.00	.94			
Observer 2 Points	1=Health Institution	7	1.29	2.00	0.00	3.00	1.25	14,14	0.423	0.809
	2=Healthcare Personnel	15	1.60	1.00	0.00	3.00	1.30	16.73		
	3=Other User	9	1.56	2.00	0.00	3.00	1.13	16.22		
	Total	31	1.52	2.00	0.00	3.00	1.21			

INDICATION1	1=Health Institution	7	1.29	1.00	0.00	2.00	.76	14.86	0.209	0.901
	2=Healthcare Personnel	15	1.47	1.00	0.00	3.00	.83	16.07		
	3=Other User	9	1.44	2.00	0.00	2.00	.73	16.78		
	Total	31	1.42	1.00	0.00	3.00	.76			
INDICATION2	1=Health Institution	7	.86	1.00	0.00	2.00	.90	12.29	1,677	0.432
	2=Healthcare Personnel	15	1.40	2.00	0.00	3.00	1.06	16.93		
	3=Other User	9	1.44	2.00	0.00	3.00	1.01	17.33		
	Total	31	1.29	1.00	0.00	3.00	1.01			
CONTRAINDICATION	1=Health Institution	7	.29	0.00	0.00	2.00	.76	16.43	0.082	0.96
	2=Healthcare Personnel	15	.13	0.00	0.00	1.00	.35	16.00		
	3=Other User	9	,11th	0.00	0.00	1.00	.33	15.67		
	Total	31	.16	0.00	0.00	2.00	.45			
INFORMATION ABOUT THE TRANSACTION1	1=Health Institution	7	1.86	2.00	0.00	3.00	.90	14.93	1,755	0.416
	2=Healthcare Personnel	15	2.20	2.00	1.00	3.00	.56	17.80		
	3=Other User	9	1.89	2.00	1.00	3.00	.60	13.83		
	Total	31	2.03	2.00	0.00	3.00	.66			
INFORMATION ABOUT THE TRANSACTION2	1=Health Institution	7	1.29	1.00	0.00	3.00	1.11	11.57	3,075	0.215
	2=Healthcare Personnel	15	2.07	2.00	1.00	3.00	.80	18.40		
	3=Other User	9	1.78	2.00	1.00	3.00	.67	15.44		
	Total	31	1.81	2.00	0.00	3.00	.87			

		Group						Kruskall Wallis H Test	
		n	Average	Median	Minimum	Maximum	ss	Rank Avg.	H	p
POST CEMENTATION1	1=Health Institution	7	1.43	1.00	0.00	3.00	1.27	12.57	1,442	0.486
	2=Healthcare Personnel	15	2.07	2.00	0.00	3.00	.88	16.77		
	3=Other User	9	2.00	3.00	0.00	3.00	1.32	17.39		
	Total	31	1.90	2.00	0.00	3.00	1.11			
POST CEMENTATION2	1=Health Institution	7	.86	0.00	0.00	3.00	1.21	9.86	4,578	0.101
	2=Healthcare Personnel	15	2.13	2.00	0.00	3.00	.92	18.03		
	3=Other User	9	1.89	3.00	0.00	3.00	1.45	17.39		
	Total	31	1.77	2.00	0.00	3.00	1.23			
CROWN PREPARATION1	1=Health Institution	7	1.43	1.00	0.00	3.00	1.13	16.93	2,403	0.301
	2=Healthcare	1	1.47	1.00	0.00	3.00	.99	17.73		

	Personnel	5								
	3=Other User	9	.89	1.00	0.00	3.00	.93	12.39		
	Total	31	1.29	1.00	0.00	3.00	1.01			
CROWN PREPARATION2	1=Health Institution	7	1.14	1.00	1.00	2.00	.38	16.50	0.641	0.726
	2=Healthcare Personnel	15	1.27	1.00	0.00	3.00	.96	16.90		
	3=Other User	9	1.00	1.00	0.00	3.00	1.12	14,11		
	Total	31	1.16	1.00	0.00	3.00	.90			
IMPRESSION1	1=Health Institution	7	.14	0.00	0.00	1.00	.38	15.00	1,011	0.603
	2=Healthcare Personnel	15	.47	0.00	0.00	3.00	.92	17,17		
	3=Other User	9	.22	0.00	0.00	2.00	.67	14.83		
	Total	31	.32	0.00	0.00	3.00	.75			
IMPRESSION2	1=Health Institution	7	.43	0.00	0.00	2.00	.79	17.36	0.642	0.725
	2=Healthcare Personnel	15	.33	0.00	0.00	3.00	.82	16.07		
	3=Other User	9	.22	0.00	0.00	2.00	.67	14.83		
	Total	31	.32	0.00	0.00	3.00	.75			
TOOLS USED1	1=Health Institution	7	1.86	2.00	1.00	3.00	.69	14.64	1,906	0.386
	2=Healthcare Personnel	15	2.13	2.00	1.00	3.00	.64	18.03		
	3=Other User	9	1.78	2.00	1.00	3.00	.67	13.67		
	Total	31	1.97	2.00	1.00	3.00	.66			
TOOLS USED2	1=Health Institution	7	1.29	1.00	0.00	3.00	.95	13.07	4,373	0.112
	2=Healthcare Personnel	15	1.93	2.00	1.00	3.00	.80	19.33		
	3=Other User	9	1.22	1.00	0.00	3.00	.97	12.72		
	Total	31	1.58	1.00	0.00	3.00	.92			
Observer 1 Total Points	1=Health Institution	7	9.86	10.00	7.00	12.00	1.86	14.00	0.898	0.638
	2=Healthcare Personnel	15	11.67	10.00	8.00	20.00	3.70	17.53		
	3=Other User	9	10,11	10.00	6.00	14.00	2.32	15.00		
	Total	31	10.81	10.00	6.00	20.00	3.04			
Observer 2 Total Score	1=Health Institution	7	7.14	8.00	2.00	11.00	3.53	11.07	3,429	0.18
	2=Healthcare Personnel	15	10.73	10.00	5.00	19.00	3.75	18.67		
	3=Other User	9	9,11	8.00	4.00	13.00	3.02	15.39		
	Total	31	9.45	9.00	2.00	19.00	3.69			

In the distrubition of the videos according to the uploading sources, it was determined that they were mostly uploaded by healthcare personnel (%48.4). There were no videos uploaded by television channels and news agencies.

When the distribution of the videos according to their level of usefulness was analyzed, it was determined that those with low level of usefulness were the most (%45.2) and those with high level of usefulness were the least (%19.4) (Table 2).

Table 2. Distribution of video demographic characteristics by source of attribution and usefulness group

		n	%
Group	Health Institution	7	22.6
	Health personnel	15	48.4
	Other User	9	29.0
	Total	31	100.0
GQS	poor quality	14	45.2
	Generally poor quality	11th	35.5
	Moderate+Good quality	6	19.4
	Total	31	100.0

There was a significant difference between the groups in terms of 'post cementation' and 'crown preparation' values ($p<0.05$). The mentioned criteria were higher in the 'generally poor quality' and 'moderate +good quality' video groups, while the 'poor quality 'group showed significantly lower values. This groups also showed significantly lower values for 'number of views' ($p<0.05$).

When evaluated in terms of 'video duration' values, a significant difference is observed ($p<0.05$). 'Video duration' values of those with 'generally poor quality' group are significantly lower than those with 'poor quality' and 'moderate + good quality' group.

When the uploader groups and the number of views, video duration, year of publication, and number of likes, number of comments and ratings of the videos are analyzed, there is no significant difference between the groups. (Table 3)

Table 3. Statistical distribution between upload sources and video information

		Group						Kruskall Wallis H Test	
		n	Average	Median	Minimum	Maximum	ss	Rank Avg.	H	p
VIEWS	1=Health Institution	7	151542.86	115000.00	2800.00	364000.00	146605.58	18.71	1,348	0.51
	2=Healthcare Personnel	15	140200.00	67000.00	4300.00	991000.00	246394.89	16.27		
	3=Other User	9	85233.33	33000.00	4700.00	370000.00	118799.92	13.44		
	Total	31	126803.23	63000.00	2800.00	991000.00	192729.66			
VIDEO DURATION	1=Health Institution	7	8.00	2.00	1.00	34.00	11.96	11.86	2,406	0.3
	2=Healthcare Personnel	15	10.80	7.00	1.00	44.00	11,12	18.23		
	3=Other User	9	6.22	5.00	3.00	17.00	4.49	15.50		
	Total	31	8.84	5.00	1.00	44.00	9.79			
Year	1=Health Institution	7	6.43	7.00	2.00	11.00	3.82	22,21	4,583	0.101
	2=Healthcare Personnel	15	3.13	2.00	1.00	10.00	2.70	13.43		
	3=Other User	9	3.87	4.00	.33	8.00	2.86	15.44		
	Total	31	4.09	3.00	.33	11.00	3.20			
NUMBER OF LIKES	1=Health Institution	6	1153.67	475.00	19.00	3900.00	1506.90	13.08	1.37	0.504
	2=Healthcare Personnel	15	1377.00	927.00	73.00	6000.00	1579.64	16,17		

	3=Other User	7	721.14	335.00	37.00	2300.00	802.45	12,14		
	Total	28	1165.18	651.00	19.00	6000.00	1390.51			
NUMBER OF COMMENTS	1=Health Institution	6	27.83	24.00	0.00	71.00	27,19	12.08	3,113	0.211
	2=Healthcare Personnel	15	76.20	47.00	2.00	250.00	83.66	17.03		
	3=Other User	7	21.71	11.00	0.00	55.00	21,20	11,14		
	Total	28	52.21	28.00	0.00	250.00	67.52			
VIEWING RATE	1=Health Institution	7	165.69	40.09	3.83	713.72	263.95	14.71	0.657	0.72
	2=Healthcare Personnel	15	254.28	68.49	10.54	2715.00	683.54	17.37		
	3=Other User	9	63.56	72.22	4.29	126.71	45.80	14.72		
	Total	31	178.91	56.16	3.83	2715.00	489.29			

The relationship between the total scores of the observers and the number of views, duration, likes and comments of the videos were analyzed. There is a significant and positive relationship between ‘observer 1 total score’ and ‘number of comment ‘values($r=0.440$; $p<0.05$). As the ‘observer 1 total score ‘increases, the ‘number of comments’ values also increase. There is a significant and positive relationship between ‘observer 2 total score’ and ‘video duration’ values. ($r=0.635$; $p<0.05$) As the ‘observer 2 total score’ increases, the ‘video duration’ values also increase.

There is no significant difference between quality groups and uploader groups. ($p>0.05$)(Table 4) Most of the uploaded videos were found to be of low quality. When the distribution of uploaders in this group is examined, it is seen that most videos were uploaded by healthcare personnel. Good quality videos were the lowest in number. Medium quality videos were also found to be uploaded mostly by health personnel. (Table 4)

Table 4. Statistical relationship between loader groups and usefulness groups

		GQS								Chi-Square Analysis	
		poor quality		Generally poor quality		Moderate+Good quality		Total			
		n	%	n	%	n	%	n	%	Chi-Square	p
Group	Health Institution	3	42.9	4	57.1	0	0.0	7	100.0	*	0.452
	Health personnel	7	46.7	5	33.3	3	20.0	15	100.0		
	Other User	4	44.4	2	22.2	3	33.3	9	100.0		
	Total	14	45.2	11th	35.5	6	19.4	31	100.0		

The agreement between the observers was examined with ‘ıntraclass correlation’. There is a highly significant relationship ($r=0.894$) between ‘observer 1 score’ and ‘observer 2 score’ values. ($p<0.05$)

Discussion

While healthcare professionals can access scientific evidence to enhance their understanding, patients often rely on social media platforms for health information. Audio-visual sources like YouTube positively impact patients seeking health information freely (28). In the literature, there are many YouTube video analysis studies on medical and dental health-related topics (10-21), but there is no study on post core restorations.

Patients need for additional information about post core restorations, which are frequently applied by dentists, leads them to use the internet.

Since technology and the internet have become an indispensable part of our daily lives, providing access to quality videos on digital platform is important in terms of patient education (12,13,15,16). Although patients are informed with videos, this information is sometimes not sufficient or has the effect of increasing the patient’s anxiety (16). According to the results of YouTube video analysis studies related to dental topics conducted to date, videos have exhibited inconsistency in quality. In studies

conducted on different topics, some researchers reported that the information content quality of the videos was sufficient (12,13), while others reported that the information content of the videos was insufficient (14,16,18,19). According to the results of the content analysis of the videos related to post core, most of the videos showed a low level of usefulness and most of the videos were published by healthcare personnel as the uploader group.

When the findings were evaluated, it was revealed that the null hypothesis of the study was rejected and that there were statistically significant differences between the evaluation criteria in terms of the level of usefulness and the predictor source. In another study in which implant related videos were evaluated, it was determined that videos were mostly uploaded by TV channels or news agencies(%48) in the distribution according to upload sources(25). In this study, most videos were uploaded by healthcare personnel(%48.4) and then by other users(%29). There was no significant difference between quality groups and user groups.

In one study, the rate of YouTube users not watching more than the first 60 results was found to be %95(21).For this reason, it was found appropriate to evaluate the first 50 videos accessed in this study. It is known that most of the uploaded videos are in English (19,25). For this reason, the analysis was made from English and Turkish videos.

YouTube users watch the videos they access without evaluating or distinguishing the content of the videos (29). In a study, it was concluded that 86% of internet users trust the accuracy of the information they access via the internet in the field of health, and 64% of them believe that this information affects their choice of treatment (30).

Some researchers have shown that the public is less likely to watch high quality videos uploaded by healthcare professionals (25), but in this study, the number of views of low usefulness videos was lower than other usefulness groups.

At the same time, when evaluated in terms of containing information about the process, it was seen that poor quality videos received significantly lower values than other groups. In our study, it was seen that information about post core, post cementation and crown preparation were the most mentioned criteria in the videos.

In another study, it was stated that the viewership rates of high quality videos were lower than those of low quality videos and it was necessary to increase the attractiveness of these videos(28). As strategies to increase the viewership rates of published videos, it may be an alternative that the person presenting the videos is famous and the video content contains understandable and entertaining information.

Considering the limitations of this study, it is the lack of definitive criteria for evaluating video content in internet-based studies (31).

Therefore, the criteria were determined using other similar studies. Additionally, since internet information was used in the study, it should be taken into consideration that the data obtained may vary over time.

Conclusion

In this study, the information level and quality of YouTube videos about post core were found to be mostly inadequate. Since the uploaders of most videos are healthcare personnel on this subject, it was found appropriate for healthcare personnel and institution to increase the level of knowledge and sensitivity of the society by uploading more useful and high-quality videos about post core.

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There is no conflict of interest in this study.

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Identification of the main risk factors for occlusal disorders.

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Abstract

Background: Violations of occlusive relationships are an urgent problem in dental practice due to the high prevalence, complexity of diagnosis and treatment, as well as the connection with common somatic diseases. These pathologies reduce the quality of life of patients and complicate the process of medical rehabilitation. Prevention aimed at early detection of risk factors is especially important.The purpose of this study is to identify the main risk factors for the development of disorders of occlusive relationships.

Materials and methods: A randomized controlled trial was conducted with 120 patients aged 18 to 44 years. The assessment included clinical examination, cone beam computed tomography (CBCT), electromyography (EMG), ultrasound examination of the temporomandibular joint (TMJ) and occlusion analysis. Methods of 3D modeling and analysis of the symmetry of the skull were used, as well as the Hamburg test to assess the functional state of the TMJ. The results of the clinical examination were subjected to a hierarchical cluster analysis.

Results: Clinical and functional examination revealed three key components of occlusive disorders: muscle, joint and jaw complexes. The main factors, such as the size of the articular gap, electromyography of the masticatory muscles and the area of occlusal contacts, turned out to be the most significant, covering 68% of all information. The addition of face symmetry and ANB angle parameters increased the classification accuracy to 85%. The study confirmed a high correlation between the functional features of the temporomandibular joint (TMJ), the muscle complex and bone-dental factors, which emphasizes the need for a preventive approach in early diagnosis.

Conclusion: The study identified key risk factors for the development of occlusive disorders through a comprehensive analysis of clinical and functional parameters. Cluster analysis revealed three primary components—muscle, joint, and jaw complexes—accounting for most occlusal risk factors. The use of advanced technologies, such as 3D modeling and artificial intelligence, enabled detailed assessment of occlusal relationships and helped improve diagnostic accuracy. The study results demonstrate the importance of early identification significantly enhancing the effectiveness of both prevention and treatment of occlusal disorders.

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Keywords: Violations of occlusive relationships, risk factors, correlation relationship.

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Introduction

Currently, it has been revealed that violations of occlusive relationships are an urgent problem in practical dentistry [1]. This is due to the high prevalence of pathology, the complexity of therapeutic and diagnostic measures, as well as a significant role in the development and progression of general somatic diseases [2].

The presence of violations of occlusive relationships in patients leads to a decrease in the quality of life, complexity and duration of medical rehabilitation, and requires significant economic costs [3].

The interest of many scientists is devoted to the clinical and diagnostic picture of disorders of occlusive relationships. However, it is necessary to note the importance of preventive orientation, which is a priority in the formation of health protection principles [4,5,6].

In addition, the prevalence of occlusion disorders in young people has increased significantly in recent years, which can be explained by the early formation of lesions of the stomatognathic system as a result of the combined effects of risk factors for the development of pathology. This takes on the character of a socially significant health problem, as it significantly reduces the effectiveness of long-term dental rehabilitation and the quality of life of patients [7].

An urgent direction to reduce the prevalence of violations of occlusive relationships is an individual preventive orientation. This strategy is based on the principle of early detection of risk factors for the development of pathology and determining their degree of influence. This direction will allow us to form a comprehensive diagnostic approach to the management of patients with disorders of occlusive relationships [8,9].

An urgent issue in the development of the scientific orientation of violations of occlusive relationships is compliance with the prenosological principle, which provides for the development and justification of diagnostic methods for early detection of the disease at the upper limit of the norm, including in the absence of symptoms, subclinical picture [10].

The aim of the study was to identify the most significant risk factors for the development of disorders of occlusive relationships in dental patients.

Materials and methods

To achieve this goal, a randomized controlled trial of 120 patients was conducted as part of the grant requirements. The work was carried out on the basis of the Department of Dentistry of the Institute of Continuing Medical and Pharmaceutical Education of the Federal State Budgetary educational institution "Volgograd State Medical University" of the Ministry of Health of the Russian Federation (FGBOU VO VolgSMU of the Ministry of Health of the Russian Federation). The selection of subjects was carried out during the examination of patients on the basis of the state autonomous healthcare institution "Volgograd Regional Clinical Dental Clinic". The study was approved by the Ethics Committee of Volgograd State Medical University (No. 089, 15/04/2024).

