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FROM THE EDITOR

We are very pleased to announce to you that our journal, Eurasian Dental Research, which is a new scientific journal in the field of dentistry, has started its publication life.

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We will be happy to see your scientific studies and articles in Eurasian Dental Research, the journal of our Faculty.

Prof. Dr. İlknur ÖZCAN
Editor in Chief

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https://doi.org/10.62243/edr.1487026

Evaluation of Online Orthodontics Course Perceptions and Learning Levels of Dentistry Faculty Students

Esra ÇİFÇİ ÖZKAN[1], Şirin HATİPOĞLU[1], Ayşe KARKAÇ[2]

Abstract

Aim This study aimed to evaluate the perceptions, learning levels, and overall experience of dental school students regarding the online Orthodontics course

Material and method In this cross-sectional study, 145 participants answered a 25-question survey using Google Forms. The questionnaires were sent to the study participants via e-mail. The findings were analyzed by the Pearson Chi-Square test when the sample size assumption was met (n>5) and Fisher's Exact test when it was not met. Multiple Chi-Square test was used to investigate the relationship between multiple-choice questions.

Results A total of 145 participants answered 25 survey questions between February 2022 and May 2022. It was determined that 62.1% of the participants were female and 75.9% were 4th-grade students. It was determined that 57.9% of the participants attended all online courses. Although most of the participants thought that online orthodontic education was well structured (53.1%), well understood (53.8%), had good audio-visual quality (60%), was a good option for orthodontic theoretical learning (54.5%), and provided motivation (42.8%), only 36.7% preferred online education to face-to-face education. It was found that the majority of the participants (37.2%) thought that the amount of online education in the future curriculum should be in the range of 0-25%, regardless of the pandemic.

Conclusion Although students' perceptions and evaluations of online courses were found to be positive, they prefer face-to-face education.

Keywords Dental students, Learning level, Online learning, Orthodontic education, Undergraduate

Introduction

Online learning is a system where education can be obtained through Internet access (1). Although online education and courses are organized in various branches of the field of education, online education has become mandatory due to the restriction measures implemented to slow down the transmission rate of the virus, especially during the pandemic period experienced worldwide in recent years (2). During this period, the field of education has undergone a major transformation from face-to-face classes to online learning (3).

Dental schools have also suspended preclinical and clinical activities and switched to online education as part of pandemic restrictions (4). In dental schools, students should be trained through both theoretical and clinical courses in order to have the necessary competencies. Hands-on training with mannequins in the preclinical phase and patient care in the clinical phase is essential. In clinical education, dental students learn about the patient approach, intervention method/time, and evaluation of treatment results (5). As in all branches of dentistry, clinical education is essential in orthodontics. Although the pandemic period is considered to have created a chance for new developments in theoretical and clinical education by accelerating digital transformation in online learning, online education could only be applied to theoretical learning content (6).

Although online learning encourages flexibility and allows students to learn wherever they want, the sudden shift to online learning has raised a variety of worries and questions (7,8). While online learning has advantages such as eliminating place and time barriers and introducing new trends in learning, it has several disadvantages including social isolation, additional costs, and technical problems (9). Although the anxiety of being away from the motivation provided by being together with the lecturer and other students during face-to-face education and the necessity to continue their education effectively in a new system by moving away from the system they are used to are worrying for students, research has reported that well-designed online education may increase willingness and perseverance to learn (8,10-12). It was aimed to evaluate the students' perspectives towards the online orthodontics course and to provide data for the development of online learning with this study.

Material and Methods

This cross-sectional survey was conducted between February 2022 and May 2022 with 145 participants, who were 4th

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and 5th-year students of the Faculty of Dentistry of different Universities, who consented to participate in the study and who had taken Online Orthodontics course during the pandemic period on properly completed questionnaire forms. The questionnaires were sent to the participants as online Google forms. Participants who did not want to participate in the study, students who did not attend the online Orthodontics course, and questionnaires that were not answered properly were excluded from the study. The questionnaire consisted of a total of 25 questions, including 3 personal information questions including gender, nationality, and the class they attended, 7 questions about the frequency of participation in the online orthodontics course, 7 questions about the evaluation of the online orthodontics course, 9 questions about the comparison of face-to-face education and online education, 4 questions about the device they used for online connection, internet connection, the place where they participated in online education, and 4 questions about what percentage of orthodontic education should be included in their education.

Confidentiality regarding the participants' responses was maintained throughout the study. Institutional ethics committee approval (2021/63-06) was obtained before starting the study.

Statistical analysis

The g-power analysis of the study was conducted. According to the g-power analysis of the study, the effective rate was calculated as 0.2 and 60 people were expected to participate in the survey. Since there is no upper limit for participation in the study, the total sample size in this study was taken as 145 people and t-test was applied with α= 0.05 at 95% confidence level.

The Pearson Chi-Square test was used to look at how categorical data related to one another when the sample size assumption was met (n>5) and by Fisher's Exact test when it was not met. Multiple Chi-Square test was used to investigate the relationship between multiple-choice questions. Analyses were performed in IBM SPSS 25 (IBM Corp. Armonk, NY, USA) program.

Results

In the study, it was found that 62.1% of the participants were female and 75.9% were 4th-grade students. It was observed that 57.9% of the participants attended all online courses, while 3.4% did not attend any online courses.