Inclusion criteria: Availability of signed voluntary informed consent, Age from 18 to 44 years old, Criteria for non-inclusion, Interpretation of the Hamburg test results in the range from 0 to 1 points, Age less than 18 or more than 44 years, Lack of informed consent from patients, Socially vulnerable groups of the population, Acute infectious diseases and decompensated forms of chronic somatic diseases, Inflammatory periodontal diseases in the acute stage, The presence of a mental illness in the patient, Oncological diseases, Exclusion criteria, The patient's refusal to participate during the study.

As part of the project, a database of occlusive disorders was created based on the examination of 120 patients at risk of developing occlusive disorders or with occlusive disorders of various etiologies and severity based on the short Hamburg test. Basic and additional methods were included in the clinical examination scheme. The main ones included a survey to clarify the nature of complaints, to clarify the development of the disease, an external examination of the maxillofacial region, an examination of the oral cavity and dentition, probing of hard tissues of teeth, palpation of soft tissues, chewing muscles and temporomandibular joint (TMJ).

The additional examination scheme included cone beam computed tomography (CBCT) to visualize the bone structures of the stomatognathic system, ultrasound examination of the TMJ, registration of the ratio of dentition using an occlusogram, as well as electromyography (EMG) of the masticatory muscles.

The method of calculating the symmetry of a person's face was used to analyze bone structures. For these purposes, the data of the CBCT format.dcm (the standard format for presenting 3D X-ray images) was transformed from a set of voxels into a polygonal 3D model in the .stl format using the Invesalius 3.1.1 program. When translating from the data, we were guided by the principle of maximum preservation of bone structures and reduction of noise present on the CBCT data. The selection was made in a manual format. To work with bone landmarks, the following were

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necessarily segmented: lower jaw, zygomatic bones, upper jaws, frontal bone, temporal bones.

To analyze the symmetry on each 3d model, model processing was performed, which includes the search and detection of the main craniometric points: Po – porion (The uppermost point of the external auditory canal), Or – orbital (The lowest point of the edge of the orbit), An - Antegonial notch (The highest point of the antegonial notch of the mandible). Planes were formed based on the selected points: Plane 1 (Frankfurt horizontal) – Or – Po, Plane 2 - An – Or. Thanks to the obtained points and planes, it turned out to form 5 main fragments for analyzing the symmetry of the skull: the upper jaw, the zygomatic bone, the body of the lower jaw, the branch of the lower jaw. For further analysis of articular signs, at this stage, the following were additionally identified: articular processes of the mandible and articular surfaces of the temporal bone.

For further symmetry analysis, mirrored 3D models in the sagittal plane were additionally formed. The resulting copies were superimposed on the original models in the HP 3D Scan program using the maximum matching algorithm, and then deviations in the distances between the original model and its mirrored counterpart in mm were calculated. Based on this information, a color map was formed for better visualization.

For the analysis of the muscular component, the registration of movements of the lower jaw was carried out according to the author's method (patent RU 2817471 C1) and the registration of biopotentials of the masticatory muscles (actually masticatory and temporal).

EMG activity of the masticatory and temporal muscles proper was recorded simultaneously on both sides. In order to remove biopotentials, cutaneous bipolar round electrodes were used, which were fixed at the points of greatest muscle tension, determined by palpation. The amplitude was recorded in MV EMG at rest, maximum fisure-tubercle contact, floating and left laterotrusions.

To assess the state of the TMJ, an ultrasound examination of the TMJ was used with registration of the main parameters of the size of the articular gap using the LOGICSCAN 128 EXT device, as well as a short Hamburg test. Objective methods of its assessment were used by digitizing each of its components to exclude subjective assessment. This method is considered a method of preliminary examination of the TMJ function and includes six questions: Is the mouth opening asymmetrical, Is the opening of the mouth sharply limited or too large, Are intraarticular noises detected, Is the occlusive sound asynchronous, Is palpation of the chewing muscles painful, Is eccentric occlusion of teeth traumatic.

After receiving the test results (from 0 to 6 points, 1 point for a positive answer to each of the questions), it is possible to assess the function of the TMJ: the functional norm is 0-1 points, the risk of dysfunction (risk group) is 2 points, TMJ dysfunction is 3-6 points.

To analyze the teeth and dentition, they were digitized by scanning the jaws and occlusion keys using a 3D scanner. Obtaining digital occlusion registers using the OccluSense system for the diagnosis of occlusion. The obtained digital models were combined with data obtained during the analysis of the kinematics of the mandible to form the results of the analysis of the patient's occlusion: localization of the first contact, distribution of balance in the maximum interlobular position (MMP), the presence of supracontacts and the area of their occurrence, the time spent to achieve MMP, the time of separation on the working side during laterotrusion movement.

After receiving the data from the clinical and functional examination of patients, an exploratory cluster analysis was conducted to determine whether a group of 120 patients contained natural subgroups of similar patients. 40 quantitative indicators were selected ("Is mouth opening asymmetric?", "Is mouth opening sharply limited or too large?", "Are intraarticular noises detected?", "Is occlusive sound asynchronous?", "Is palpation of the chewing muscles painful (Temporal (right, left), Chewing (right, left))?", "Is eccentric occlusion of teeth traumatic?", electromyography at rest (mkV): (10, 11, 12, 13) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left, electromyography in the state of "maximum compression" (mkV): (14, 15, 16, 17) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left, electromyography in the state of "protrusion" (mkV): (18, 19, 20, 21) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left, electromyography in the state of "laterotrusion right" (mkV): (22, 23, 24, 25) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left, electromyography in the state of "laterotrusion left" (mkV): (26, 27, 28, 29) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, The temporal

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muscle on the left, joint gap size (mm): (30, 31, 32, 33, 34, 35) Anterior right, Upper right, Posterior right, Anterior left, Upper left, Posterior left, facial symmetry (mm), angle ANB (°), First occlusal contact (Premolar, Molar), total the area of occlusal contacts), the values of which are available in all patients, a standardization procedure was performed and then a hierarchical cluster analysis of patients by the Word method with the choice of a Euclidean metric was carried out. The use of factor analysis made it possible to conduct an analysis of the main components (GC), designed to identify the structure of the relationship of indicators and verify the uniformity of the clinical contingent.

The statistical analysis was carried out using Microsoft Excel 2016 and Statistica 13.0 programs.

Results

Based on the results of the clinical and functional examination of patients, a wide base of risk factors for the development of disorders of occlusive relationships was formed, we found the results of the relationship of these clinical symptoms, and combined effects were revealed. In addition, data were obtained on the main and secondary risk factors for the development of the pathology under study. The average age of the examined patients was 29.4±3.22 years.

As a result of the examination of patients, quantitative indicators reflecting the state of the stomatognathic system for the identified five main components were obtained (Table 1).

The results of the distribution of persons based on the Hamburg test are presented in Table 2.

Table 1. Clinical and functional quantitative characteristics of the main components of the examined patients.

The parameter of the survey of the main components	Quantitative survey results
Symmetry of the face (("ZR-AGR"-"ZL-AGL") / ("ZR-AGR"+"ZL-AGL")) (mm)	3,32±1,08
ANB Angle (°)	2,34±2,09
The size of the articular gap for TMJ (mm)	
Front right	3,19±1,09
Top right	2,69±0,85
Rear right	2,24±0,7
Front left	3,3±1,04
Top left	1,95±0,77
Rear left	2,41±0,77
Resting electromyography (mkV)	
of the masticatory muscle on the right	47,23±12,66
Chewing muscle on the left	50,87±16,25
The temporal muscle on the right	56±12,18
The temporal muscle on the left	49,18±13,29
Mouth opening value mm	54,52±2,81
Total area of occlusal contacts (mm2)	131,08±40,74

Table 2. The results of the Hamburg test in patients.

Parameter	Number of people, n (%)
Risk of dysfunction (2 points)	45 (37,5 %)
The presence of dysfunction (3-6 points)	85 (62,5 %)

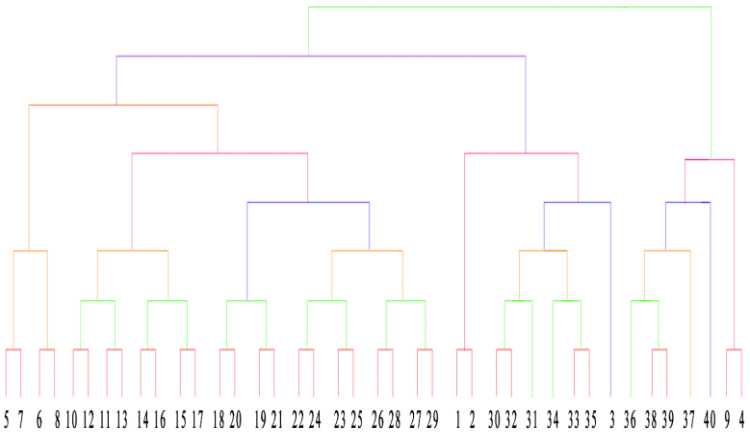

Figure 1. The scheme of the result of the cluster analysis of the main components of the risk of developing disorders of occlusive relationships.
Note: (1) "Is the opening of the mouth asymmetrical?", (2) "Is the opening of the mouth sharply limited or too

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large?", (3) "Are intraarticular noises detected?", (4) "Is the occlusive sound asynchronous?", (5,6) "Is palpation of the masticatory muscles painful (Temporal (right, left), (7,8) Chewing (right, left))?", (9) "Is eccentric occlusion of teeth traumatic?".

Electromyography at rest (mkV): (10, 11, 12, 13) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left.

Electromyography in the state of "maximum compression" (mkV): (14, 15, 16, 17) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left.

Electromyography in the "protrusion" state (mkV): (18, 19, 20, 21) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left.

Electromyography in the state of "laterotrusion right" (mkV): (22, 23, 24, 25) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left.

Electromyography in the state of "laterotrusion left" (mkV): (26, 27, 28, 29) Masticatory muscle on the right, Masticatory muscle on the left, Temporal muscle on the right, Temporal muscle on the left.

Joint Gap size (mm): (30, 31, 32, 33, 34, 35) Front Right, Top Right, Rear Right, Front Left, Top Left, Rear Left.

(36) Facial Symmetry (mm), (37) ANB Angle (°)

(38.39) First contact (Premolar, Molar)

(40) The total area of occlusal contacts.

Discussion

The results of our study emphasize the importance of preventive orientation in identifying risk factors for the development of disorders of occlusive relationships. Interpretation of the results of the Hamburg test shows that a significant part of the examined patients demonstrate pronounced dysfunctions of the musculoskeletal relationship. The average score of the Hamburg test was 3.79±0.73, which indicates the presence of pronounced problems in the field of TMJ.

The conducted exploratory analysis using cluster analysis and principal component analysis (GC) allowed us to identify three main clusters that reflect the structure of relationships between various factors:

The muscle complex covers 60% of all analyzed factors and includes indicators related to electromyography of the masticatory muscles, which indicate the functional state of the muscular apparatus.

The joint complex made up 22.5% of the main components. It includes data on the state of the articular gap, which is important for understanding the mechanics of movement of the mandible and its interaction with the temporal bone.

The jaw complex covers 17.5% of all factors and includes both dental and bone signs, which confirms the need for an integrated approach to the diagnosis and treatment of occlusion disorders.

The results also showed that the parameters related to the size of the articular gap, electromyography of the masticatory muscles and the total area of occlusal contacts are the most informative characteristics, including 68% of the information of all the main components. In addition, the addition of parameters such as facial symmetry and ANB angle revealed statistically significant differences ($p<0.001$) in the classification of patients, increasing the informative value of the analysis to 85%.

The high degree of positive correlation between the functional features of the TMJ and muscle, bone and dental occlusion factors confirms the need to integrate various approaches into the diagnosis and prevention of disorders of occlusive relationships. Thus, the results of our study emphasize the relevance of developing an integrated approach to the management of patients with occlusion disorders, which will not only improve the quality of diagnosis, but also increase the effectiveness of therapeutic measures, which, in turn, can contribute to improving the quality of life of patients and reducing the economic costs of medical rehabilitation.

Conclusion

Timely, accurate and informative identification of risk factors for the development of disorders of occlusive relationships is an urgent task of modern dentistry, which can be solved using various parameters of artificial intelligence. The basis for this is the conducted cluster analysis to find and identify hidden relationships, as well as grouped and dependent on each other clinical and functional parameters of the stomatognathic system. The results obtained will improve the effectiveness of diagnosis and treatment of patients with disorders of occlusive relationships, as well as the quality of dental care provided.

Statement of conflict of interest

The authors declare that there is no conflict of interest.

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Contribution of the authors:
V.V.S. - general guidance, final approval for the publication of the manuscript.
E.N.Y. - data collection, analysis and interpretation of the results
Y.A.M. - development of the concept and editing of the text, final approval for the publication of the manuscript.
D.Y.D. – collection, analysis and processing of the material, writing the text, checking critical intellectual content.
L.M.G. - collection, analysis and processing of material, writing text, checking critical intellectual content;
I.Y. – collection, analysis and processing of material, writing text, checking critical intellectual content;
The authors confirm the compliance of their authorship with the international ICMJE criteria (all authors made a significant contribution to the development of the concept, preparation of the article, reviewed and approved the final version before publication).

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Root and Canal Anatomy of Maxillary and Mandibular Teeth in Rome Emparial

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Abstract

In recent years, root and canal anatomy has been studied in detail by endodontists to ensure successful endodontic treatment. Today, the evolutionary trend in human dentition is towards simplification, although there is no exact information on when this trend first emerged. This study aims to investigate the root and canal morphology of the Late Roman populations living 1800 years ago. Nine mandibular and six maxillary jaws with teeth were scanned using X Radius Trio 3D Cone beam computed tomography CBCT (Castellini, Bologna, Italy) at 90 kVp, 13–16 mA, 13x16, 13x10 FOV, 0.03 mm voxel size. Multiplanar reconstruction images were obtained using iRYS (Castellini) software. After this scan, one premolar tooth among 39 teeth in the maxilla was identified as Vertucci Class VII. In the mandibular, all of the canines were single rooted; one of them was identified as Vertucci Class III. Of the first molars, all were two-rooted; two of them were identified as Vertucci Class VII and one of them as Vertucci Class VIII. All of the ten mandibular second molars examined were two-rooted, and no type C canal configuration was found. The root canal anatomy of the 81 scanned teeth showed considerable similarity to the root canal morphology of today's societies.

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Keywords: Roman, mandibular, maxillary, morphology, canal.

1.Introduction

The morphological characteristics of teeth have been extensively studied by dentists, anthropologists and, to a lesser extent, forensic specialists to determine the biological connection between the past and the present and assess the possible consequences (1) Recently, with the development of dental imaging technologies, different studies on the root and canal morphology of permanent teeth have shown considerable differences (2,3). This suggests that root canal anatomies are more complex than the simple canals described by Hess and Zurcher in 1925. The heterogeneity and anatomy of the root canal system have been classified by many researchers(4,5) but these classifications have varied for different populations worldwide. The complex anatomy of the root canal system and its different variations may differentiate among populations worldwide (2). The exact etiology of these different variations and accessory canals is still poorly understood. In endodontic treatments, a thorough knowledge of the anatomy of the root canal system is necessary for successful treatment (6).

With the advantages in dental imaging technologies, anthropologic studies have gained importance in recent years. However, due to the limited anthropologic material, it has not been possible to conduct detailed studies on this subject. Therefore, there are very few studies on the anatomy of root canal systems in paleoanthropological studies (7,8). The limited studies in the anthropological literature and further studies will provide information about how root

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and canal morphology has changed from past societies to the present.

This study aims to compare the root canal anatomy of specimens thought to be from the II–IV century AD with current root canal anatomy after scanning with CBCT.

Materials and Method

This study was conducted with permission of the Ethics Committee of Harran University (HRÜ No. 24.16.04). The materials for this study originated from the Ancient Edessa rock tombs located in Kızılkoyun and Kale Eteği Necropolises in Grade II and III Archaeological Protected Areas in the Yeni Mahalle and Halepli Bahçe Neighborhood of Eyyübiye District of Şanlıurfa Province. The excavations were conducted by expert archaeologists working within the Provincial Directorate of Culture and Museums of the Şanlıurfa Governorship. Since the Kızılkoyun region has been used as a residential area up to today, the existing structures here were first expropriated and demolished. Then, the debris residues exposed here were removed from the environment. Rock grave chambers were opened using protective equipment, such as masks, overalls, visors and gloves, against infectious diseases and the risk of contamination. After the necessary examinations, the samples were numbered and stored in individually closed boxes as they were. Before the samples were scanned using CBCT, they were cleaned of soil and debris, again with complete protection against contamination and infectious diseases. Samples were scanned using X Radius Trio 3D CBCT (Castellini, Bologna, Italy) at 90 kVp, 13–16 mA, 13x16, 13x10 FOV, 0.03 mm voxel size. All scans were performed by specialized personnel using a special setup. Multiplanar reconstruction images were obtained using iRYS (Castellini Bologna, Italy) software.

2.Results

Eighty-one different teeth in nine mandibular and six maxillary jaws were scanned for this study using CBCT. The findings of the scanning showed that, of the 39 maxillary teeth, all the central incisor, lateral incisor and canine teeth had a single root and Vertucci Class I canal structure. Of the seven maxillary first premolars, one had a single root, five had two roots and one had three roots; four had a Vertucci Class IV root canal anatomy, two had a Class V and one a Class VII root canal anatomy. Of the seven maxillary second premolars, five were single-rooted and two were two-rooted; two had a Vertucci Class I root canal anatomy, two had a Class II, one a Class III and two a Class IV root canal anatomy (Fig. 1).

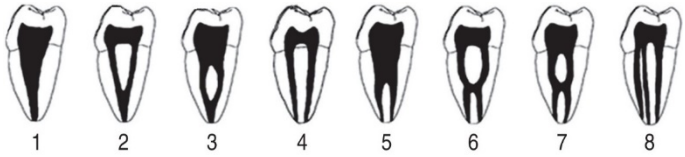

Figure 1. Vertucci classification of root canal configuration.

Examination of the eight maxillary first molars revealed that all of them had three roots and the distobuccal and palatal roots of these roots had a Vertucci Class I root canal anatomy. With respect to the mesiobuccal canal, two canals had a Vertucci Class 1 root canal anatomy, four had a Vertucci Class II and two a Vertucci Class IV root canal anatomy (Fig. 2).

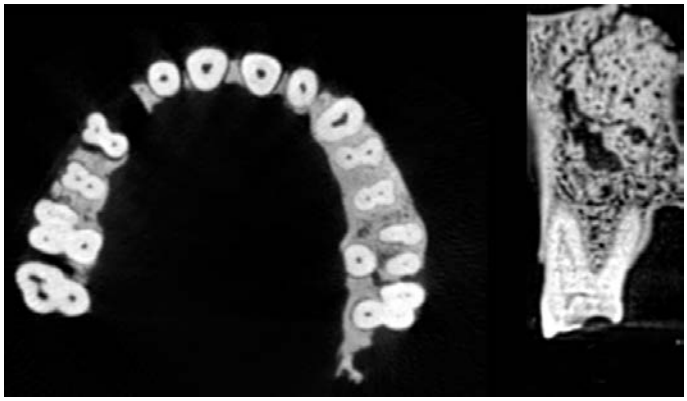

Figure 2. Cbct image of the maxillar first molar mesial canal with two canals.

Examination of six maxillary second molars revealed that all of them had three roots and the distobuccal and palatal roots of these roots had a Vertucci Class I root canal anatomy. The findings indicate that three of the mesiobuccal roots had a Vertucci class I, two a Class II and one a Class IV root canal anatomy.

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Of the 42 mandibular teeth, one mandibular lateral incisor was single rooted and the root canal anatomy had a Vertucci Class III root canal anatomy. All eight mandibular canines were single rooted; five of them had a Vertucci Class I, two a Class II and one a Class III root canal anatomy (Fig. 3.) Of the six mandibular first premolars evaluated, five were single rooted and one was two-rooted; five had a Vertucci Class I and one a Class IV root canal anatomy. Evaluation of the five mandibular second premolar teeth revealed that four of them were single-rooted and one was two-rooted; the root canal anatomy of four was Vertucci Class I and one of was Vertucci Class V.

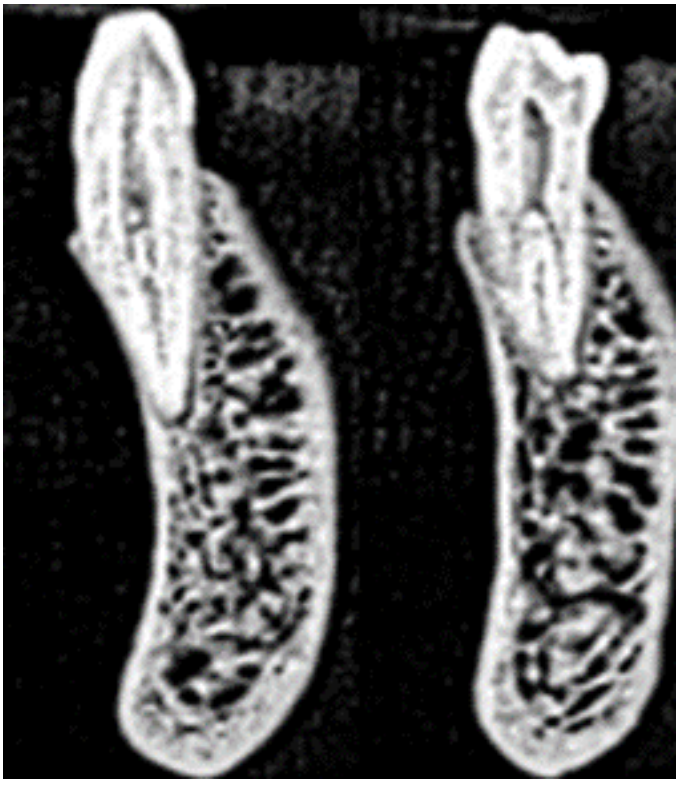

Figure 3. Cbct image of mandibular canine and premolar teeth.

All 12 mandibular first molars evaluated were revealed to have two roots. Of the mesial roots, eight were Vertucci Class IV, two were Vertucci Class VII, one was Vertucci Class VIII and one was not included in the classification [Fig. 4.]

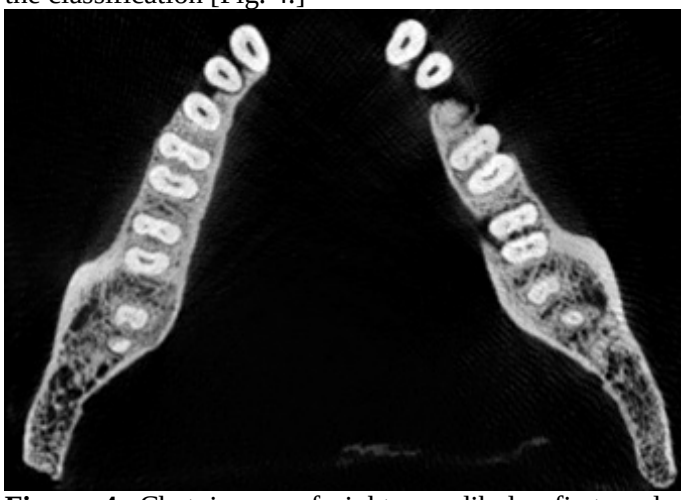

Figure 4. Cbct image of right mandibular first molar with midmesial canal

Of the distal roots, eight were Vertucci Class I, one was Vertucci Class IV and three were Vertucci Class V. Evaluation of the 10 mandibular second molars revealed that, all of them had two roots. One of the mesial roots had a Vertucci Class I, two a Vertucci Class II, five a Vertucci Class IV and two a Vertucci Class V root canal anatomy. Of the distal roots, six were Vertucci Class I, two were Vertucci Class II and two were Vertucci Class IV. The findings are summarized in (Table 1.)

Table 1. Vertucci classification of specimens, number of roots and root canals of the findings

Tooth Type	Number of Specimens	Number of Tooth Roots				Vertucci Classification								
		1	2	3	4	I	II	III	IV	V	VI	VII	VIII	Different
Maxillary Central Incisor	2	2				2								
Maxillary Lateral Incisor	2	2				2								
Maxillary Canine	7	7				7								
Mandibular Lateral Incisor	1	1						1						
Mandibular Canine	8	8				5	2	1						

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Maxillary First Premolar	7	5	2	1					4	2			1	
Maxillary Second Premolar	7	5	2			2	2	1	2					
Mandibular First Premolar	6	5	1			5			1					
Mandibular Second Premolar	5	4	1			4				1				
Maxillary First Molar	8			8										
Mesiobuccal						2	4		2					
Distobuccal						8								
Palatinal						8								
Maxillary Second Molar	6			6										
Mesiobuccal						3	2		1					
Distobuccal						6								
Palatinal						6								
Mandibular First Molar	12		12											
Mesial									8			2	1	1
Distal						8			1	3				
Mandibular Second Molar	10		10											
Mesial						1	2		5	2				
Distal						6	2		2					

3.Discussion

Root and canal morphologies vary from population to population and even within the same population (8,9). The role of genetics and racial variation may contribute to differences in the incidence of root number and canal number in human populations (10). Thus, the anatomical features of the root canal system should be carefully and thoroughly examined before root canal treatment. The success of nonsurgical root canal therapy depends on locating all canals and shaping, cleaning and filling the root canal system in three dimensions (11,12). Trope et al. found significant ethnic differences in their study on mandibular premolars, comparing African American and Caucasian patients in terms of both number of roots and number of canals. The incidence of two or more canals was 32.8% in African American patients compared to 13.7% in Caucasian patients (13). Root canal anatomy also varies within population groups. Sert et al., Çalışkan et al. found a prevalence of two or more canals (39.5% and 36%, respectively) in studies conducted among the Turkish population (14,15). Since our study was performed on skeletal specimens, this variable was not taken into consideration in our study. This is one of the limitations of our study.

The one lateral and eight canine mandibular anterior teeth examined in this study all had single roots. The results of this study indicate that the mandibular anterior teeth were Vertucci Class I (55.5%), Class II (22.2%) and Class III (22.2%). As in our study, Vertucci Class I is the most prevalent type in many studies evaluating root canal anatomy (16-18).

Mandibular first and second premolars are defined as single-rooted teeth with oval roots in cross-sections and developmental pits on the mesial and distal aspects of the root surfaces (19,20). However, rare variations with two, three and four roots have been reported in the literature (13,21). Of the 11 premolars examined, six were first and five second premolars. Five of the first premolars were single-rooted and one was

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two-rooted. Of the five second premolars, four were single-rooted and one was two-rooted. Llena et al. reported Vertucci Class I (78.1%), followed by Class V (12.3%), as the most common type of mandibular first premolar in the Spanish population (22). In our study, Vertucci Class I (83.3%) and Vertucci Class IV (16.7%) were observed for the first premolar. For the second premolar, Vertucci Class I (80%) and Vertucci Class V (20%) were observed. Liao Q et al., in a study conducted among a Chinese population, found that premolars of the Vertucci Class I were more prevalent, consistent with our study (3).

All 12 mandibular first molars we examined had two separate roots. The mesial roots were found to be Vertucci Class IV (66.66%), Vertucci Class VII (16.66%) and Vertucci Class VIII (8.33%). The distal roots were Vertucci Class I (66.66%), Vertucci Class V (25%) and Vertucci Class IV (8.33%). One tooth could not be included in any classification. Demirbuga et al. also found two completely separate roots for mandibular first molars, similar to our study (23). With regard to the mandibular second molars, all 10 primary teeth have two roots. The mesial roots were found to be Vertucci Class I (10%), Vertucci Class II (20%), Vertucci Class IV (50%) and Vertucci Class V (20%). The distal roots were 60% Vertucci Class I (60%), Vertucci Class II (20%) and Vertucci Class IV (20%). The fact that our study consists entirely of two-rooted teeth makes it different from many other studies (24,25). Another noteworthy point is the absence of a C-type canal configuration in our study. However, when we look at the literature, C-type canal configuration is found in many populations, even at low rates (24,25).

The maxillary central, lateral and canine teeth were classified as single-rooted and Vertucci Class I, which is similar to most of the current collections. The first premolars were found to be single-rooted (14.28%), two-rooted (71.42%) and three-rooted (14.28%). According to the Vertucci classification, Class IV (57.14%), Class V (28.57%) and Class VII (14.28%) were the most prevalent. Vertucci Class VII in first premolars is a rare classification, as it is today (26,27). With regard to the maxillary second premolars, one root (71.42%) and two roots (28.57%) were detected. One of the two-rooted teeth was Vertucci Class III (14, 28%), which is higher than the results of Kartal et al. (26). The remaining classification yielded similar results to the present. This difference in our study may be due to the limited number of specimens we examined. In addition, the first molars (100%) all had three roots. All of the distobuccal and palatal roots were Vertucci Class I, while the prevalence of MB2 canals in the mesiobuccal root (75%) is similar to that in many other studies (28,29). The second molars (100%) all had three roots. However, today, two roots and four roots and different canal variations are found (30). This difference in our study may be due to the limited number of specimens we examined, similar to the situation with the first molars.

4.Conclusion

Large-scale analysis of root canal systems has become a crucial issue for treatment success in endodontics. It is also necessary to investigate this topic anthropologically in different populations and races. However, due to the limited availability and lack of preservation of archaeological materials, such studies have not been conducted. This study determined, on the basis of tomographic examinations, that the root and canal morphologies of 81 teeth from nine mandibular and six maxillary jaws from a Late Roman population are similar to those of today's societies.

Conflicts of interest

"No potential conflict of interest relevant to this article was reported."

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Authors' contributions

N.Ç.- general guidance, final approval for the publication of the manuscript.

N.Ç., M.D.. - data collection, analysis and interpretation of the results

N.Ç., M.E. - development of the concept and editing of the text, final approval for the publication of the manuscript.

N.Ç., M.E., M.D.– collection, analysis and processing of the material, writing the text, checking critical intellectual content.

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Evaluating the Influence of Coconut Oil Pulling and Adhesive Application Modes on Shear Bond Strength to Enamel

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Abstract

Backround: This study aims to evaluate the effects of coconut oil pulling and two different application modes of Clearfil™ Universal Bond Quick (etch-and-rinse vs. self-etch) on the shear bond strength of composite resins to bovine enamel.
Materials and Methods: Forty healthy bovine incisor teeth were selected, cleaned, and stored in a 0.1% thymol solution for one week. The crowns were separated from the roots and embedded in acrylic resin blocks. Oil pulling group: Samples were treated with coconut oil pulling prior to adhesive application. Non-oil pulling group: Samples did not undergo oil pulling. Two adhesive application modes of Clearfil™ Universal Bond Quick were tested: Etch-and-rinse mode. Self-etch mode. Composite resin was bonded to the enamel surface, and the shear bond strength was measured using a universal testing machine. The results were analyzed using ANOVA, with p-values set at <0.05 to determine statistical significance.
Results: Statistically significant differences were observed between the test groups ($p< 0.001$). The group treated with coconut oil pulling exhibited lower bond strength compared to the control group without oil pulling. Additionally, the etch-and-rinse application mode resulted in significantly higher bond strength compared to the self-etch mode, regardless of oil pulling treatment.
Conclusions: Coconut oil pulling was found to reduce the shear bond strength of composite resins to bovine enamel. Furthermore, the etch-and-rinse adhesive application mode outperformed the self-etch mode in terms of bond strength. These findings suggest that oil pulling may interfere with adhesive bonding, and the choice of adhesive mode plays a crucial role in optimizing bond strength.

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Keywords: Adhesive, oil pulling, shear bond strength.

Introduction

Shear bond strength between composite resins and enamel is crucial for the longevity and success of restorations in dentistry (1,2). Various factors influence bond strength, including the type of adhesive system used and surface pre-treatment methods. Among these, coconut oil pulling has gained significant attention as a traditional oral hygiene practice, particularly in Ayurvedic medicine (3). Oil pulling involves swishing oil, typically coconut oil, in the mouth for an extended period (around 15–20 minutes) with the goal of improving oral health by reducing bacterial load, preventing plaque formation, and promoting overall oral hygiene (4).

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Coconut oil is particularly popular for this practice due to its high lauric acid content, which has antimicrobial properties (5). Proponents of oil pulling claim it can help with a variety of oral health issues, including reducing bad breath, preventing tooth decay, and even improving gum health (6). However, despite its widespread popularity, the scientific evidence supporting these claims is limited and often anecdotal (7).

One area where oil pulling may have unintended consequences is in the bonding of dental materials to enamel. Since oil pulling involves prolonged exposure of teeth to an oil-based substance, it may leave a residue on the enamel surface. This residue could potentially interfere with the adhesion of restorative materials, such as composite resins, by hindering the bonding process or affecting the penetration of adhesive systems. In particular, the hydrophobic nature of oil might create a barrier, preventing optimal bonding between the adhesive and the enamel surface.

Clearfil™ Universal Bond Quick (CUB) is a versatile adhesive that can be applied using both etch-and-rinse and self-etch modes. Each mode has distinct mechanisms of bonding to enamel, and it is unknown how oil pulling prior to adhesive application might influence these bonding mechanisms. Etch-and-rinse adhesives typically involve the use of phosphoric acid to demineralize the enamel surface, providing a more defined bonding surface. On the other hand, self-etch adhesives do not require separate etching, as they etch and prime the surface simultaneously (8). These differences in bonding mechanisms could result in varying bond strengths depending on the presence of oil residues from oil pulling.

This study aims to evaluate how coconut oil pulling influences the bond strength of composite resins to enamel when different adhesive modes (etch-and-rinse and self-etch) are employed. Understanding these effects is important for clinicians to make informed decisions regarding the use of adhesives in patients who practice oil pulling regularly.

Material and Methods

Extracted sound, forty bovine incisors teeth (n =40) were gathered, and the calculus, plaque, and remaining tissue were removed with scaling instruments and pumice using a rubber cup. The teeth were stored in 0.1% thymol for 1 week at room temperature and transferred to distilled water at 4°C until specimen preparation. A water-cooled diamond disc (Isomet, Buehler, Lake Bluff, IL, USA) was used to separate crowns from roots. After examination under a stereomicroscope (Leica, Meyer Instruments, Houston, TX, USA) for surface structural damage or defects, the crowns were embedded in a block of acrylic resin (Meliodent, Heraeus/Kulzer, Hanau, Germany) with the buccal surface positioned up for surface treatment and composite bonding. Enamel surfaces were polished with 200, 400, and 600 grit silicon carbide papers. The materials used in the study are presented in Table 1.

The specimens were then randomly divided into four groups (n = 10).

Group 1: Acid+ Clearfil™ Universal Bond Quick (CUB) was used with etch-and-rinse mode

Teeth were etched with 37% phosphoric acid for 15 sec, rinsed for 15 sec, and dried for a few seconds until the surface was chalky white.

Clearfil™ Universal Bond Quick (CUB) applied and light cured for 10 sec. with a LED device (3M ESPE Elipar TM S10).

Group 2: Clearfil™ Universal Bond Quick (CUB) was used with self-etch mode

Clearfil™ Universal Bond Quick (CUB)applied and light cured for 10 sec. with a LED device (3M ESPE Elipar TM S10).

Group 3: Coconut oil pulling+ Acid+ Clearfil™ Universal Bond Quick (CUB) was used with etch-and-rinse mode

The specimens were immersed in coconut oil (The Life Co., Istanbul, Turkey) for 15-20 min twice times a day for 2 week and stored in artificial saliva in intervals.

Teeth were etched with 37% phosphoric acid for 15 sec, rinsed for 15 sec, and dried for a few seconds until the surface was chalky white.

Clearfil™ Universal Bond Quick (CUB) applied and light cured for 10 sec. with a LED device (3M ESPE Elipar TM S10).

Group 4: Coconut oil pulling + Clearfil™ Universal Bond Quick (CUB) was used with self-etch mode

The specimens were immersed in coconut oil (The Life Co., Istanbul, Turkey) for 15-20 min twice times a day for 2 week and stored in artificial saliva in intervals.

Clearfil™ Universal Bond Quick (CUB) applied and light cured for 10 sec. with a LED device (3M ESPE Elipar TM S10).

Omnichroma composite resin was applied with a teflon mold (2mm in height, 3,75 mm in diameter) and light cured for 20 seconds. Shear bond strength were analysed by using universal testing machine (Instron,

National Institute of Technology, Raipur, Chhattisgarh) at a crosshead speed of 1 mm/min. After 24 hr storage in water, Shear bond strengths were analysed by using universal testing machine. A knife-edged loading head which was loaded at the interface between the composite and enamel surface was used and the maximum load at failure was recorded in Newton (N) and converted into megapascal (MPa). After testing, modes of failure were examined using a stereomicroscope under 30x magnification and categorized as adhesive failure, cohesive failure and mixed failure.