The majority of participants found online orthodontic education to be well organized (53.1%), well understood (53.8%), and of good audiovisual quality (60.0%), making it a good option for learning orthodontic theory (54.5%). It was discovered that a significant portion of participants preferred in-person instruction to online instruction (46,9%- who think otherwise: 35.8%), and a significant portion felt that online orthodontic education did not adequately prepare them for orthodontic practice (46.2% - who think otherwise: 27.5%).

When the participants compared face-to-face education with online education, it was found that the majority of the participants thought that online education was easier to participate in (76.6%), required less effort (67.6%), and was more modern (56.6%). On the other hand, when better knowledge transfer (57.9%), easier-to-ask questions (55.2%), more fun (66.2%), more understandable (55.2%), and better learning (54.5%), were compared, it was determined that the majority preferred face-to-face courses.

Table 1: The relationship between the participants' answers to the question "How often have you participated in online Orthodontics courses" and their answers to the question "Online learning was well structured"

		None	Very little	half the lessons	To all of them	No answer	Test Statistics	p
I strongly disagree	n	1	3	4	4	1	23,172**	,044*
	%	7,7	23,1	30,8	30,8	7,7		
	%S.	20	21,4	11,4	4,8	14,3		
I do not agree	n	0	2	1	3	0		
	%	0	33,3	16,7	50	0		
	%S.	0	14,3	2,9	3,6	0		
I'm undecided	n	4	5	10	29	1		
	%	8,2	10,2	20,4	59,2	2		
	%S.	80	35,7	28,6	34,5	14,3		
I agree	n	0	3	19	34	4		
	%	0	5	31,7	56,7	6,7		
	%S.	0	21,4	54,3	40,5	57,1		
Absolutely I agree	n	0	1	1	14	1		
	%	0	5,9	5,9	82,4	5,9		
	%S.	0	7,1	2,9	16,7	14,3		

**p<0,05 **Fisher's Exact test*

It was found that the majority of the participants (37.2%) thought that the amount of online education should be in the range of 0-25% in the upcoming curricula, 64% of the participants participated in online education with a laptop, 73.8% of the participants used LAN (Local Area Network) for connection, and 63% of the participants rarely experienced connection problems.

Table 2: Relationship and cross-tabulation between the participants' answers to the question "How often have you attended online Orthodontics courses" and their answers to the question "Easier participation"

		None	Very little	half the lessons	To all of them	No answer	Test Statistics	p
Face-to-face education	n	1	3	5	15	0	22,371**	,011*
	%	4,2	12,5	20,8	62,5	0		
	%S.	20	21,4	14,3	18,1	0		
Equal	n	1	1	1	1	1		
	%	20	20	20	20	20		
	%S.	20	7,1	2,9	1,2	14,3		
Online education	n	1	10	28	66	6		
	%	0,9	9	25,2	59,5	5,4		
	%S.	20	71,4	80	79,5	85,7		
No answer	n	2	0	1	1	0		
	%	50	0	25	25	0		
	%S.	40	0	2,9	1,2	0		

**p<0,05 **Fisher's Exact test*

A statistically significant relationship was found only between the answers given to the question "What type of internet connection did you use the most?" and the gender of the participants (p<0.05). When the observations were analyzed for the reason of the relationship, it was determined that the people using

WLAN (Wireless Local Area Network) were mostly female and the people using LAN were mostly male. In other questions, gender and the provided answers had no statistically significant correlation (p>0,05).

Table 3: The relationship between the participants' answers to the question "How much online learning should be related to the theoretical part of Orthodontic education in the future curriculum " and their answers to the questions in the section "To what extent does it apply to online Orthodontic learning" and cross table