Statistical Analysis

The data were analyzed using IBM SPSS V23 software. The normality of the data distribution was assessed using the Shapiro-Wilk test. Two-Way Analysis of Variance (ANOVA) was applied for the comparison of bond strength values according to oil pulling and different adhesive modes for normally distributed data. The Bonferroni test was used for multiple comparisons to identify specific group differences. The relationship between groups and fracture types was analyzed using the Fisher-Freeman-Halton test. Results are presented as mean ± standard deviation for quantitative variables and frequency (percentage) for categorical data. A significance level of $p < 0.050$ was considered statistically significant.

Results

This study evaluated the effects of oil pulling and different adhesive application modes on shear bond strength. The findings are summarized in Tables 2 and 3. Statistical analysis revealed a significant effect of oil pulling on mean bond strength values ($p < 0.001$). The group subjected to oil pulling had a mean bond strength of 18.71 MPa, while the non-oil pulling group exhibited a higher mean value of 20.92 MPa.

Adhesive mode also significantly influenced bond strength ($p < 0.001$). The etch-and-rinse mode yielded a mean bond strength of 20.65 MPa, compared to 18.99 MPa in the self-etch groups.

A significant interaction was observed between oil pulling and adhesive modes ($p = 0.003$). For the oil pulling group, the etch-and-rinse mode produced a mean bond strength of 20.02 MPa, while the self-etch mode resulted in 17.41 MPa. In contrast, the non-oil pulling group showed a mean bond strength of 21.28 MPa with the etch-and-rinse mode and 20.56 MPa with the self-etch mode.

Interestingly, the bond strength in the non-oil pulling group with self-etch adhesive was similar to the values observed in the no-oil-pulling etch-and-rinse group and the oil-pulling etch-and-rinse group. However, it was significantly higher than the bond strength in the oil-pulling self-etch group.

Table 4 examines the relationship between fracture types and groups. No statistically significant correlation was found between fracture types and the groups ($p = 0.418$).

Table 1: Materials used in the Study

Material	Product Name	Manufacturer
Phosphoric Acid (37%)	Scotchbond™ Universal Etchant	3M, ESPE, ABD
Adhesive	Clearfil™ Universal Bond Quick (CUB)	Kuraray Noritake Dental Inc., Tokyo, Japan
Coconut Oil	The Life Co.	Istanbul, Turkey
Composite Resin	Omnichroma	Tokuyama Dental Corporation, Tokyo, Japan

Table 2: Main Effects

Main Effect	F	p	Partial Eta Squared
Presence of Application	54.579	**<0.001**	0.603
Type of Adhesive	30.984	**<0.001**	0.463
Application Adhesive Type	9.985	**0.003**	0.217

Table 3: Descriptive Statistics of Bond Strength

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Type of Adhesive	Application Present	Application Absent	Total
Total etch	20.02 ± 1[B]	21.28 ± 1.16[A]	20.65 ± 1.24
Self etch	17.41 ± 0.51[C]	20.56 ± 0.99[AB]	18.99 ± 1.79
Total	18.71 ± 1.55	20.92 ± 1.11	19.82 ± 1.74

"Mean ± Standard Deviation; A-C:Interactions with the same letter do not differ."

Table 4: Relationship Between Fracture Types and Groups

Fracture Type	Application Present Total etch	Application Present Self etch	Application Absent Total etch	Application Absent Self etch	Total
Adhesive	0 (0)	3 (30)	1 (10)	3 (30)	7 (17,5)
Cohesive	8 (80)	4 (40)	6 (60)	4 (40)	22 (55)
Mixed	2 (20)	3 (30)	3 (30)	3 (30)	11 (27,5)

P* 0.418 Test Statistic: 6.018

Discussion

The aim of this study was to evaluate the influence of coconut oil pulling and different adhesive application modes (etch-and-rinse and self-etch) on the shear bond strength of composite resins to bovine enamel. The results demonstrated a significant reduction in bond strength in the oil pulling groups and a higher bond strength when the etch-and-rinse mode was used compared to the self-etch mode. These findings provide important insights into the clinical relevance of oil pulling practices and the choice of adhesive systems.

The shear bond strength test is a key method used to evaluate the effectiveness of bonding at the tooth-restoration interface. Recently, the microshear bond strength test, which involves a bonded area of 1mm² or smaller, has become increasingly popular. This is because it is thought that a smaller bonding area results in a more even stress distribution, leading to more accurate measurements (9).

Coconut oil pulling, an ancient practice primarily rooted in Ayurvedic medicine, is believed to reduce oral bacteria and promote oral health (3,10). However, the results of this study suggest that coconut oil pulling may negatively affect the bonding process of restorative materials to enamel. The group subjected to oil pulling exhibited significantly lower bond strength compared to the non-oil pulling group. This finding is consistent with previous studies that suggest oil residues may form a hydrophobic layer on the enamel surface, which could interfere with the penetration and adhesion of hydrophilic adhesive systems (11).

Furthermore, the prolonged exposure of enamel to oil-based substances may hinder the proper etching of the enamel surface. Oil residues might prevent the adhesive from fully penetrating into the demineralized enamel prisms, reducing micromechanical retention. Similar findings were reported by Sood et al.(11) who observed that oil pulling may interfere with the bonding of dental materials by altering surface wettability.

In a study, it was shown that coconut oil pulling had no significant effect on the microshear bond strength of universal adhesive compared to other mouth rinses such as chlorhexidine and probiotic-based mouthwashes. However, in the oil pulling group, a significant difference in bond strength was observed between the etch-and-rinse and self-etch modes. The etch-and-rinse mode demonstrated significantly higher bond strength compared to the self-etch mode when oil pulling was performed (12). This difference was explained by the interaction of lauric acid in coconut oil with salivary components, forming a soap-like layer on the tooth surface (13,14).

The adhesive mode also played a crucial role in determining bond strength in this study. The etch-and-rinse mode produced significantly higher bond strength compared to the self-etch mode, both in the oil pulling and non-oil pulling groups. This result is consistent with existing literature that highlights the superior performance of etch-and-rinse adhesives, particularly when bonding to enamel. Etch-and-rinse systems, which involve the application of phosphoric acid, create a well-defined bonding surface by completely removing the

smear layer and exposing enamel prisms, resulting in stronger micromechanical interlocking (1).

In contrast, self-etch adhesives rely on simultaneous etching and priming of the enamel surface without the use of separate phosphoric acid. While self-etch adhesives are known for their efficiency and reduced technique sensitivity, their ability to fully etch enamel is limited, which may result in weaker bonds (15). The reduced bond strength observed in the self-etch groups in this study aligns with these findings, particularly when oil residues were present. The oil pulling groups showed a further reduction in bond strength with the self-etch mode, suggesting that self-etch adhesives are more susceptible to surface contamination from hydrophobic substances like oil.

The results of this study have important implications for clinical practice, particularly when treating patients who regularly engage in oil pulling. Coconut oil pulling, while widely regarded for its potential oral health benefits (3), may compromise the adhesion of restorative materials to enamel. Clinicians should be aware of this potential interference, especially when performing restorative procedures in patients who practice oil pulling. Based on the findings of this study, it may be advisable to instruct patients to refrain from oil pulling prior to undergoing bonding procedures to reduce the risk of compromised adhesion.

Additionally, the superior performance of the etch-and-rinse mode in the presence of oil residues suggests that this adhesive system may be the preferred choice for patients who practice oil pulling. The more aggressive etching achieved with phosphoric acid appears to mitigate some of the negative effects of oil residues, resulting in stronger and more reliable bond strength. Future research could focus on developing protocols for cleaning or decontaminating enamel surfaces prior to bonding to remove oil residues effectively.

While this study provides valuable insights, several limitations should be considered. First, bovine enamel was used as a substitute for human enamel, which, while common in laboratory studies, may not fully replicate the conditions of human enamel in vivo (16). Differences in enamel composition, including mineral content and surface structure, could influence adhesion outcomes (17). Future studies should include human enamel specimens to confirm these findings under clinically relevant conditions.

Second, this study focused exclusively on coconut oil. Other oils commonly used in oil pulling, such as sesame or sunflower oil, may have different effects on bond strength. Investigating the effects of various oils and their interactions with different adhesive systems could provide a more comprehensive understanding of how oil pulling practices influence dental restorations. Additionally, future research could explore decontamination protocols or surface treatments to remove oil residues prior to bonding.

Lastly, the controlled laboratory conditions used in this study, including standardized enamel surfaces and adhesive application techniques, may not fully reflect the variability present in clinical settings. Moisture control, operator technique, and the presence of saliva or other contaminants could affect adhesion in a real-world environment. Incorporating thermocycling or long-term water storage into future studies could help simulate clinical conditions more accurately and assess the durability of adhesive bonds over time (18).

Contribution of the authors:

B.K.K.K. - general guidance, final approval for the publication of the manuscript- data collection, analysis and interpretation of the results - development of the concept and editing of the text, final approval for the publication of the manuscript – collection, analysis and processing of the material, writing the text, checking critical intellectual content. - collection, analysis and processing of material, writing text, checking critical intellectual content; – collection, analysis and processing of material, writing text, checking critical intellectual content

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The Relationship Between Anxiety, Age, Gender, and Periodontal Status: A Case-Control Study

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Abstract

Background: Dental anxiety is a common issue observed in the general population and poses a significant barrier to achieving optimal oral health. This study aims to examine the relationship between dental anxiety, periodontal status, oral hygiene habits, and sociodemographic factors in patients seeking periodontal treatment.
Material and Method: In this prospective study, 150 individuals aged 18-65 were divided into three groups based on clinical and radiographic periodontal examinations: gingivally healthy (n=50), gingivitis (n=50), and periodontitis (n=50). Following periodontal diagnosis, participants were asked to complete the Index of Dental Anxiety and Fear. The relationships between dental anxiety levels, periodontal status, sociodemographic data, and oral hygiene habits were assessed, with a significance level of $p<0.05$.
Result: The results indicated that dental anxiety levels were significantly higher in the periodontitis group compared to the gingivally healthy group ($p<0.05$), while no significant differences were observed between the other groups ($p>0.05$). In terms of gender, women had a significantly higher mean anxiety level (1.78) than men (1.50) ($p = 0.028$). Additionally, individuals under 45 years of age had a mean anxiety level of 1.57, compared to 1.95 in those aged 45 and over ($p<0.05$).
Conclusion: The findings of this study suggest that periodontitis patients experience higher levels of dental anxiety compared to gingivally healthy individuals. Furthermore, women and those aged 45 and over exhibited higher anxiety levels compared to men and younger individuals. These data suggest that periodontal health status and sociodemographic characteristics may have a strong association with dental anxiety. Therefore, integrating dental anxiety management strategies into periodontal treatment protocols may help improve patient adherence and periodontal health.

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Keywords: Dental anxiety, periodontal health, periodontitis, gingivitis, gender.

INTRODUCTION

Dental anxiety is a common concept defined as a mixture of discomfort, anxiety, and fear experienced by an individual when faced with dental treatment (1). The use of hand tools and dental anesthesia procedures often triggers fear and anxiety, causing discomfort in patients visiting the dentist. Dental anxiety may arise from previous dental experiences, as well as from past traumatic events or a general anxiety condition unrelated to dental procedures (2, 3).

Dental anxiety, a prevalent issue that negatively affects individuals' willingness to attend dental appointments, can also adversely impact oral health. Numerous studies have reported an association between dental anxiety and poor dental and periodontal health (4-6). These findings suggest that dental anxiety may have negative effects on periodontal health.

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Dental anxiety can be influenced by socio-demographic variables such as age, gender, and educational level (7, 8). Age is known to play a complex role in dental anxiety. While younger individuals tend to exhibit higher anxiety levels due to lack of familiarity with dental treatments and fear of pain, older individuals may experience reduced anxiety levels as they become accustomed to dental care (9). However, this relationship is not linear; various psychosocial factors, such as past experiences and health status, may shape the effect of age on dental anxiety (10).

Regular dental visits are essential for maintaining periodontal health; thus, reducing dental anxiety is believed to positively impact periodontal health. Understanding the relationship between dental anxiety, periodontal health, age, and gender may be beneficial in developing strategies to reduce dental anxiety. The aim of this study is to investigate the relationship between dental anxiety and these factors.

MATERIAL AND METHODS

Study Design and Participants

This cross-sectional study was conducted on patients presenting to the periodontology department between September 2024 and October 2024. The study protocol was approved by the Ethics Committee of Necmettin Erbakan University, Faculty of Dentistry (Protocol No: 2024/478).

The inclusion criteria for the study were as follows: (1) volunteers aged 18-65; (2) individuals diagnosed with healthy periodontium, gingivitis, or periodontitis. Exclusion criteria were: (1) refusal to participate in the study; (2) presence of psychiatric, mental, or physical disabilities; (3) having received periodontal treatment within the last 6 months; (4) being pregnant or breastfeeding; and (5) having used antibiotics, anti-inflammatory, or any other medications affecting periodontal tissues within the last 6 months.

All participants provided written informed consent in line with the principles of the Declaration of Helsinki.

Based on the power analysis conducted before the study (G*Power 3.1 software; Heinrich Heine University, Düsseldorf, Germany), assuming a moderate effect size (Cohen's f = 0.25) with $\alpha = 0.05$ and 80% power (1-β), a sample of 50 participants per group across 3 groups was targeted, totaling 150 participants (11).

Data Collection

The 150 patients included in the study were classified according to the 2017 Classification of Periodontal and Peri-implant Diseases (12). Patients were divided into three groups: periodontal healthy (n=50), gingivitis (n=50), and periodontitis (n=50).

Socio-demographic Variables and Frequency of Dental Visits

Information on gender, age, education level, and frequency of dental visits was collected from the participants.

Periodontal Examination

Periodontal parameters, including plaque index (PI), gingival index (GI), probing depth (PD), clinical attachment loss (CAL), and bleeding on probing (BoP), were measured to diagnose periodontal status. PD was recorded as the distance from the gingival margin to the deepest point of the periodontal pocket. CAL was determined as the distance from the cemento-enamel junction to the deepest point of the periodontal pocket. BoP was noted as present or absent. All measurements were performed by a calibrated periodontist (Z.T.E). Participants were evaluated according to the criteria specified in the consensus report of the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions (12, 13). Diagnostic criteria included: (i) Gingival health: no CAL, PD ≤3 mm (assuming no pseudo-pocket), BoP <10%, and no radiographic bone loss; (ii) Gingivitis: no CAL, PD ≤3 mm (assuming no pseudo-pocket), BoP >30%, and no radiographic bone loss; (iii) Periodontitis: interproximal CAL of ≥2 mm or ≥3 mm and radiographic bone loss in at least two non-adjacent teeth.

After the clinical assessment, each participant was provided with both verbal and written diagnoses regarding their oral health status and encouraged to consult a dentist for preventive and treatment measures if necessary.

Dental Anxiety and Fear

Dental anxiety and fear were assessed using the core module (IDAF-4C) of the IDAF 4C+ questionnaire, whose Turkish validity and reliability had been previously established (1). The core module of IDAF-4C consists of eight questions with two items each, addressing the behavioral, emotional, cognitive, and

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physiological aspects of dental anxiety and fear. Responses in IDAF-4C are rated on a scale from "Strongly Disagree" (1) to "Strongly Agree" (5), with higher scores indicating increased dental fear. Average scale scores were classified as follows: "No or very low dental fear" (score range 1–1.5), "Low dental fear" (score range 1.51–2.5), "Moderate dental fear" (score range 2.51–3.5), and "High dental fear" (score >3.5).

Statistical Analysis

Data were analyzed using IBM SPSS V23. Normality of data distribution was assessed with the Kolmogorov-Smirnov and Shapiro-Wilk tests. Gender distribution among groups was analyzed using the chi-square test. Comparisons of age, periodontal parameters, and dental anxiety between groups categorized by periodontal status were first evaluated with ANOVA, followed by pairwise comparisons with Tukey's HSD post hoc test. Marital status, gender, age, and frequency of dental visits were analyzed with the independent t-test. For comparisons of dental anxiety by educational level, ANOVA and Tukey's HSD post hoc test were applied. Statistical significance was set at $p<0.05$.

RESULTS

A total of 150 individuals participated in the study, including 87 females (58%) and 63 males (42%). The mean ages and gender distributions of participants across the study groups are presented in Table 1. The gender distributions among the groups diagnosed with gingival health, gingivitis, and periodontitis were statistically similar ($p>0.05$). The mean age of the periodontitis group was higher than that of the other groups ($p<0.05$). No statistically significant difference was found between the mean ages of participants in the gingival health and gingivitis groups ($p>0.05$).

The comparison of periodontal parameters by group is shown in Table 2. Among the groups, the lowest PD, PI, and GI scores were observed in the gingival health group, while the highest scores were found in the periodontitis group ($p<0.05$).

The comparison of total IDAF-4C scores by group is presented in Figure 1. Higher dental anxiety scores were observed in the periodontitis group compared to the gingival health group ($p<0.05$). No significant differences were observed in comparisons between the other groups ($p>0.05$).

Higher dental anxiety scores were observed in females compared to males ($p<0.05$) (Figure 2).
When comparing dental anxiety scores between individuals under 45 and those over 45, higher dental anxiety scores were observed in individuals over 45 ($p<0.05$) (Figure 3).

The effect of educational levels on dental anxiety scores is shown in Figure 4. Higher dental anxiety scores were observed in university/postgraduate graduates compared to primary school graduates or individuals with no formal education ($p<0.05$). However, no significant association was found among other educational levels ($p>0.05$).

It was observed that individuals who visited the dentist regularly had significantly lower levels of dental anxiety ($p=0.013$) (Figure 5).

Table 1. Age and gender distribution by group.

Group	Number of Females	Number of Males	Total Participants	Age (Mean ± SD)
Gingival Health	32	18	50	33.63 ± 13.18[a]
Gingivitis	30	20	50	33.20 ± 12.09[a]
Periodontitis	25	25	50	44.50 ± 11.31[b]
p-value	0.334	0.334	1.0	0.006[‡*]

[†] Chi-square test
[‡] ANOVA and Tukey HSD post-hoc test; groups with the same letter have no significant difference; abbreviations: SD: Standard Deviation
* $p<0.05$

Table 2. Comparison of periodontal parameters by group.

Parameter	Gingival Health (Mean	Gingivitis (Mean ± SD)	Periodontitis (Mean ± SD)	p-value

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	± SD)					
Probing	1.59	±	2.10	±	3.49 ± 0.62[c]	p =
Depth	0.20[a]		0.24[b]			0.00*
Plaque	1.09	±	1.92	±	2.25 ± 0.51[c]	p =
Index	0.29[a]		0.50[b]			0.00*
Gingival	0.92	±	1.69	±	1.96 ± 0.43[c]	p =
Index	0.19[a]		0.30[b]			0.00*

‡ ANOVA and Tukey HSD post-hoc test; groups with the same letter have no significant difference; abbreviations: SD: Standard Deviation
* p<0.05

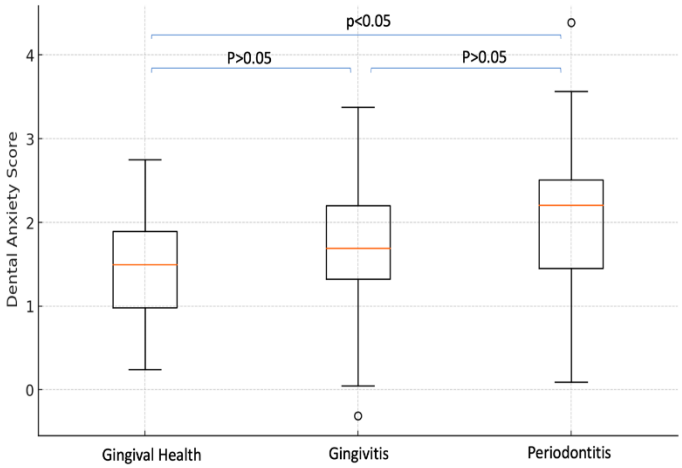

Figure 1. Comparison of dental anxiety scores by periodontal health status.

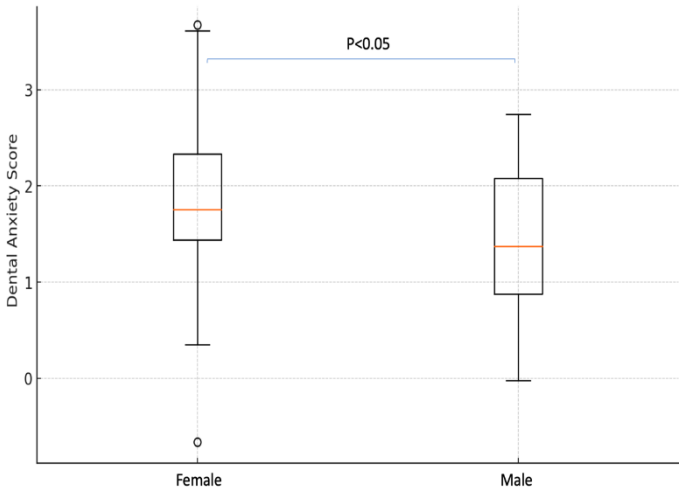

Figure 2. Comparison of dental anxiety scores by gender

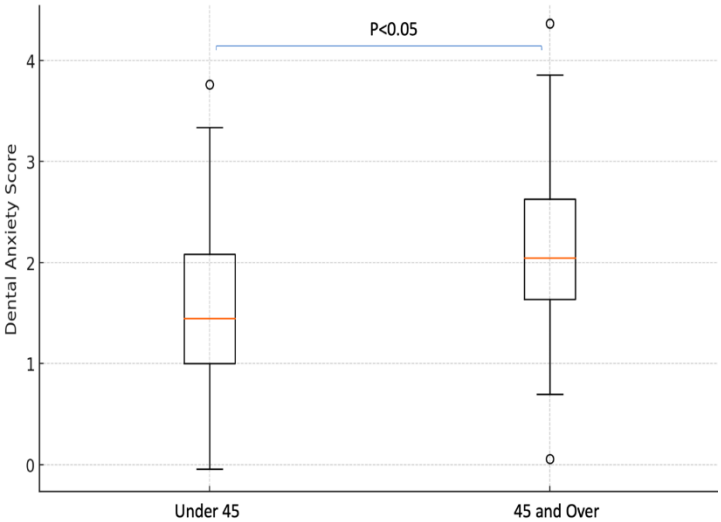

Figure 3. Comparison of dental anxiety scores by age group (under 45 vs. over 45)

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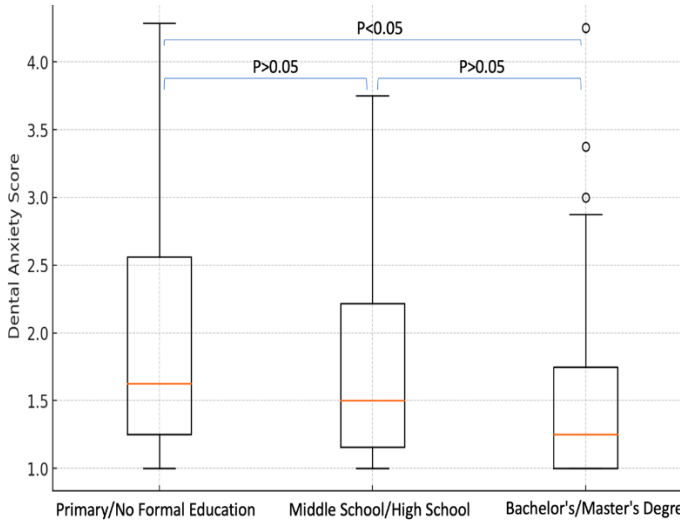

Figure 4. Relationship between educational level and dental anxiety scores.

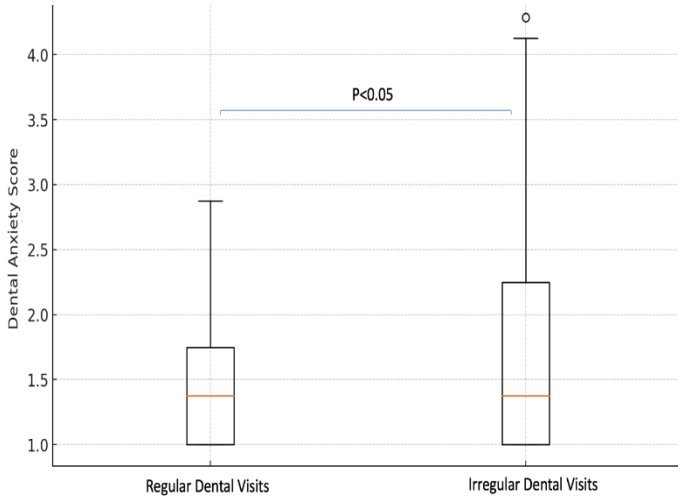

Figure 5. Relationship between frequency of dental visits and dental anxiety scores

DISCUSSION

This study aimed to evaluate dental anxiety in patients presenting to the Periodontology clinic using the IDAF-4C questionnaire. The findings of the current study indicate that dental anxiety levels are higher in patients with periodontitis compared to those with healthy gingiva. Additionally, it was observed that females had higher dental anxiety scores than males.

In a cross-sectional study conducted by Goh et al. on individuals with periodontitis, the effects of depression, anxiety, and stress on the severity of periodontitis and oral health-related quality of life were evaluated, revealing a relationship between clinical attachment levels and anxiety (14). Similarly, an observational cross-sectional study by Gisler et al. examined the association between oral conditions and aspects of health-related quality of life in a population in Switzerland with dental treatment needs, showing that increased dental anxiety was associated with impaired oral health-related quality of life (15). Another study reported a link between dental anxiety and poor dental and periodontal health (4). Wisloff et al. found that military recruits with dental fear were characterized by more oral health problems compared to those without dental fear (16). Consistent with these studies, our study also observed higher levels of dental anxiety in individuals with periodontitis.

The impact of gender on dental anxiety has been demonstrated in several studies, with findings suggesting that females are more prone to dental anxiety (17, 18). Similarly, in this study, female patients exhibited significantly higher dental anxiety levels compared to males. This phenomenon is often attributed to differences in pain perception or pain thresholds and psychological differences between the genders (19).

Most studies examining the relationship between age and dental anxiety suggest that dental anxiety levels tend to decrease as individuals age (9, 20, 21). However, in our study, higher levels of dental anxiety were observed in individuals over 45. This may be influenced by the higher mean age of participants in the periodontitis group. Additionally, fear of pain, tooth loss, and the negative impact of poor dental health on overall well-being may contribute to increased anxiety levels in this demographic (22).

Educational status is considered a determinant factor in predicting a patient's capacity for anxiety and their potential psychological response to ongoing medical treatment (23). Therefore, it is expected that highly educated patients would exhibit less dental anxiety compared to those with lower education levels. Ragnarsson (8), in a study conducted on a population in Iceland, suggested that individuals with higher educational levels had significantly lower dental anxiety and fear during dental visits, as well as a lower incidence of total edentulism. A study by Eroglu et al. (24) revealed that a patient's level of education and culture were more influential in the development of dental anxiety and fear than their economic status. Similarly, our study found that individuals with undergraduate and postgraduate degrees had lower dental anxiety compared to primary school graduates and those with no formal education.

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This finding supports the impact of educational level on dental anxiety and suggests that higher education may reduce anxiety levels due to greater knowledge and awareness of dental health.

Due to its cross-sectional design, this study does not allow for establishing causal relationships, and its single-center nature limits the generalizability of the results. Additionally, the reliance on self-reported data from participants increases the risk of bias. Future multi-center, large-scale studies examining factors influencing dental anxiety would provide more comprehensive insights on this topic.

In this study, it was observed that dental anxiety levels were higher in individuals with periodontitis, and this condition may be associated with demographic factors such as gender, age, and education. The findings suggest that females tend to experience higher levels of anxiety compared to males, and that dental anxiety levels may decrease with increasing education levels. These findings indicate that considering demographic factors in the development of strategies to reduce dental anxiety may be beneficial for improving periodontal health.

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Author contributions: Z.T.E conceived the ideas, collected the data, analysed the data, and led the writing.

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Modern Methods of Diagnosis of Occlusive Imbalance in Patients with Temporomandibular Myofascial Pain Syndrome

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Abstract

Background: In recent years, there has been a growing interest in digital methods for diagnosing occlusive imbalance both in Russia and abroad. The development of technologies in this area opens up new prospects for improving the diagnosis and treatment of dental diseases.
The purpose of this study is to analyze existing digital methods and devices for diagnosing occlusive imbalance, identify their advantages and disadvantages, and assess the prospects for their implementation in clinical practice.
Materials and methods: To achieve this goal, a systematic review of 40 scientific publications covering the period from 2016 to 2024 was conducted. The study includes both domestic and international sources from leading scientific electronic libraries and databases. Data on various types of digital devices such as strain gauges, piezoresistive and piezoelectric transducers, pressure sensors and fiber optic sensors are analyzed. Methods of index evaluation of occlusal contacts have also been studied.
Results: The analysis showed that existing digital technologies for the diagnosis of occlusive imbalance have significant potential to improve the accuracy and effectiveness of diagnosis. Load cells, piezoresistive and piezoelectric transducers, as well as pressure sensors and fiber optic sensors provide various approaches to measuring the occlusion force. Despite their high sensitivity and accuracy, the implementation of these technologies faces challenges such as the complexity of equipping clinics and the insufficient level of digital competencies among doctors.
Conclusion: Digital diagnostic technologies for occlusal imbalance have significant potential to improve dental practice. However, for the successful implementation of these methods, it is necessary to overcome the existing difficulties associated with equipment and training of specialists. Further efforts in the field of digital technology development, process automation and advanced training of dentists can contribute to more effective diagnosis and treatment of occlusion disorders.

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Key words: Occlusion, digital radiography, strain gages, piezoelectric devices, artificial intelligence.

INTRODUCTION

Occlusion disorders are an important risk factor for the development of various diseases of the oral cavity, including dental, periodontal and temporomandibular joint pathologies. Studies have also shown that occlusive imbalance can contribute to the development of endocrine (for example, diabetes mellitus) and cardiovascular diseases, as well as cognitive impairment (1, 2, 3).

A decrease in occlusive strength is one of the diagnostic signs of hypofunction of the oral cavity, which includes an assessment of hygiene, dry mouth, mobility and pressure of the tongue, as well as the functions of chewing and swallowing. The diagnosis is considered positive if there are at least three of these signs (4). The concept of "hypofunction of the oral cavity", originally developed for elderly patients, has recently been recognized as relevant for young people, especially in terms of occlusive strength (5).

Thus, the diagnosis of occlusion disorders has not only dental, but also general medical significance, as it allows us to study the relationship between oral health and the general state of human health.

For dentists, conducting a high-quality, accurate and prompt assessment of the occlusive status of a patient is an important task. In this regard, there is a high need to develop effective and affordable methods for diagnosing occlusive imbalance. Doctors would like to have methods that meet the modern requirements of dental care: they must be effective, accurate, reliable, economical and easy to use. These tasks can be solved through the development of technologies for the diagnosis and correction of occlusive disorders.

One of the promising directions in the assessment of dental status is the digitalization of diagnostic processes. This includes not only the correction of occlusion pathologies, but also the creation of a digital patient profile for monitoring, including telemedicine, as well as for preventive and rehabilitative measures (6). It is also important to update and improve traditional methods of diagnosing occlusive imbalance using computer technology.

Thus, the wide prevalence and diversity of oral diseases arising from occlusion disorders, as well as the limited capabilities of modern diagnostic technologies, emphasize the relevance of analyzing digital methods for diagnosing these disorders.

The purpose of the study is to analyze digital methods and devices used to diagnose disorders of occlusive relationships.

MATERIALS AND METHODS

A systematic analysis of 40 scientific publications devoted to digital methods of diagnosis of occlusive imbalance for the period from 2016 to 2024 was carried out. Of these publications, 9 were indexed in Russian scientific electronic libraries (CyberLeninka and eLibrary), and 31 articles were indexed in international databases (PubMed, Google Scholar, ResearchGate). The search for sources was carried out using combinations of keywords: "occlusive relationships", "occlusion disorders", "digital technologies", "occlusive sensors".

An analysis of the literature has shown that in practice, doctors can use various commercial electronic devices to register the strength of occlusion. These devices operate on the basis of the transformation of mechanical force into electrical energy using various sensors (7, 8). According to the mechanism of action, they can be classified as load cells, piezoelectric and piezoresistive transducers, as well as pressure sensors (9). These devices are used to diagnose various conditions, such as disorders in the temporomandibular joint, fractures of the mandible, malocclusion deformities, as well as to monitor the strength of occlusion during treatment (10). Brief characteristics of these devices are presented in Table 1.

Table 1. Characteristics of devices for determining the force of occlusion

Type (device)	Composition	Advantages	Disadvantages
Load cells («Dentoforce 2», Itlab, «IDD», Kratos)	a metal bite plug covered with rubber or a plastic disc, a digital monitor	high accuracy, wide range of measurements, light weight and size	bite plug thickness is more than 10 mm, interference with occlusion during measurements
Piezoresistive transducers («FSR151», Interlink Electronics, «Flexiforce», Tekscan)	, thermoplastic sheets with built-in conductive electrodes and semiconductor polyethyrimide ink, or an electronic device for detecting changes in sensor resistance	high sensitivity, thin, light weight, inexpensive	is less accurate compared to load
Pressure sensors («GM10», Nagano Keiki «MPX 5700 Motorola», SPS)	occlusal vinyl element or flexible occlusal tube	portable, soft, create uniform force distribution	cells measurement inaccuracies
Piezoelectric sensors («T-scan III», Tekscan)	piezoelectric sensor made of foil	thin (0.1mm) and flexible sensor, quantification of occlusion force	insufficient sensor sensitivity, narrow range

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Load cells: Strain gauges measure pressure and control the applied force using a strain gauge, which converts mechanical deformation caused by tooth compression into an electrical signal (11-13). The advantages of load cells include high sensitivity and accuracy, compactness and resistance to external influences. However, their metal surface can cause discomfort in patients, which complicates the registration of the maximum compression force (14).

Piezoresistive transducers: Piezoresistive transducers change resistance when pressure increases and use semiconductor materials. These sensors are characterized by high sensitivity and measurement accuracy, as well as compact dimensions. They are widely used not only in dentistry, but also in other medical fields. Nevertheless, some studies have noted certain inaccuracies in their measurements compared to other types of sensors (15-19).

Pressure sensors: These sensors convert the pressure of a liquid or gas into electrical signals. The advantages of such sensors include the accuracy and repeatability of measurements, the ability to adapt to the anatomy of teeth and comfort for patients. However, they are limited in use with different environments, which can reduce accuracy and reliability (20-21).

Piezoelectric converters: These devices operate on the basis of a piezoelectric effect that converts pressure into an electrical signal. They are characterized by high accuracy and reliability, as well as the ability to create a three-dimensional map of the occlusive force. However, the disadvantage is the limited flexibility of the sensors and the narrow measurement range (22-27).

Fiber-optic sensors: These devices use optical transducers to register the compression force of teeth and transmit data to a computer (Figure 1). They are characterized by their miniature size, independence from electrical energy and resistance to electromagnetic interference, which makes them promising for use in wireless technologies (28-31).

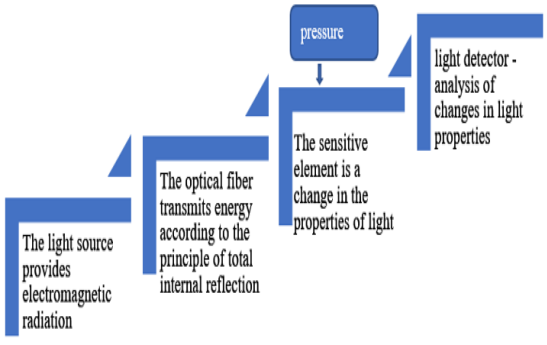

Figure 1: Operating principle of fiber optic pressure sensors.

Methods of index evaluation of occlusal contacts: A number of studies are devoted to the development of methods for the index assessment of occlusal disorders using articulation paper of various thicknesses and colors to identify static and dynamic contacts, followed by photographing and digitizing for computer diagnostics, as well as 3D analysis of occlusal imbalance using dental scans and studying digital models (32, 33). Exponential monitoring makes it possible to identify the severity of trigger factors and their effect on occlusion disorders (34). The point scale of occlusal contacts provides recommendations to the clinician on the choice of a differentiated algorithm: whether to limit oneself to selective grinding of teeth, restoration, or whether orthodontic treatment is necessary (35).

Prospects for the use of occlusive sensors: Modern technologies allow the development of miniature sensors that can be integrated into dentures and other dental devices for continuous monitoring of occlusive strength. This opens up new possibilities for quantitative analysis of occlusive disorders in real time. The use of artificial intelligence for the diagnosis and treatment of occlusive imbalances is also developing, which makes it possible to create more accurate and effective algorithms based on the analysis of large volumes of clinical data (36-40).

RESULTS

The results of a systematic analysis of 40 scientific publications conducted as part of the study showed that for the period from 2016 to 2024, a variety of digital methods and devices for diagnosing occlusive imbalance were presented in the scientific literature. A study of the sources revealed a significant number of commercially available electronic devices used to register the occlusion force. These devices operate on the basis of various sensors such as load cells, piezoresistive and piezoelectric transducers, as well as pressure sensors and fiber optic sensors.