			0-25%	26-50%	51-75%	76-100%	Test Statistics	p
1. Online learning was well structured.	I strongly disagree	n	8	3	1	1	25,760**	,004*
		%	61,5	23,1	7,7	7,7		
		%S.	14,8	11,1	2,9	3,4		
	I do not agree	n	4	0	1	1		
		%	66,7	0	16,7	16,7		
		%S.	7,4	0	2,9	3,4		
	I'm undecided	n	22	11	13	3		
		%	44,9	22,4	26,5	6,1		
		%S.	40,7	40,7	37,1	10,3		
	I agree	n	18	10	17	15		
		%	30	16,7	28,3	25		
		%S.	33,3	37	48,6	51,7		
	Absolutely I agree	n	2	3	3	9		
		%	11,8	17,6	17,6	52,9		
		%S.	3,7	11,1	8,6	31		
2. The level of understanding of online learning was good.	I strongly disagree	n	12	5	1	4	41,255**	,000*
		%	54,5	22,7	4,5	18,2		
		%S.	22,2	18,5	2,9	13,8		
	I do not agree	n	8	0	0	3		
		%	72,7	0	0	27,3		
		%S.	14,8	0	0	10,3		
	I'm undecided	n	16	6	10	2		
		%	47,1	17,6	29,4	5,9		
		%S.	29,6	22,2	28,6	6,9		
	I agree	n	17	14	20	9		
		%	28,3	23,3	33,3	15		
		%S.	31,5	51,9	57,1	31		
	Absolutely I agree	n	1	2	4	11		
		%	5,6	11,1	22,2	61,1		
		%S.	1,9	7,4	11,4	37,9		
3. The image and sound quality of online learning was good.	I strongly disagree	n	9	3	2	4	29,226**	,002*
		%	50	16,7	11,1	22,2		
		%S.	16,7	11,1	5,7	13,8		
	I do not agree	n	5	2	0	1		
		%	62,5	25	0	12,5		
		%S.	9,3	7,4	0	3,4		
	I'm undecided	n	15	8	6	3		
		%	46,9	25	18,8	9,4		
		%S.	27,8	29,6	17,1	10,3		
	I agree	n	23	11	23	9		
		%	34,8	16,7	34,8	13,6		
		%S.	42,6	40,7	65,7	31		
	Absolutely I agree	n	2	3	4	12		
		%	9,5	14,3	19	57,1		
		%S.	9	3	2	4		
4.In the current situation, online learning was a good option to learn the theoretical part of education.	I strongly disagree	n	15	7	4	0	48,188**	,000*
		%	57,7	26,9	15,4	0		
		%S.	27,8	25,9	11,4	0		
	I do not agree	n	7	0	0	3		
		%	70	0	0	30		
		%S.	13	0	0	10,3		
	I'm undecided	n	16	8	5	1		
		%	53,3	26,7	16,7	3,3		
		%S.	29,6	29,6	14,3	3,4		
	I agree	n	13	6	16	11		
		%	28,3	13	34,8	23,9		
		%S.	24,1	22,2	45,7	37,9		
	Absolutely I agree	n	3	6	10	14		
		%	9,1	18,2	30,3	42,4		
		%S.	5,6	22,2	28,6	48,3		
5. By participating in online learning, I feel well-prepared for the practical part of education.	I strongly disagree	n	16	11	7	3	36,885**	,000*
		%	43,2	29,7	18,9	8,1		
		%S.	29,6	40,7	20	10,7		
	I do not agree	n	15	4	6	5		
		%	50	13,3	20	16,7		
		%S.	27,8	14,8	17,1	17,9		
	I'm undecided	n	17	7	9	4		
		%	45,9	18,9	24,3	10,8		
		%S.	31,5	25,9	25,7	14,3		
	I agree	n	6	3	11	5		
		%	24	12	44	20		
		%S.	11,1	11,1	31,4	17,9		
	Absolutely I agree	n	0	2	2	11		
		%	0	13,3	13,3	73,3		
		%S.	0	7,4	5,7	39,3		

6. The use of new digital teaching methods motivates me to learn.	I strongly disagree	n	18	5	1	3	47,174**	,000*
		%	66,7	18,5	3,7	11,1		
		%S.	33,3	18,5	2,9	11,1		
	I do not agree	n	9	1	1	1		
		%	75	8,3	8,3	8,3		
		%S.	16,7	3,7	2,9	3,7		
	I'm undecided	n	18	9	12	3		
		%	42,9	21,4	28,6	7,1		
		%S.	33,3	33,3	34,3	11,1		
	I agree	n	9	8	15	10		
		%	21,4	19	35,7	23,8		
		%S.	16,7	29,6	42,9	37		
	Absolutely I agree	n	0	4	6	10		
		%	0	20	30	50		
		%S.	0	14,8	17,1	37		
7. I think online learning is useful and I will prefer it to "normal" face-to-face learning in the future.	I strongly disagree	n	13	7	5	3	88,859**	,000*
		%	46,4	25	17,9	10,7		
		%S.	24,1	25,9	14,3	10,7		
	I do not agree	n	33	2	2	3		
		%	82,5	5	5	7,5		
		%S.	61,1	7,4	5,7	10,7		
	I'm undecided	n	5	9	8	2		
		%	20,8	37,5	33,3	8,3		
		%S.	9,3	33,3	22,9	7,1		
	I agree	n	3	7	18	7		
		%	8,6	20	51,4	20		
		%S.	5,6	25,9	51,4	25		
	Absolutely I agree	n	0	2	2	13		
		%	0	11,8	11,8	76,5		
		%S.	0	7,4	5,7	46,4		

*p<0,05 **Fisher's Exact test

When the relationship between the answers to the question "How often did you participate in online Orthodontics courses?" and the answers to the question "Online learning was well structured" was analyzed, a statistically significant relationship was found between the answers (p= .044). When the observations were analyzed for the reason of the relationship, it was observed that the people who attended "none" and "very little" of the courses gave the answers "undecided" and "strongly disagree", and the people who attended half and all of the courses mostly gave the answers "agree" and "strongly agree" (Table 1).

A statistically significant relationship was found between the 'frequency of participation in online courses' and the answers to the question "Easier participation" (p= .011). It was determined that the people who thought that online participation was easy mostly attended half and all of the courses (Table 2).

It was determined that the people who used the mobile network mostly connected via telephone and the people who used WLAN mostly connected via laptop (p= .000). A statistically significant relationship was found between the devices used and the frequency of having problems with the connection (p= .029). It was determined that the people who had 'very rarely' or 'never' problems mostly used laptops.