Each type of sensor has its own advantages and disadvantages, which makes their application specific to certain clinical situations. The advantages include high accuracy, sensitivity and ease of use, while the disadvantages are related to limitations in measurement accuracy, difficulties in positioning sensors and patient comfort.

Modern methods of index evaluation of occlusive contacts based on digital technologies allow for a detailed analysis of occlusive disorders, which contributes to a more accurate diagnosis and selection of effective treatment methods.

In addition, the development of artificial intelligence technologies and the miniaturization of sensors open up prospects for continuous monitoring of occlusive strength, which is an important step towards improving the diagnosis and treatment of occlusive disorders.

DISCUSSION

Violations of occlusive relationships in modern dentistry are becoming an increasing problem due to their rather high prevalence, a variety of clinical symptoms, difficulties in diagnosis and treatment, as well as the need for long-term rehabilitation of patients. Currently, the subject of interest of domestic and foreign researchers is the diagnosis, treatment and prevention of occlusion disorders. It should be noted that in recent years, an increase in the frequency of occurrence of these pathologies in clinical practice has been recorded. In addition, occlusive disorders imply characteristic clinical manifestations in the oral cavity and on the face, accompanied by pathologies of the hard tissues of the teeth, periodontal, temporomandibular joint (TMJ), balance of the chewing muscles. Despite the variety of clinical manifestations, it is believed that patients with occlusive disorders represent one of the most difficult groups of patients, since this group of pathologies has a multifactorial etiopathogenetic nature, consisting in the formation of several developmental links: teeth, jaw bone, muscle factor, as well as TMJ. In addition, these patients often have concomitant diseases that exacerbate the course of pathology of the dental system.

In light of the above, occlusive disorders are a subject of considerable interest among researchers, which is confirmed by the abundance of scientific publications on this topic. It is important to note that recent scientific developments are focused on automation of diagnostic processes, data analysis using computer vision and neural networks, which opens up new horizons for the application of these technologies in dentistry and related fields.

The development of new methods and highly sensitive sensors for measuring chewing pressure provides new diagnostic capabilities, allowing the identification of clinical parameters that were previously unavailable for analysis.

Modern hardware technologies and software make it possible to integrate machine vision and neural network analysis algorithms into the practice of doctors, which, based on the analysis of previous clinical cases, can not only evaluate current data, but also predict the risk of developing diseases and possible complications.

CONCLUSION

Thus, our study demonstrates that digital methods for diagnosing occlusal imbalance are currently being actively developed, which will become a priority in dental practice in the future. However, the introduction of these techniques into the daily work of dentists is still limited not only by the difficulties in equipping clinics with the necessary digital equipment, but also by the insufficient level of digital competencies of specialists. Overcoming these obstacles will significantly improve the quality of dental care for patients with occlusive disorders.

Statement of conflict of interest : The authors declare that there is no conflict of interest.

Ethical Statement

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Diffuse Large B-Cell Lymphoma of Anterior Mandible: A Case Report

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Abstract

Diffuse Large B Cell Lymphoma (DLBCL), which is rare in the oral cavity, poses diagnostic challenges due to its similarity to benign lesions. In this report, a case of DLBCL presenting as an asymptomatic swelling in the anterior region of the mandible that gradually grows in a 58-year-old female patient is presented. Although it was thought to be a benign lesion in the preliminary diagnosis, it was diagnosed as DLBCL in the histopathological examination performed after excisional biopsy. This case highlights the importance of considering DLBCL in the differential diagnosis of swellings in the oral cavity and emphasizes the importance of making the diagnosis and treatment quickly.

Case Report (HRU Int J Dent Oral Res 2024;4(3): 119-122)

Key words: Oral, cancer, lymphoma, mandible.

INTRODUCTION

Lymphomas are malignant neoplasms originating from lymphocytes and can be observed in lymphatic tissue, bone marrow or extranodal sites. They are classified into different subtypes based on morphological, genetic, immunological, molecular and clinical features (1). They are mainly classified as Hodgkin´s lymphoma (HL) or non-Hodgkin´s lymphomas (NHL) (2). Approximately 25% of NHL cases seen at extranodal areas; skin, central nervous system, gastrointestinal system and are the most common of them (3). Oral NHLs are rare compared to other sites, accounting for only 2–3% of all reported lymphomas (4).

Diffuse large B-cell lymphoma (DLBCL) is a type of NHL characterized by diffuse proliferation of large neoplastic B cells and can involve the oral cavity and jaw bones (5).

The most commonly affected areas in the oral and maxillofacial region are the Waldeyer ring, followed by the buccal mucosa, base of the tongue, floor of the mouth and posterior molar region (2). Apart from Waldeyer's ring, DLBCL can also involve the maxillary alveolus, maxillary vestibule and posterior palate in the oral cavity (4).

DLBCL can be misdiagnosed as benign or inflammatory lesions such as periodontitis, osteomyelitis, and pyogenic granuloma, as well as different malignant tumors (6). DLBCL treatment usually consists of chemotherapy, radiotherapy or a combination of these (7).

This article reports a case of DLBCL affecting anterior part of mandible in a 58 years old female patient.

CASE-REPORT

A 58-year-old female patient came to our clinic with a complaint of swelling in the anterior region of mandible for 2 months. History revealed that the swelling started as a small lesion and progressively enlarged in size. There was no toothache or pain associated with it. There was no history of any purulent discharge from the swelling.

On examination, a single well-circumscribed swelling was seen on the anterior mandible, ovoid in shape, measuring about 2,5 cm in greatest diameter, with the surface color resembling that of normal mucosa, margins were well defined and the swelling crossed the midline on the left side without surface ulceration. (Figure 1) On palpation there was slight tenderness, the swelling was firm in consistency, sessile, attached to the underlying bone, not yielding to pressure, non-fluctuant. The patient reported that she did not feel any pain when the submental area was palpated.

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Vitality testing was performed for both lower canines and incisors, and all teeth were vital.

Figure 1. Preoperative intraoral examination.

Panoramic radiographs revealed generalized destruction of alveolar bone in the anterior mandible region of teeth 42-33. A cone beam computed tomography (CBCT) without contrast was ordered to rule out concerning features and showed a diffuse bone destruction and nonspecific 9,66x35.25x27,64 mm enhancing soft tissue mass. (Figure 2) No mobility was observed in the teeth in the lesion area. Submandibular lymphadenopathy was not detected in the patient. The patient had diabetes in her medical history. Fine-needle aspiration cytology was done, but no aspirate was obtained.

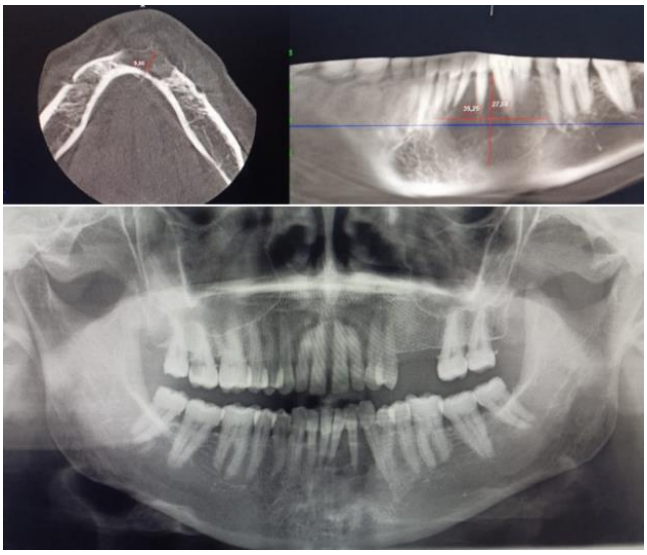

Figure 2. Preoperative radiographic findings.

Central giant cell granuloma, myxoma and ameloblastoma were considered as preliminary diagnoses. Under local anesthesia, the mandibular incisors associated with the lesion were extracted, and an excisional biopsy was performed. Collected specimens were sent for a histopathological test. Ten days after the surgery, the sutures were removed and the healing status was examined (Figure 3).

Figure 3. Intraoperative and postoperative view.

The histological examination revealed a diffuse proliferation of atypical round cells with lymphoid features positive for CD79a, CD20, Pax5, CD138, CD3, CD5, CD68, CD138, LCA and PanCK. (Figure 4.) Negative for Bcl-2, Bcl-6, MUM1, CD10, RCC, S100, SOX10, MelanA, CD21, CD23, D1 cyclin and Lambda, Kappa. Ki-67 index was %75-80 positive. (Figure 5.)

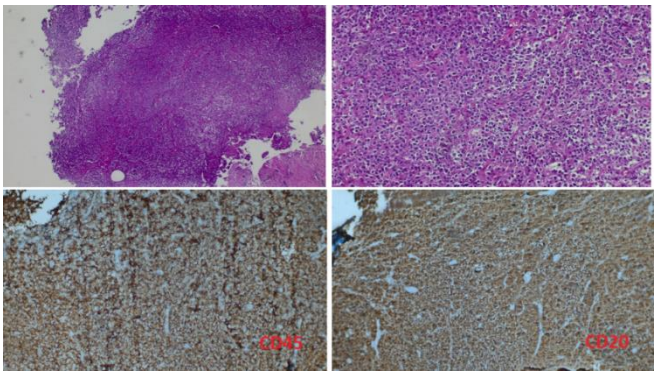

Figure 4. An infiltration of medium/large lymphoid cells with diffuse involvement was observed. According to the immunohistochemistry results, CD45, CD20, CD79a and PAX5 were positive.

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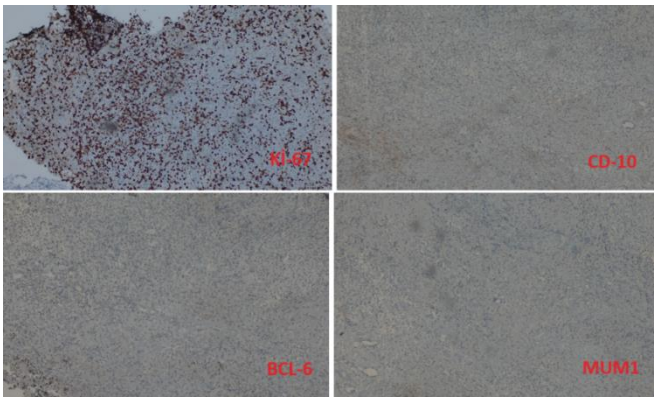

Figure 5. In the immunohistochemical examination, CD10, Bcl6 and MUM1 were negative. Ki-67 proliferation index was 75-80%. Diffuse large B-cell lymphoma non-germinal center origin was diagnosed with morphological and immunohistochemical findings.

The final diagnosis was NHL compatible with extranodal DLBCL and the patient was referred to the Department of Oncology. In the PET/CT evaluation, the operated intraosseous area was observed to be clean. A chemotherapy regimen of five sessions was arranged upon the discovery of a suspicious area in the submental region. Control PET/CT scans were planned to determine the effectiveness of the treatment and possible recurrences.

DISCUSSION

The incidence of extranodal lymphoma is 24-27% in North America, 37-48% in Europe and 44.5% in Turkey (8) DLBCL has an unclear etiology that includes immunosuppression, autoimmune diseases, exposure to pesticides and radiation. Additionally, viruses like Epstein-Barr virus, human immunodeficiency virus, human T-cell lymphotropic virus, hepatitis C and B, human herpes virus and some microorganisms play a role in the etiology of DLBCL (9).

Diagnosis of intraosseous lymphoma of the jaws is difficult and is often delayed due to its characteristics similar to other pathologies. Extranodal lymphomas occurring in the mandible often present with nonspecific signs, such as painless swelling. Paresthesia, teeth mobility and cervical adenopathy are not common (10). Early lesions can be confused with inflammatory odontogenic or periodontal diseases, resulting in unnecessary treatments for patients (i.e., endodontic therapy, tooth extraction, antibiotic therapy) and delays before biopsy diagnosis (11).

Lymphomas can cause clinically indeterminate pain and discomfort and can easily be misdiagnosed as an endodontic lesion resulting from an odontogenic infection. Radiological changes in the early stages of the tumor may not be very obvious and are usually detected as a radiolucent lesion late in the disease, similar to a dental abscess. Histologically, NHLs can easily resemble a periapical granuloma or odontogenic cyst due to cells that appear to be lymphocytic proliferation (12).

Severe jaw pain and teeth mobility caused by rapid destruction of bone can be an early sign of malignancy in the bones (13). The clinician should be aware of jaw tumor symptoms, which may aid in early diagnosis and treatment. Severe local destruction of bone without visible odontogenic infection is an important feature of jaw tumors (14).

The best way to manage lymphoma is correct diagnosis; clinically an excisional or incisional biopsy should be performed to obtain sufficient tissue for morphological and molecular analysis (15). Differential diagnoses of DLBCL include periodontal disease, some benign tumors of hard and soft tissues, squamous cell carcinoma, osteosarcoma, multiple myeloma, Ewing sarcoma, bone metastasis, Langerhans cell histiocytosis, leukemia, and osteomyelitis (16).

There are few case reports of oral and maxillofacial DLBCL in the literature. This makes diagnosis, prognosis, pathological behavior and treatment options difficult. Current treatment for DLBCL generally consists of chemotherapy (17). In the treatment of DLBCL, the chemotherapy regimen consisting of the combination of rituximab, cyclophosphamide, doxorubicin, vincristine and prednisone (R-CHOP) has been used as the standard of treatment in the first line for more than 20 years. In resistant cases, radiotherapy is also used in addition to treatment (18). The initial remission rate of the disease with treatment has been reported as 60-80%, and the 5-year survival rate of cases with bone involvement is seen to be around 50%, which is a sign of poor prognosis (19).

Diagnosis of oral DLBCL is challenging for oral surgeons due to its rarity and nonspecific clinical and radiographic features. Maxillofacial surgeons play an important role in the early diagnosis and prognosis of oral NHL. Therefore, they need to have sufficient clinical and pathological knowledge and careful examination in such diseases. Biopsy should be considered without delay.

An informed consent form was obtained from the patient. The treatment and publication process was explained.

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Contribution of the authors: M.C.D., İ.Ö. - general guidance, final approval for the publication of the manuscript. M.C.D., İ.Ö. - data collection, analysis and interpretation of the results, development of the concept and editing of the text, final approval for the publication of the manuscript. İ.Ö., H.R.E. – collection, analysis and processing of the material, writing the text, follow-up of case. M.C.D., İ.Ö., H.R.E.,S.Ö. - collection, analysis and processing of material, writing text, checking critical intellectual content; analysis and processing of material, writing text, checking critical intellectual content; The authors confirm the compliance of their authorship with the international ICMJE criteria (all authors made a significant contribution to the development of the concept, preparation of the article, reviewed and approved the final version before publication).

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Treatment approach to a traumatically intrused maxillary central tooth: a case report

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Abstract

This case report presents the treatment of a 10-year-old boy with a traumatic maxillary right central tooth. Radiologic examination of the patient revealed an uncomplicated traumatic dental injury with an intrusion of more than 7 mm in the right maxillary lateral incisor. Following flap lifting, the intruded tooth was luxated to the desired position. After the tooth was positioned, the soft tissue was sutured and the teeth were splinted with a semirigid wire for four weeks. At the next appointment after three weeks the pulp was extirpated and calcium hydroxide was sent to inserted the canals and root canal treatment was finished 1 week later. No marginal bone loss, resorption of the periapical tissues, or pathology was detected in the clinical and radiologic examinations and at the end of the 6-month follow-up. Routine clinical and radiologic follow-up of our case continues. Treatment planning of fully intruded permanent teeth requires a multidisciplinary approach. The collaboration of specialists such as pedodontists, maxillofacial surgeons and orthodontists is important in the treatment process.

Case Report (HRU Int J Dent Oral Res 2024;4(3): 123-126)

Key words: Dental Trauma, splint, surgical extrusion.

INTRODUCTION

Dentoalveolar trauma is prevalent in children (1). Most of these cases occur in childhood as a result of bicycle accidents, during sports activities or falls (2). Dental trauma, especially in the anterior teeth of children, may require emergency treatment (3). Intrusion is a condition in which the tooth is pushed downward and takes up more space in the jaw. This condition usually occurs as a result of trauma (2,4). In cases of intrusion, the teeth may be partially or completely embedded in the jaw bone (5). The current treatment method in permanent teeth can be listed as waiting for the tooth to return to its former position if the amount of intrusion is less than 3 mm in teeth with a closed apex, orthodontic/surgical repositioning if the amount of intrusion is between 3-7 mm, and surgical repositioning if it is more than 7 mm (6). According to the International Association of Dental Traumatology (IADT) guidelines for the treatment of traumatic dental injuries, surgical extrusion is reported as the treatment option for intrusive luxation injuries with more than 7 mm intrusion (7). The treatment and prognosis of teeth intruded as a result of trauma may vary depending on many factors such as the type of dentition, age of the patient, severity of trauma and development of the roots (3). In the case of permanent teeth with an occluded apex, researchers recommend surgical repositioning of the intruded tooth or maintenance with orthodontic treatment (8).

In this case report, we present the treatment approaches applied to a 10-year-old boy whose right maxillary permanent central tooth was completely intruded as a result of trauma.

CASE REPORT

In our case, the right maxillary central tooth of a 10-year-old boy who fell while running was intruded and an uncomplicated traumatic dental injury occurred at the same time. The patient applied to our clinic one week later with pain and aesthetic complaints due to the complete embedding of the right central apex closed tooth into the gum (Figure 1). When the patient came to our clinic, it was found that the tooth was 7 mm intruded (Figure 2). The impacted tooth was incised, slightly luxated, brought to occlusion and sutured (ALKASILK round 3/0 silk suture, Turkey) (Figure 3). Immediately afterwards, the teeth were first etched, bond (3M ESPE Simple Bond Universal, Germany) was applied, and

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then splinted and reposed with the help of resin composite (3M ESPE filtek, USA) and dental light device (Guilin Woodpecker, 3.6V, LED C, Germany) using 0.4 mm full round flexible steel wire (AYSET 2ml, hollow round 0.4 mm, Turkey) (Figure 4-5).