The answers given regarding the structuring of online orthodontic learning (p= .004), level of comprehension (p= .000), image and sound quality (p= .002), whether it is a good option to learn the theoretical parts of the lesson (p=.000), whether it provides good preparation for the practical parts of the lesson (p= .000), whether it provides learning motivation (p= . 000), whether it is preferable to face-to-face education (p= .000) are given in Table 3. Statistically significant relationships were found between the answers given to the question "How much online learning should be related to the theoretical part of Orthodontic education in the upcoming curricula "(Table 3).

The answers given regarding 'easier participation' (p= .001), 'better knowledge transfer' (p= .000), 'easier to ask questions' (p= .000), 'more fun' (p= .000), 'more modern' (p= .000), 'more understandable' (p= .000), 'better learning' (p= .000), 'better focus' (p= . 000) and the answers to the question "What should be the amount of online learning related to the theoretical part of orthodontic education in the upcoming curricula" are given in Table 4.

Table 4: The relationship and cross-tabulation between the participants' answers to the questions "To what extent should online learning be associated with the theoretical part of Orthodontic education in the future curriculum?" and "Explain whether face-to-face and online Orthodontic education differ according to the following topics"

			0-25%	26-50%	51-75%	76-100%	Test Statistics	p
1.Less effort?	Face to face education	n	11	3	2	1	11,988**	0,154
		%	64,7	17,6	11,8	5,9		
		%S.	20,4	11,1	5,7	3,6		
	Equal	n	5	6	6	8		
		%	20	24	24	32		
		%S.	9,3	22,2	17,1	28,6		
	Online education	n	37	18	25	18		
		%	37,8	18,4	25,5	18,4		
		%S.	68,5	66,7	71,4	64,3		
	No answer	n	1	0	2	1		
		%	25	0	50	25		
		%S.	1,9	0	5,7	3,6		
2.Easier participation?	Face to face education	n	18	3	1	2	21,779**	,001*
		%	75	12,5	4,2	8,3		
		%S.	33,3	11,1	2,9	7,1		
	Equal	n	1	2	2	0		
		%	20	40	40	0		
		%S.	1,9	7,4	5,7	0		
	Online education	n	33	22	30	26		
		%	29,7	19,8	27	23,4		
		%S.	61,1	81,5	85,7	92,9		
	No answer	n	2	0	2	0		
		%	50	0	50	0		
		%S.	3,7	0	5,7	0		

3.Better information transfer?	Face to face education	n	50	14	12	8	59,209**	,000*
		%	59,5	16,7	14,3	9,5		
		%S.	92,6	53,8	34,3	28,6		
	Equal	n	2	8	13	5		
		%	7,1	28,6	46,4	17,9		
		%S.	3,7	30,8	37,1	17,9		
	Online education	n	1	4	7	14		
		%	3,8	15,4	26,9	53,8		
		%S.	1,9	15,4	20	50		
	No answer	n	1	0	3	1		
		%	20	0	60	20		
		%S.	1,9	0	8,6	3,6		
4.Ability to ask questions more easily?	Face to face education	n	43	14	17	6	35,423**	,000*
		%	53,8	17,5	21,3	7,5		
		%S.	79,6	51,9	50	21,4		
	Equal	n	6	8	7	7		
		%	21,4	28,6	25	25		
		%S.	11,1	29,6	20,6	25		
	Online education	n	4	4	10	15		
		%	12,1	12,1	30,3	45,5		
		%S.	7,4	14,8	29,4	53,6		
	No answer	n	1	1	0	0		
		%	50	50	0	0		
		%S.	1,9	3,7	0	0		
5.More fun?	Face to face education	n	48	17	21	10	31,886**	,000*
		%	50	17,7	21,9	10,4		
		%S.	88,9	65,4	61,8	35,7		
	Equal	n	3	5	7	6		
		%	14,3	23,8	33,3	28,6		
		%S.	5,6	19,2	20,6	21,4		
	Online education	n	1	4	5	11		
		%	4,8	19	23,8	52,4		
		%S.	1,9	15,4	14,7	39,3		
	No answer	n	2	0	1	1		
		%	50	0	25	25		
		%S.	3,7	0	2,9	3,6		
6.More modern?	Face to face education	n	22	2	2	1	33,752**	,000*
		%	81,5	7,4	7,4	3,7		
		%S.	40,7	7,4	5,9	3,4		
	Equal	n	10	6	7	3		
		%	38,5	23,1	26,9	11,5		
		%S.	18,5	22,2	20,6	10,3		
	Online education	n	17	18	23	24		
		%	20,7	22	28	29,3		
		%S.	31,5	66,7	67,6	82,8		
	No answer	n	5	1	2	1		
		%	55,6	11,1	22,2	11,1		
		%S.	9,3	3,7	5,9	3,4		
7. More understandable?	Face to face education	n	51	12	11	6	73,171**	,000*
		%	63,8	15	13,8	7,5		
		%S.	94,4	44,4	31,4	20,7		
	Equal	n	2	10	12	8		
		%	6,3	31,3	37,5	25		
		%S.	3,7	37	34,3	27,6		
	Online education	n	0	5	11	15		
		%	0	16,1	35,5	48,4		
		%S.	0	18,5	31,4	51,7		
	No answer	n	1	0	1	0		
		%	50	0	50	0		
		%S.	1,9	0	2,9	0		
8.Better learning?	Face to face education	n	48	13	11	7	56,376**	,000*
		%	60,8	16,5	13,9	8,9		
		%S.	88,9	50	31,4	24,1		
	Equal	n	4	8	12	7		
		%	12,9	25,8	38,7	22,6		
		%S.	7,4	30,8	34,3	24,1		
	Online education	n	1	4	11	15		
		%	3,2	12,9	35,5	48,4		
		%S.	1,9	15,4	31,4	51,7		
	No answer	n	1	1	1	0		
		%	33,3	33,3	33,3	0		
		%S.	1,9	3,8	2,9	0		
9.Better focus?	Face to face education	n	50	16	10	6	68,641**	,000*
		%	61	19,5	12,2	7,3		
		%S.	92,6	59,3	29,4	20,7		
	Equal	n	1	3	7	8		
		%	5,3	15,8	36,8	42,1		
		%S.	1,9	11,1	20,6	27,6		
	Online education	n	1	7	17	15		
		%	2,5	17,5	42,5	37,5		
		%S.	1,9	25,9	50	51,7		
	No answer	n	2	1	0	0		
		%	66,7	33,3	0	0		
		%S.	3,7	3,7	0	0		

*p<0,05 **Fisher's Exact test

Discussion

Online education has taken its place in our educational life with its advantages and disadvantages. Today, online education is a good alternative to face-to-face education to ensure continuity of education in pandemics, natural disasters, or compulsory situations. Due to the importance of online education in our lives, it has become extremely important to structure online education, its validity for orthodontic learning and to investigate whether it differs from face-to-face education. This study aimed to evaluate the perceptions and general experiences of the students of the Faculty of Dentistry regarding the online orthodontics course, and since it did not include the evaluation of the courses academically, the grade of the participants was ignored in the evaluation of the results.

In the findings of the study, although the majority of the participants stated that they thought that online orthodontic education was "well structured" (53.1%), "comprehension level" was

good (53.8%), "audiovisual quality" was good (60%) and "it is a good option for orthodontic theoretical learning" (54.5%); it was found that the rate of those who thought that "new digital teaching methods motivate learning" was 42.8% and only 35.8% preferred online education to face-to-face education. In this study, although the answers of the participants to the comparison of face-to-face education and online education, it was determined that the majority of those who thought that participation in online education was easier, required less effort, and was more modern; when compared in terms of better knowledge transfer, easier to ask questions, more fun, more understandable and better learning, it was determined that the majority of students preferred face-to-face courses. This finding is similar to the findings of Nold et al.. In their study, they reported that the vast majority of the participants, 88.1%, preferred face-to-face education, despite having experience in digital teaching. It has been reported that the disadvantages of online learning, such as eyestrain or lack of motivation caused by working in front of the screen, may be the reasons for this result.13 The main barriers to online learning are technical barriers, the inapplicability of some subjects, and limited interaction (9).

In their study to evaluate academic performance before and during the COVID-19 pandemic in medical education, Istadi et al. reported that students showed low rates of success during the pandemic period and the reason for this was the lack of direct social interaction, lack of practical face-to-face education, technical problems such as unstable internet access, and sudden transition to online learning without adequate technological support quality (14). In our study, in the technical evaluation of online education, they reported that orthodontic education was "well structured", "level of understanding" was good, "audio-visual quality" was good, and they had very few problems with internet connection. No matter how advanced the technological possibilities are, online education lacks hands-on training and interactive discussions (15). In our study, the participating students stated that they preferred face-to-face courses in terms of 'better knowledge transfer', 'easier to ask questions', 'more fun', 'more understandable', and 'better learning'. Dental students are required to acquire both theoretical and practical knowledge to fulfill the necessary competencies. Practical application has an important place in dentistry faculty education. Although online learning lacks practical hands-on training, the use of digital strategies through software that can create and reproduce virtual three-dimensional models accessible to computers and mobile devices can be used as an alternative to online practical applications (16,17). Such digital approaches help students learn techniques applied to different dental specialties but do not replace clinical practice with patients.

Combining online and traditional courses is a consistent design approach that helps students combine the strengths of online and traditional learning to effectively achieve their educational goals. Furthermore, such blended learning supports innovative continuous learning beyond the classroom and has been reported to provide generally positive experiences among undergraduate students (18,19).

Conclusion

Today, online education has assumed an important role in providing students with good academic and psychological support, and in ensuring the continuity of education in case of epidemics, natural disasters, or compulsory situations that may be encountered in the future. Students prefer face-to-face classes instead of online learning and think that online learning does not adequately prepare them for the practical part of education. There is a need for new practices to support and encourage online learning in education models with a practical application pillar.

Declarations

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Effectiveness of Tens in Pain Management During Restorative Treatment

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Abstract

Aim This study aims to evaluate the effectiveness of Transcutaneous Electrical Nerve Stimulation (TENS) in managing pain during restorative dental treatments.
Material and method A total of 45 patients aged 18 to 41 were selected for the study. Patients were divided into two groups: 30 patients received active TENS treatment, while 15 received a placebo TENS treatment. TENS was applied for 30 minutes during cavity preparations without the use of local anesthesia. Pain levels were assessed using the Visual Analog Scale (VAS) immediately after the procedure.
Results Among the active TENS group, 28 patients reported no pain during the procedure, while 2 patients experienced moderate pain. In the placebo group, pain levels ranged from 4 to 9 on the VAS. The results were analyzed using the Mann-Whitney U test, revealing a statistically significant difference in pain perception between the active TENS and placebo groups.
Conclusion The findings suggest that TENS is effective in reducing pain during restorative dental treatments. The application of TENS could serve as a viable alternative or adjunct to traditional analgesic methods, providing a non-invasive and cost-effective option for pain management in dental procedures. Further research is recommended to explore the broader applications of TENS in dentistry and its long-term efficacy.