Figure 1: Preoperative photograph

Figure 2: Preoperative panoramic radyograph

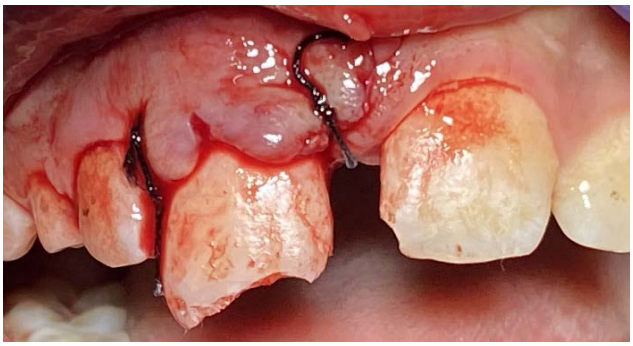

Figure 3: Reposed image of the intruded tooth

Figure 4: Splinting treatment of the intruded tooth

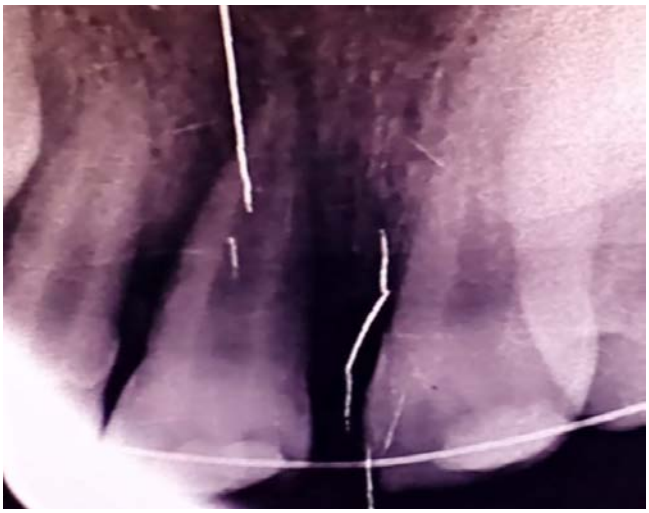

Figure 5: Radiographic examination with splint treatment

After the procedure, the patient was prescribed a broad-spectrum antibiotic, analgesic and chlorhexidine mouthwash, and was advised to eat soft food and maintain maximum oral hygiene. Parents were recommended to clean the affected area superficially with a soft brush or cotton swab twice daily for one week with an alcohol-free 0.1-0.2% chlorhexidine gluconate mouthwash. When the patient came for appointment 2 weeks later, the sutures were removed and the patient was called for a follow-up appointment. 4 weeks later, the root canal was started, calcium hydroxide was applied to the canals via pulp extirpation, and the root canal treatment was completed 1 week later (Figure 6).

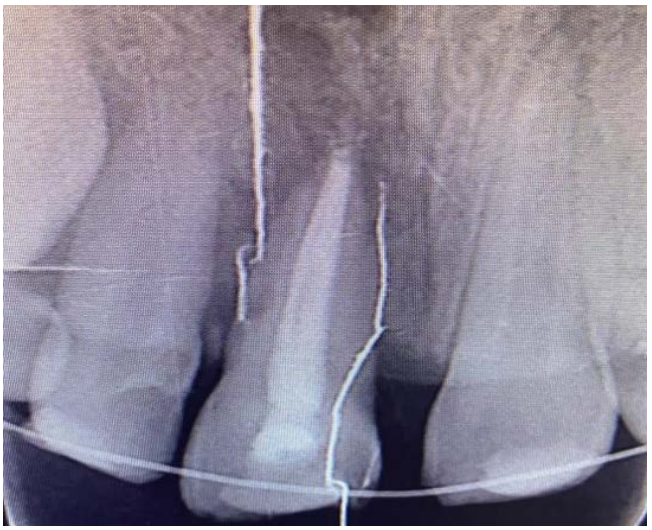

Figure 6: After root canal treatment

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After root canal treatment, splinting was removed because no mobility was observed in the patient's central incisor. (Figure 7-8). The fractured tooth was polymerized with a light device using bond (3M ESPE Simple Bond Universal, Germany) and composite (3M ESPE filtek, USA) restoration was completed (Figure 9). The patient was followed up with 2-weekly follow-up visits for 2 months, and then recommended for 6-month, 1-year and 5-year follow-up visits. At the end of the 6-month follow-up period, clinical and radiographic examinations revealed no resorption, marginal bone loss or pathology in the periapical tissues (Figure 10).

Figure 7-8: Intraoral examination after repositioning and splinting treatment

Figure 9: Clinical image after composite restoration

Figure 10: 6 month follow up

DISCUSSION

Intrusion is a severe dental injury with significant implications for the periodontal ligament, pulp, and alveolar bone (9). Intrusion is considered to have the worst prognosis because it causes significant damage to the periodontal ligament (PDL), pulp or alveolar bone (10). There are three ways to treat intruded teeth; spontaneous eruption, surgical extrusion and orthodontic extrusion (8). When spontaneous repositioning was not attempted, no significant difference was observed between orthodontic treatment and surgical repositioning. Since the surgical repositioning approach is a much less time-consuming process, this should be the preferred treatment option (11). Recently, it has also been documented that emergency surgical repositioning is the treatment of choice for completely intruded teeth (12). Emergency surgical repositioning is advocated for completely intruded teeth to displace the contaminated crown surface and reduce osteoclastic activity (10).

Dias et al. followed 20 central teeth treated with surgical extrusion for 3 years and 2 months and did not observe any clinical or radiographic findings at the end of this follow-up. Similarly, Kırzıoğlu and Karayılmaz did not observe any marginal bone loss, root resorption or periapical lesions after 48 months in teeth treated with surgical extrusion (8).

The idea that orthodontic extrusion of a tooth may be somewhat safer than surgical repositioning, but this small difference does not create an advantage due to reasons such as the ease of endodontic treatment, economic reasons, and the decrease in the frequency of the patient visiting the clinic, has made surgical repositioning a more preferable treatment method (13).

Orthodontic and surgical repositioning: available evidence comparing orthodontic extrusion and surgical repositioning of intruded teeth suggests no significant difference in the development of pulp necrosis, root resorption or marginal bone loss. However, surgical repositioning has been recommended in cases of severe intrusion of mature teeth to allow extirpation of the pulp canal (14).

According to the latest updated 2020 guideline of the Dental Traumatology Association Guidelines; spontaneous re-eruption in open apex, orthodontic extrusion if not occurring within 4 weeks, in closed apex if intrusion level is less than 3 mm, waiting for re-eruption if there is intrusion, if not occurring within 8 weeks, root canal treatment is performed in the 2nd week and splint is applied for 4 weeks, if 3-7 mm, orthodontic extrusion or surgical extrusion, root canal treatment is performed in the 2nd week,

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splint is applied for 4 weeks, if more than 7 mm, surgical extrusion, splint is applied for 4 weeks, root canal treatment is applied in the 2nd week (15). As in our case, since surgical extrusion is stated as a treatment option in cases where tooth intrusion exceeds 7 mm, surgical extrusion was preferred instead of orthodontic extrusion.

CONCLUSION

The treatment of an intruded tooth can be adapted depending on the condition of the tooth and complications. In our case, we performed surgical extrusion because the tooth was completely intruded. Effective management and adherence to follow-up protocols are crucial for favorable recovery outcomes. In addition, the patient's sensitivity to control examinations and home care positively supports recovery after traumatic dental injury. This clinical case report demonstrates that careful and continuous evaluation is necessary to follow the progression of the favourable healing outcome of a traumatically intruded permanent maxillary incisor and to determine the prognosis.

Author contribution: The authors confirm the compliance of their authorship with the international ICMJE criteria (all authors made a significant contribution to the development of the concept, preparation of the article, reviewed and approved the final version before publication).

*At the 29th International Turkish Pedodontics Association Congress, held at the Sheraton Ankara Hotel & Convention Center in Ankara on October 12-15, 2023, our study titled "Treatment Approach to Traumatically Intruded Maxillary Central Incisor: A Case Presentation" was evaluated by the scientific committee and accepted as a poster presentation.

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Root canal treatment in a spina bifida patient with developmental root-canal anomaly: Case Report

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Abstract

Neural tube defects are common congenital malformations that could be apparent at birth or manifested in later stages of life. Spina bifida is a type of neural tube defect that results from failure of neural tube closure during the first month in utero. Predisposition to dental caries, latex allergy, and craniosynostosis causing maxillary deficiency are some of the key problems in spina bifida.

Normal root development results from the induction between the hertwig epithelial root sheath and the dental papilla after enamel formation, whereas root anomalies are caused by complex interactions between genetic, epigenetic and environmental factors during these stages. It is very important to make the correct diagnosis in patients with special conditions and to start root canal treatment by considering various variations in order to achieve success. In this case, we present the root canal treatment of a patient diagnosed with spina bifida who presented to our clinic with pain in the right lower molar tooth and developmental root shape anomaly in the mandibular first molar teeth.

Case Reports (HRU Int J Dent Oral Res 2024; 4(3):127-132)

Keywords: Spina bifida, Root-canal anomalies, Root canal treatment, Molar-incisor malformation.

INTRODUCTION

In tooth development, after crown formation, root development begins with the interaction between the Hertwig epithelial root sheath and the dental papilla originating from ectomesenchyme. The dental papilla differentiates into odontoblasts to form dentin and pulp, while the Hertwig epithelial root sheath is associated with root number and morphology. However, as with the mechanism underlying crown formation, how root formation occurs has not yet been fully elucidated. Root malformations are the result of various genetic and developmental factors (1).

When pathologic conditions of root development are analyzed, short roots or absent roots are most often due to hard tissue resorption. Such secondary anomalies, which usually affect single teeth or small groups of teeth, often develop as a result of dentoperiodontal trauma, local inflammation, orthodontic tooth movement, endocrine disorders or tumors (2).

More rarely, radicular dysplasias can also develop as a result of a primary disruption or early disruption of normal root formation. Primary disruption of root development is associated with dentin dysplasia type 1 and regional odontodysplasia. In these two conditions, root dysplasia may be generalized or affect a specific part of the dental arch (3).

The most common root malformations can be subdivided into disorders of root development only and disorders of root development associated with a generalized dental dysplasia. Disorders of root

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development only include: premature cessation of root formation due to an external adverse effect, root enlargement, molar incisor malformation, short root anomaly, taurodontism. Disorders of root development associated with general dental dysplasia include; double teeth, regional odontodysplasia, hypophosphatasia, dentin dysplasia type I (2).

Neural tube defects are malformations related to abnormal neural tube closure. They occur between the third and fourth weeks of gestation and cause structural defects anywhere along the neural axis from the developing brain to the sacrum (4).

Genes play a common role in the development of neural tube defects by interacting with environmental factors. Genes such as Sonic Hedgehog, dishevelled and thermolabile variant of methylenetetrahydrofolate reductase (MTHFR) have been implicated in neural tube defects. In infants with mutations in the folate receptor-a gene, the risk of neural tube defects is increased due to decreased binding affinity for 5-MTHF, the physiologic form of folic acid. Neural tube defects can also be caused by hyperhomocysteinemia resulting from deficiency of vitamins B6, B11 and B12, which are involved in the methylation cycle. Low socioeconomic status, smoking, excess vitamin A, zinc deficiency and high levels of organic matter have been shown to be risk factors for neural tube defects. Maternal obesity, diabetes, colds in the first trimester, hyperthyroidism, stress, hyperthermia and infections have been found to be associated with neural tube defects. Antiepileptic drug use during pregnancy is associated with an increased risk of neural tube defects due to free radical-induced damage (4).

Spina bifida is a congenital malformation of the spinal cord associated with various vertebral abnormalities caused by incomplete closure of the neural tube. It is one of the most common malformations of the central nervous system (5).

Another issue that requires extra care during dental treatments is that patients with spina bifida are allergic to latex and the incidence of this allergy varies between 28% and 67%. As a matter of fact, it has been reported that 64% of spina bifida patients who have undergone more than one procedure are sensitized to latex and many of them experience life-threatening reactions (5).

In recent years, several case reports have presented root anomalies, usually involving the first permanent molars, rarely the deciduous second molars and the permanent upper central incisors. In this article, we present a case of root canal treatment of a patient diagnosed with spina bifida suggestive of an anomaly called molar incisor malformation or molar root-incisor malformation.

CASE REPORT

An 11-year-old male patient was admitted to our clinic with the complaint of nocturnal pain in the right mandibular region for about a week. In the anamnesis, it was learned that the patient had a history of spina bifida and had undergone surgery when he was three years old. In the anamnesis, it was learned that the patient had no history of allergy. A panoramic radiograph was obtained from the patient and root shape anomaly was observed in the mandibular first molars. Periapical radiograph obtained from the right lower mandibular region revealed a lesion in the apical part of the lower right first permanent teeth. Palpation was negative and percussion was positive. On clinical examination, no mobility, extraoral swelling, gingival abscess or fistula was observed. The patient's parents were informed about possible treatment options and it was decided to perform routine root canal treatment. Written informed consent was obtained from the family and root canal treatment was started on the lower right first permanent teeth . Latex-free materials were used for prophylactic purposes during the treatment. The endodontic cavity was prepared for root canal treatment with diamond rond and steel rond burs. A single canal entrance was found mesial to the pulp chamber floor. The working length of the mesiobuccal canal was first measured using an apex locator. Then, a number 10 K-file file was inserted into the root canal and periapical X-rays were taken and the measurement made with the apex locator was confirmed. The canal was expanded with endomotor files following the step-back technique. The first session ended with the placement of calcium hydroxide into the canal and temporary resorption following the root canal enlargement. The patient was recalled two weeks later. The canal was irrigated with 2.5% sodium hypochlorite and saline was used as the final flushing agent. The canal was dried and filled at the working length determined by the lateral condensation technique. The final restoration was made with composite. Informed consent form was obtained from the patient's parents to give permission for publication. The patient was followed up at the 1st and 3rd month follow-up visits and it was determined that the

patient's complaints were resolved and the lesion started to shrink in the periapical X-rays taken at both visits.

Figure 1. Panoramic X-ray image of the patient.

Figure 2. Anterior intraoral bite image of the patient.

Figure 3. Intraoral image of tooth number 46 before treatment

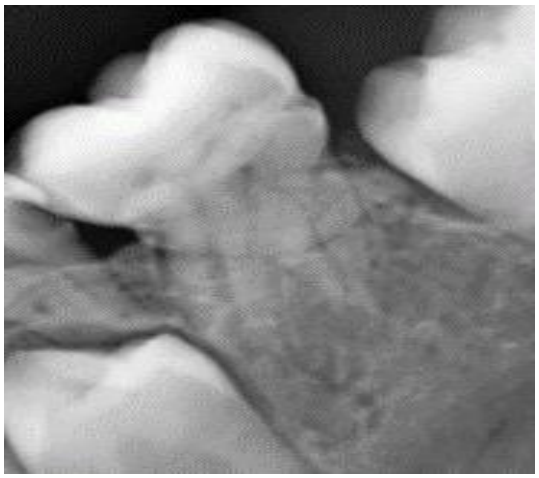

Figure 4. Periapical X-ray of tooth number 36.

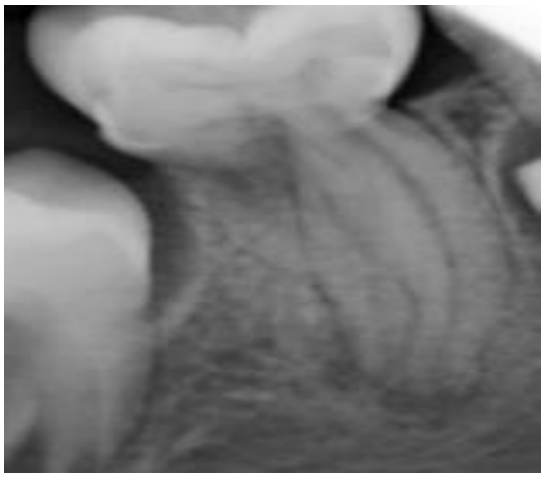

Figure 5. Periapical X-ray of tooth number 46.

Figure 6. Periapical Image of Mandibular Milk 2nd Molar

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Figure 7. File film of tooth number 46.

Figure 8. Post-treatment periapical image of tooth number 46.

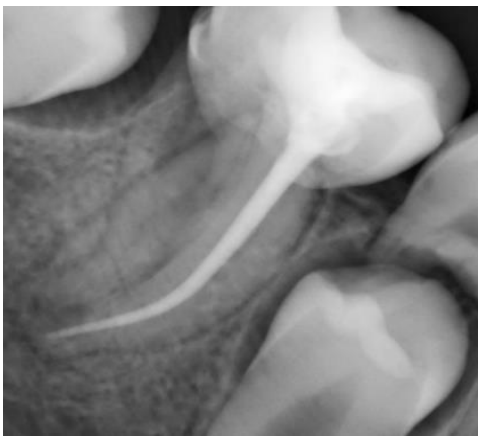

Figure 9. 3rd month follow-up periapical image.

DISCUSSION

Molar-incisor malformation (MIM) or molar root-incisor malformation (MRIM) is a dental anomaly that was first described in the literature in 2014 and can affect molars and maxillary central incisors (6,7).

The prevalence of MIM has not yet been precisely determined and it usually occurs in the first permanent molars, but it can also occur in the second molars, although this is rare (8).

Typical findings of molars with MIM are malformed roots that appear hypoplastic, incomplete or short and narrowed, and crowns that are narrowed from the cervical portion, reduced ceiling-to-floor distance in the pulp chamber, and a cleft appearance of the pulp chamber on radiographs. Similarly, maxillary central teeth may have crowns narrowed towards the cervical part and/or groove-like enamel defects. Molar crowns are not affected and appear clinically normal (6-9).

The etiology of MIM is unknown but has been described to be related to epigenetic mechanisms: A change in gene function and eventual phenotype without a change in DNA sequence (6). Medical conditions occurring in the first two years of life have been associated with this anomaly in root development. Remarkably, a significant proportion of affected patients have a history of neurological systemic disease such as meningitis, spina bifida, seizures, hydrocephalus or idiopathic brain diseases. Other less frequently described health conditions include preterm birth, abdominal tumor detected prenatally, kidney disease, urinary tract infection or staphylococcal infection diagnosed shortly after birth (8). Epigenetic changes resulting from important medical events such as surgery and drug use in the first years of life are also likely to affect the development of MIM (10). On the other hand, four individuals who did not show any disorder at birth or in the neonatal period have been described in the current literature (8).

Since the roots of the first permanent molar begin to form around the age of three, root malformation seems to be related to environmental factors that the patient experiences mostly in early childhood (11).

Propofol, commonly called “milk of anesthesia”, is one of the most popular intravenous anesthetic agents in modern medicine. Propofol has many pharmacologic advantages over other anesthetic agents, including rapid onset of action, short duration of action, and fewer side effects such as postoperative nausea (12).

The fact that propofol has many advantages and is frequently preferred today has led to the questioning of whether it is an ideal agent or not, and thus, researches on its potential harms have been conducted. Especially the

harmful effects of propofol on the developing brain tissue and neurologic system have been investigated in various studies (13-15).

Human brain tissue originates from the neural crista during embryonic development. Along with brain tissue, the formation of mesoderm, head skeleton, facial, trigeminal, and glassopharyngeal nerves, maxillary and mandibular bones, periodontal ligament, dentin tissue and alveolar bones also originate from neural crista. Except for the enamel of ectoderm origin, all other tissues and supporting structures of the tooth are formed with the support of neural crista cells (16).

Özer et al. 2017, the results of his thesis study show that dentin thickness and pulp chamber length are affected due to propofol administration during tooth development. In the findings obtained from histological examinations, it is seen that the predentin layer was affected in all experimental groups, and calcifications were observed in places, unlike the control group. The findings obtained from the study suggest that propofol may be effective on neurons and may affect the development of teeth developing from the same embryologic origin, but the results do not seem to be sufficient to reach a definite judgment (16).

Choi et al. 2022 published in vitro study showed that propofol, which is widely used in dental sedation, may have an inhibitory effect on odontogenic/ osteogenic differentiation of human dental pulp stem cells (17).

Our patient also had a history of surgery for spina bifida when she was 3 years old. Based on all these studies, it can be thought that the propofol taken by the patient during surgery may have caused the malformation of the lower first teeth. In the differential diagnosis of MIM, idiopathic root resorption, regional odontoplasia, dentin dysplasia type 1 and molar incisor hypoplasia (MIH) may be considered (18).

MIM can be diagnosed differently from other diseases showing root malformations. Dentin dysplasia type I is a hereditary disease that can affect the entire dentition, while molar incisor malformation is a non-hereditary disease localized to specific teeth. Regional odontodysplasia and molar incisor malformation are related in that both are non-hereditary and localized to a specific region. However, while regional odontodysplasia exhibits thin enamel, large pulp chambers and affects several adjacent teeth, molar incisor malformation exhibits none of these phenotypes. MIH is similar to MIM in that both are localized to the first permanent molar and maxillary incisor. However, teeth affected by MIH have weakened enamel with normal roots, whereas teeth affected by MIM exhibit normal enamel with abnormal roots (19).

Endodontic treatment is recommended when symptoms such as pain, abscess, periapical lesion and root resorption are present in molar incisor malformation (20). Two case reports of successful endodontic treatment have been reported. In the treatment of teeth with molar incisor malformation, Yue et al. successfully performed endodontic treatment of a thirteen-year-old boy's mandibular left permanent first molar with molar incisor malformation. Byun et al. performed endodontic treatment of a suspected maxillary incisor malformation in a twelve-year-old boy. Even if endodontic treatment was performed, it was reported that the prognosis was poor because the periodontal disease was more difficult to treat (21,22). The long-term prognosis of these cases needs to be determined. Therefore, more research is needed. Based on these studies, root canal treatment may be considered for apical abscesses in teeth with molar incisor malformation and preferably a conservative treatment approach may be chosen.

CONCLUSION

Molar root-incisor malformation or molar incisor malformation is a rare disorder characterized by permanent first molars, deciduous second molars and maxillary central incisors with a cervical notch, usually with normal crowns and malformed roots. Molar incisor malformation can cause mobility, loss of teeth and thus loss of space, spontaneous pain, periodontal disease and aesthetic problems in the incisors. Early diagnosis with the help of radiographs, including panoramic radiographs, is important to guide the treatment of the affected teeth.

It has been determined that there are very few studies and case reports in the literature on molar incisor malformation. It was concluded that further research on the subject could close this gap and guide physicians in diagnosis and treatment planning.

Additional Information

This study was presented as a poster presentation at the 1st Gaziantep University International Dentistry Congress (25-27 October 2024).

Conflıct of ınterest

None

Author contrubutıon R.M.: Investigation, Validation, Writing-review & editing R.M., ÖP.G.: Data analysis, follow-up case, methodology. R.M.: Data curation, Writing-review & editing, Data Analysis

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Stafne Mandıbular Bone Cavıty: Case Serıes

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Abstract

Stafne Mandibular Bone Cavity (SMBC) is an asymptomatic bone depression typically seen on the lingual surface of the mandible, often in the posterior region. It was first described by Edward C. Stafne in 1942. Although the etiology is not definitively known, it is thought that the submandibular salivary gland (at the posterior region) or the sublingual salivary gland (at they anterior region) causes bone resorption by exerting pressure on the mandible. SMBC is typically found in males, between the ages of 50-70 and is often detected incidentally on panoramic radiographs. In the case series, radiolucent areas were observed below the mandibular canal in 9 patients; 1 was irregular, 2 were round and 6 were oval in shape, all with well-defined borders. These structures do not require treatment and are monitored with regular clinical and radiological follow-ups.

Case Reports (HRU Int J Dent Oral Res 2024; 4(3):133-138)

Keywords: Bone, Case Series, Mandible.

INTRODUCTION

In 1942, Edward C. Stafne first described a series of asymptomatic radiolucent lesions in a region near the mandibular angle. Similar lesions have since been documented and are visualized as round or oval depressions on the lingual surface of the mandible. This bony depression has been variously labeled in the literature as “Stafne bone cyst,” “Stafne bone cavity,” “latent bone cyst,” “developmental bone defect of the mandible,” “idiopathic bone cavity,” “lingual cortical mandibular defect” and “lingual mandibular salivary gland depression” (1). Unlike true cysts, these lesions lack an epithelial lining. Various components, such as salivary gland tissue, muscle, lymphatic tissue, blood vessels, adipose tissue, and connective tissue, may be identified within these pseudocysts or bone cavities. To avoid confusion with true cysts, the lesion was classified as “Stafne mandibular bone cavity (SMBC)” in the 11th edition of the International Classification of Diseases (2). While the etiology of SMBC remains uncertain, several hypotheses have been proposed (3). The most widely accepted theory posits that the salivary gland exerts pressure on the lingual surface of the mandible, creating a depression in this region (4,5). Other theories suggest that SMBC is a developmental anomaly, with hypoplasia in the affected area of the mandible during growth, or associate it with abnormal vascular pressure from the facial artery (6,7). SMBC can be classified into four types: posterior lingual, anterior lingual, lingual ramus, and buccal ramus depressions (8,9). The posterior type typically presents as an oval or round radiolucent defect

with smooth, well-defined radiopaque borders, situated distally on the mandibular corpus between the first molar and the mandibular angle, below the mandibular canal (1,6). The anterior type is observed as a radiolucent defect between the canine and premolar regions of the mandible, above the mylohyoid muscle. While the characteristic radiographic features of the posterior type facilitate diagnosis, the anterior type's location may lead to misdiagnosis or confusion with other pathologies (10). The posterior lingual type is the most common, with the anterior type occurring less frequently, and the ramus type being the rarest (11). SMBC which can appear round, oval, or elliptical, are most commonly observed as unilocular; however, cases of multilocular formations have also been reported. While unilateral defects are more frequently encountered, bilateral cases are also documented in the literature.(12)

SMBC is most commonly seen in adults aged 50-70, rarely in individuals under 20, and predominantly in males (13). Due to its typical presentation on panoramic radiographs, SMBC is often incidentally detected (14). However, when atypical features are present, advanced imaging techniques, such as computed tomography (CT), cone-beam computed tomography (CBCT), magnetic resonance imaging (MRI), and sialography, may be required for differential diagnosis (15,16). Surgical intervention or biopsy is not indicated for these asymptomatic, non-progressive structural lesions; rather, regular clinical and radiological follow-up suffices. This case series discusses SMBCs incidentally identified in radiographs of nine patients who presented to our clinic at different times for various complaints.

CASE SERIES

All cases were asymptomatic, with radiolucent areas situated below the mandibular canal in the posterior mandibular region, consistent with a diagnosis of SMBC. Of the patients, seven were male and two were female, with an average age of 49.7 years. Four SMBC cases were on the right side, and five on the left; one was irregular in shape, two were round, and six were oval.

Case 1

A 57-year-old female patient with a history of diabetes presented to our clinic for prosthetic treatment. Panoramic radiography revealed an oval radiolucent area measuring 12.2 mm x 7.87 mm, located below the left mandibular canal with well-defined borders.

(Figure 1: Panoramic radiograph: at the left mandible showing an oval radiolucent area measuring 12.2 mm x 7.87 mm)

Case 2

A 47-year-old male patient with no systemic disease history presented for a routine check-up. Panoramic radiography revealed an oval radiolucent area measuring 15.73 mm x 10.27 mm, located below the left mandibular canal with well-defined borders.

(Figure 2: Panoramic radiograph: at the left mandible showing an oval radiolucent area measuring 15.73 mm x 10.27 mm)

Case 3

A 59-year-old male patient with hypertension and diabetes presented with periodontal disease. Panoramic radiography showed a radiolucent area of 30.97 mm x 14.7 mm located below the right mandibular canal with well-defined borders. Comparison with a previous panoramic radiograph taken two years earlier showed no change in size; hence, further imaging was not pursued. The lesion was monitored as an irregular Stafne bone cavity.

(Figure 3: Panoramic radiograph: at the right mandible showing an irregular radiolucent area measuring 30.97 mm x 14.7 mm)

Case 4

A 58-year-old male patient with a history of cardiac disease presented with pain in the lower right jaw. Panoramic radiography revealed an oval radiolucent area of 14.03 mm x 9.57 mm located below the left mandibular canal with well-defined borders.

(Figure 4: Panoramic radiograph: at the left mandible showing an oval radiolucent area measuring 14.03 mm x 9.57 mm)

Case 5

A 50-year-old male patient with no systemic disease history was referred for tomography for retreatment. Panoramic reformatted imaging showed an oval radiolucent area measuring 14.6 mm x 8.9 mm located below the right mandibular canal with well-defined borders.

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(Figure 5: Panoramic reformatted image: at the right mandible showing an oval radiolucent area measuring 14.6 mm x 8.9 mm)

Case 6

A 46-year-old female patient with no systemic disease history presented for tomography for an upper jaw implant. Panoramic reformatted imaging revealed an oval radiolucent area measuring 13.8 mm x 8.8 mm located below the right mandibular canal with well-defined borders.

(Figure 6: Panoramic reformatted image: at the right mandible showing an oval radiolucent area measuring 13.8 mm x 8.8 mm)

Case 7

A 31-year-old male patient with no systemic disease history presented for a routine check-up. Panoramic radiography showed an oval radiolucent area measuring 9.74 mm x 7.2 mm located below the left mandibular canal with well-defined borders.

(Figure 7: Panoramic radiograph: at the left mandible showing an oval radiolucent area measuring 9.74 mm x 7.2 mm)

Case 8

A 49-year-old male patient with diabetes and gastritis presented with tooth mobility. Panoramic radiography revealed a round radiolucent area measuring 6.5 mm x 4.62 mm located below the right mandibular canal with well-defined borders.

(Figure 8: Panoramic radiograph: at the right mandible showing a round radiolucent area measuring 6.5 mm x 4.62 mm)

Case 9

A 51-year-old male patient with no systemic disease history presented with pain in the right wisdom tooth area. Panoramic radiography revealed a round radiolucent area measuring 10.03 mm x 8.04 mm located below the left mandibular canal with well-defined borders.

(Figure 9: Panoramic radiograph: at the left mandible showing a round radiolucent area measuring 10.03 mm x 8.04 mm)

Figure 1. Panoramic radiograph: at the left mandible showing an oval radiolucent area measuring 12.2 mm x 7.87 mm.

Figure 2. Panoramic radiograph: at the left mandible showing an oval radiolucent area measuring 15.73 mm x 10.27 mm.

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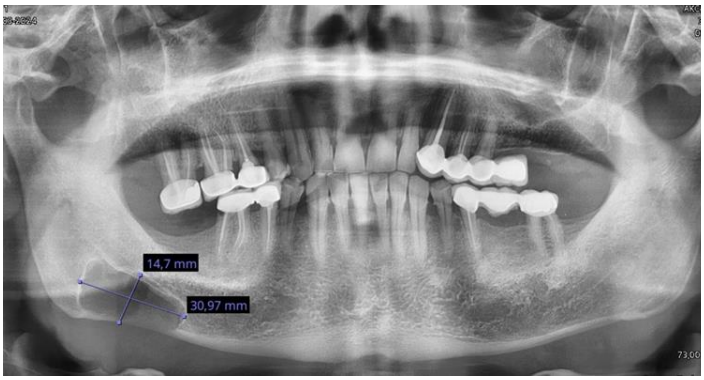

Figure 3. Panoramic radiograph: at the right mandible showing an irregular radiolucent area measuring 30.97 mm x 14.7 mm.

Figure 4. Panoramic radiograph: at the left mandible showing an oval radiolucent area measuring 14.03 mm x 9.57 mm.

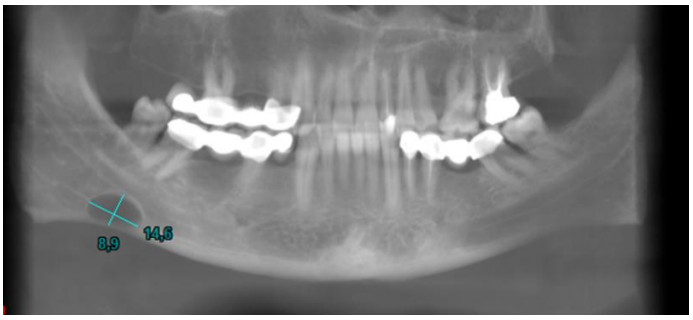

Figure 5. Panoramic reformatted image: at the right mandible showing an oval radiolucent area measuring 14.6 mm x 8.9 mm.

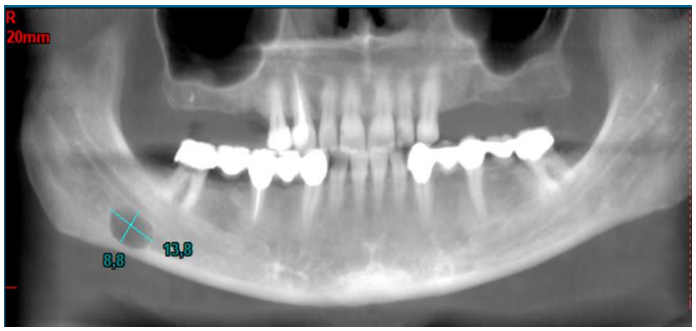

Figure 6. Panoramic reformatted image: at the right mandible showing an oval radiolucent area measuring 13.8 mm x 8.8 mm.

Figure 7. Panoramic radiograph: at the left mandible showing an oval radiolucent area measuring 9.74 mm x 7.2 mm.

Figure 8. Panoramic radiograph: at the right mandible showing a round radiolucent area measuring 6.5 mm x 4.62 mm.

Figure 9. Panoramic radiograph: at the left mandible showing a round radiolucent area measuring 10.03 mm x 8.04 mm.

DISCUSSION

SMBC is generally an asymptomatic, rare lingual bony depression located in the posterior mandible below the mandibular canal. Often incidentally identified during routine radiographic examinations, it predominantly affects males, particularly those aged 50-70 (4,17). In alignment with the literature, our case series included patients with lesions localized in the posterior mandible, all asymptomatic. The cases predominantly involved male patients, with an average age of 49.7 years (range: min 31- max 59 years).

In a retrospective study by Yüksel Kaya et al. (2023), 16,115 panoramic radiographs were examined, identifying 15 patients (0.09%) with SMBC, most of which were oval with thick sclerotic borders and heterogeneous radiolucent content (18). Similarly, in the study by Bağcı and Peker (2024), retrospective CBCT images from 1,664 patients revealed SMBC in 8 patients (0.48%), all of which were unilateral, oval, and located in the posterior mandible (19). A study by Son et al. (2024) of 32 SMBC patients imaged via panoramic radiography and CBCT found that SMBC is commonly located in the posterior mandibular body and is predominantly observed in males (2).

Although the precise etiology of SMBC is unclear, the most widely accepted theory suggests that pressure from the submandibular gland (posterior region) or sublingual salivary glands (anterior region) on the lingual cortex of the mandible leads to localized bone resorption (18,12). In a case series by Öztürk et al. (2023), SMBC was frequently reported to contain salivary gland tissue and was characterized as a developmental anomaly resulting from pressure on the lingual mandibular cortex (12). Son et al. (2024) proposed that SMBC formation may involve salivary gland tissue becoming embedded within the lingual region during mandibular development or bone resorption. Other hypotheses suggest that SMBC may develop over time, with factors like the pulsation of the facial artery leading to bone resorption on the mandible's lingual surface (2) The formation mechanism of Stafne bone cavities is generally thought to be related to the pressure exerted by salivary glands on the mandible. While major salivary glands, such as the submandibular gland, are anatomically adjacent to the posterior mandible, no such anatomical relationship exists in the ramus region. The absence of structures such as salivary glands capable of exerting pressure in the ramus area may limit the formation of lesions in this region. Similarly, the anterior variant, which is thought to be associated with the sublingual gland, may be rarer due to the less pronounced salivary gland pressure in this region and the lower incidence of developmental tissue entrapment. (2,12,19)

Although SMBC sizes generally range from 0.5 to 2 cm, with an average of 1.2 cm, defects as large as 9 cm have been documented (12). In our case series, the mean horizontal dimension was calculated as 14.8 mm and the mean vertical dimension as 8.89 mm.

The differential diagnosis for SMBC includes a range of radiolucent mandibular pathologies, such as periapical cysts, simple bone cysts, traumatic bone cysts, odontogenic keratocysts, dentigerous cysts, giant cell tumors, metastases, non-ossifying fibromas, ameloblastomas, vascular malformations, basal cell nevus syndrome, fibrous dysplasia, focal osteoporotic bone defects, and Brown tumors associated with hyperparathyroidism (12). Advanced imaging modalities such as sialography, CT, CBCT, or MRI may aid in distinguishing SMBC from other pathologies and in examining its relationship to adjacent anatomical structures (18).

A limitation of this study is the necessity for periodic follow-up to assess whether there are any changes in the size of SMBCs to ensure the validity of diagnostic accuracy. In cases of potential changes, the use of advanced imaging modalities could be required and this study is limited to only 9 cases, and studies conducted

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with a larger sample group will enhance the generalizability of the results.

Regular clinical and radiological follow-up is sufficient for SMBC management. However, if alterations in lesion size or morphology are noted during follow-up, surgical intervention and tissue biopsy are recommended to differentiate SMBC from other potential lesions.

Contribution of the authors:

The authors confirm the compliance of their authorship with the international ICMJE criteria (all authors made a significant contribution to the development of the concept, preparation of the article, reviewed and approved the final version before publication).

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