Keywords Dentistry, Pain, Restorative, TENS, Treatment

Introduction

Pain, due to the complexity of its neurophysiology, represents one of the most critical issues that need to be addressed in medicine, particularly in dentistry (1).

The International Association for the Study of Pain defines pain as a sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage, originating from any part of the body. Tolerance to pain varies among individuals and can fluctuate within the same person depending on external factors. Pain is a sensory load that is learned through experiences and is always subjective. The conscious perception of pain appears to depend on brain activity encompassing the entire cortex. An individual interprets pain based on past experiences and exhibits a personal reaction (2).

Various methods have been employed to address the issue of pain in dentistry. Since the 1770s, electrical energy has been utilized for pain control. Transcutaneous Electrical Nerve Stimulation (TENS), which is based on the principle of transmitting electrical energy through the skin to the nervous system, has also found applications in dentistry. TENS devices use positive square monophasic currents or asymmetric biphasic currents composed of positive square and negative spike waves(3).

In this study, we aim to evaluate the effectiveness of TENS, proposed as a modern alternative to analgesics, in managing pain during cavity preparation.

Material and Methods

Our study included 45 patients, aged between 18 and 41, who visited our faculty. The selection criteria for participants ensure the homogeneity of pain responses. Inclusion criteria focus on individuals with moderate or deep caries involving the middle or inner third of dentin, vital pulps confirmed by positive responses to vitality testing, and localized pain directly attributable to the carious lesion. Teeth with intact structure and no prior restorations are preferred to preserve natural pain responses. Exclusion criteria include participants with superficial caries, signs of irreversible pulpitis, necrotic pulp, or periapical pathology, as well as systemic conditions affecting pain perception or those taking medications that could alter pain responses. By adhering to these criteria, the study minimizes variability in pain perception and allows for a more accurate assessment of TENS efficacy in managing pain associated with different severities of dentin caries. The patients were treated using TENS for anesthesia, without local anesthesia. Within the selected patient group, 30 individuals received TENS treatment, while 15 received placebo TENS.

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The electrodes of the device, coated with conductive material, were placed on the trigger points corresponding to the tooth requiring filling. These points were chosen due to their high electrical conductivity and low resistance. Additionally, one electrode was placed in the "ipsilateral dorsal web" area to enhance the effect. TENS was applied for thirty minutes in this manner. Similarly, for patients receiving placebo TENS, the electrodes were positioned in the same way, with instructions to notify when contractions occurred during the application of the current. Upon the occurrence of contractions, the current was immediately stopped, and the voltage was reset to zero. Meanwhile, the device's timer was active and set for thirty minutes, signaling at the end of the period to create the impression of ongoing treatment for the patient. This procedure was applied to each patient only once.

After the procedure, patients were asked to indicate the intensity of the pain they experienced during the treatment on a Visual Analog Scale (VAS). This scale consists of a 10 cm horizontal line (4). It was explained to the patients that this line serves as a pain indicator, with the zero point representing no pain and the ten point representing the most severe pain they could endure. Patients were instructed to mark the severity of their pain on the line. The TENS used in our study generates electrical stimuli, which are transmitted to the skin via surface electrodes. The purpose of TENS is to produce electrical energy sufficient to induce depolarization in peripheral nerves. TENS devices should have at least two channels and four electrodes. A gel composed of a permeable material is applied between the electrode and the skin.

The stimulation parameters are as follows: Amplitude: 0-80 Amperes, Frequency: 1-150 Hz and Pulse Duration: 30-250 microseconds. These parameters should be adjusted to provide stimulation without causing muscle contractions in the patient.

The findings were evaluated using the Chi-Square Test, and the results were found to be statistically significant.

Results

The results of the Chi-Square Test of Independence reveal a significant association between the type of TENS group (Actual vs. Placebo) and the reported pain levels during the dental procedure ($p < 0.001$) (Table 1). Among the 30 patients in the Actual TENS group, 28 experienced no pain, and 2 reported moderate pain, with no patients reporting higher pain levels (VAS 4–9). In contrast, all 15 patients in the Placebo TENS group reported significant pain intensity within the VAS range of 4–9. The p-value indicates a highly statistically significant difference, suggesting that the Actual TENS therapy effectively reduces pain compared to the placebo.

Table 1: Intergroup comparison

Group	Number of Patients	Pain-Free (No Pain)	Moderate Pain	VAS Pain Intensity (4–9)
Actual TENS	30	28	2	0
Placebo TENS	15	0	0	15

Discussion

Recent studies on TENS have focused on whether it can provide electro-analgesia during conservative dental treatments and tooth extraction (5).

Kasat et al. reported that while TENS cannot substitute local anesthesia, it proves valuable for pain management during diverse dental procedures. Its analgesic and physiological effects can effectively contribute to managing various conditions that affect the maxillofacial region (6). Cebalo et al. demonstrated that TENS can serve as an anxiolytic and mild analgesic during various dental procedures, although it cannot completely substitute local anesthesia (7).Ottoson et al. applied 100 Hz vibration stimulation to 30 patients with dental pain, reporting 75% improvement in 16 patients and 100% improvement in 214 patients (8).

Our study was conducted with the aim of creating analgesia during restorative treatments by applying TENS and ensuring the patient does not experience pain. In this regard, the desired outcomes were achieved. Enhancing the effectiveness by placing electrodes in the dorsal web area was also ensured. Dorsal web stimulation does not alter pain thresholds but when used in conjunction with cheek stimulation, it enhances the obtained results (9).

Among patients visiting the dental clinic, factors such as hypersensitivity, pain, and fear of injections significantly influence their dental health and treatment outcomes. Additionally, the absence of unwanted side effects commonly associated with local anesthesia such as systemic toxicity, angioedema, hypotension, needle breakage, hematoma, facial nerve block, and neurological disorders opens the way for more effective applications of TENS.

Conclusion

Furthermore, it has been demonstrated that the analgesic mechanism of TENS prevents pain during cavity preparations. Consequently, despite the challenges in establishing ideal placebo conditions for TENS, its superiority, lack of significant adverse effects in use, and economic viability suggest it may enhances the effect of anesthesia and in some minor cases it can serve as an alternative to pharmacokinetic therapies.

Declarations

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Translucency of New Lithium Disilicate Ceramics After Ageing and Immersion in Coffee Solution

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Abstract

Aim To evaluate translucency parameters of different lithium disilicate glass-ceramic materials after thermocycling and coffee staining.
Material and method Three different rectangular-shaped specimens were prepared using three distinct 1.2 mm thick lithium disilicate glass ceramics (IPS e.max CAD, LD_C; Cerec Tessera, LD_A; Initial LiSi Block, LD_F) by using a precision cutting device. All specimens were standardised by polishing with abrasive silicone paper. Thereafter, the specimens were subjected to thermal cycling (5000 cycle, 5-55 C, 30 sn dwell time) and then immersed in coffee solution for 30 days. The colour coordinates of each sample before and after ageing were recorded, and the relative translucency parameter (RTP) was calculated using the CIEDE 2000 formula. The results were then subjected to statistical analysis by one-way ANOVA and a post hoc Tukey test.
Results There was a significant difference between the groups in terms of RTP both before and after staining ($p<0.001$).The LD_A group had the highest RTP value. Before staining, LD_C showed the lowest RTP value, while there was no significant difference between LD_C and LD_F after staining ($p=0.781$) These findings may guide the selection of materials for esthetically demanding restorations.
Conclusion LD_A had the highest RTP value regardless of staining, but only LD_F had an RTP change below the clinically acceptable threshold after coffee staining ($\Delta RTP=2.10$).

Keywords Coffee staining, Dentistry, Lithium disilicate, Thermocycling, Translucency

Introduction

Glass-ceramics have become a desirable material in dentistry due to a number of advantageous properties, including biocompatibility, chemical inertness, high mechanical properties, superior esthetics, optical properties and machinability (1). The initial formulations of glass ceramics principally comprised feldspathic reinforcements (2). Subsequently lithium silicate-based glass-ceramics became increasingly popular, and as time went by, numerous lithium silicate-based glass-ceramics were introduced to the market by various manufacturers (3).

Lithium disilicate glass ceramics have become a material of choice for many dental practitioners, frequently preferred for dental prosthetic rehabilitation (3-5). They have a wide range of clinical indications due to their excellent biocompatibility, advanced esthetics and mechanical properties that outperform most of their competitors among glass ceramics (3, 4, 6).

Lithium metasilicate glass-ceramic blocks are made and delivered to dentists in a partially crystallised state. The material is a glassy matrix of lithium metasilicate crystals, suitable for machining. Lithium metasilicate glass-ceramics are heated to become lithium disilicate. This makes them more rigid and hard, but not suitable to be worked by a machine (7).

Lithium aluminosilicates (LAS) are a type of glass ceramic with low expansion and aesthetic qualities. The potential use of LAS glass-ceramics as materials for dental restorations is limited due to their relatively low mechanical properties. Research has been conducted to enhance the mechanical properties of LAS glass while maintaining its favourable characteristics.(8)

Lithium disilicate, initially IPS Empress 2, became IPS e.max, a dominant material in CAD/CAM dentistry (9). The material displays a purple hue during its intermediate state, which is attributed to the stains used for identification. This material needs a specific time and temperature in its metasilicate state to reach a fully crystallised state (10). Many new lithium disilicate glass ceramics are on the market (3). These include new lithium disilicate CAD/CAM blocks (Tessera, Dentsply Sirona) introduced in 2021. The new material is aluminium silicate crystals, Virgilite, in a glassy zirconia matrix. The ceramic's exceptional fast-firing feature is its defining advantage. Tessera is a composite of lithium disilicate and virgilite crystals, embedded in zirconia glass. Virgilite enhances lithium disilicate's mechanical strength (11).

The crystallisation heat treatment is key in making glass-ceramic dental prostheses comprising lithium disilicate. Crystallisation reduces brittleness and relieves stresses caused by machining. This improves the material's strength and fracture toughness while adjusting the optical and aesthetic aspects (12). Simplifying the clinical steps allows manufacturers to produce fully crystallised, millable and cementable blocks (13). The new blocks save costs and time. Fully crystallised lithium disilicate

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glass ceramic does not require firing and can be delivered after polishing (14).

While there are numerous studies investigating the mechanical, wear-resistance, and optical properties of fully crystallised lithium disilicate glass-ceramics, there is a paucity of literature examining their translucency properties. Therefore, the present study aimed to evaluate and compare fully crystallized lithium disilicate with nano-lithium disilicate and a commonly used lithium disilicate glass-ceramic material in terms of translucency after thermocycling and stain susceptibility. Although many studies explore the optical properties of lithium disilicate ceramics, their performance after prolonged coffee exposure remains underexplored.

The null hypothesis was that the material type would not affect the translucency parameter after thermocycling and staining.

Material and Methods

Three different A2-shaded lithium disilicate ceramic blocks were tested, namely advanced lithium disilicate (LD_A; CEREC Tessera, Dentsply Sirona), lithium disilicate (LD_C; IPS e.max CAD, Ivoclar Vivadent), and fully crystallized lithium disilicate (LD_F; Initial LiSi Block, GC Corp) (n=10). The A2 shade was selected due to its common use in clinical practice. Specimens with a thickness of 1.3 mm were prepared using a diamond disc under constant water-cooling on a precision cutting device (Microcut 201; Metkon Instruments Inc.). Subsequently, each specimen was polished on 600-, 800-, and 1,000-grit abrasive silicone papers, respectively, in order to obtain a standard thickness. The thickness of the specimens was verified with the use of a digital caliper (Absolute Digimatic; Mitutoyo).

The glazing process of the LDS specimens was performed using a powder-liquid glaze (e.max Ceram Glaze Powder/Glaze and Paint Liquid; Ivoclar Vivadent), whereas for the LD_A specimens, a spray glaze was applied in a uniform coating (Universal Spray Glaze; Dentsply Sirona). The glaze was applied to a single surface of the specimens, resulting in a final thickness of 1.2 mm, in accordance with the International Organization for Standardization (ISO) standard 6872:2015. To ensure reliability, the thickness of the specimens was subsequently measured with a digital caliper. To calculate the relative translucency values of the specimens, colour coordinates (L*, a* and b*) were recorded on black (L*=16.73, a*=−2.53, b*=2.13) and white backgrounds (L*=71.1, a*=−3.86, b*=−2.7) using a spectrophotometer (VITA Easyshade V; VITA Zahnfabrik). The observations were conducted at 2-degree angles with the D65 illumination curve. Each measurement was repeated on three times and the mean values were calculated. The spectrophotometer was calibrated every 3 measurements.

The samples were subjected to thermocycling (Thermocycler; SD Mechatronic, Feldkirchen-Westerham, Germany) in accordance with the methodology described in previous studies; 5,000 cycles, 5-55 °C, 60 s holding time. Subsequently, the specimens were immersed in a coffee solution for a period of 30 days. The coffee solution was prepared by combining 3 g of coffee with 300 g of boiled distilled water. The coffee solution was renewed every 12 hours. Prior to repeating the measurements for relative translucency parameter (RTP), each specimen was brushed with toothpaste (Sensodyne, GlaxoSmithKline) for 30 seconds and cleaned in an ultrasonic cleaner. Once the specimens had reached a state of complete dryness, the colour coordinate measurements were repeated in accordance with the aforementioned methodology.

RTP calculated according to the CIEDE2000 equation:

$$RTP_{CIEDE2000} = \left[\left(\frac{L_B - L_W}{K_L S_L}\right)^2 + \left(\frac{C_B - C_W}{K_C S_C}\right)^2 + \left(\frac{H_B - H_W}{K_H S_H}\right)^2 + R_T\left(\frac{C_B - C_W}{K_C S_C}\right)\left(\frac{H_B - H_W}{K_H S_H}\right)\right]^{0.5}$$

B: black background,

W: white back

L: Lightness

C: Chroma

H: Hue

All K values in the equation are set as 1. RTP values was assessed according to the thresholds of clinical perceptibility (RTP: 0.62 units) and acceptability (RTP: 2.62 units) thresholds.

Statistical analysis of the data was performed using a software programme (IBM SPSS statistics, v25; IBM Corp). The data obtained were assessed for normal distribution and homogeneity using the Shapiro-Wilk test and Levene's test. Normally distributed and homogeneous data were then statistically analysed by one-way ANOVA test and multiple comparisons were performed by post-hoc Tukey test (α = 0.05).

Results

Statistical analysis test revealed that different lithium disilicate glass-seramic material did affect RTP values ($p < 0.001$) before staining. There were significant differences between 3 groups. Table 3 summarizes the descriptive statistics of RTP values. LD_A had the highest ΔRTP values after thermocycling, followed by LD_F (21.82). LD_C had the lowest ΔRTP (20.22), showed significant differences compared to LD_F and LD_A. These findings indicate that LD_A exhibits superior translucency, potentially due to its smaller crystal size and unique composition.

Significant differences between the groups were also observed in the post-staining measurements ($p< 0.001$). LD_A had the highest RTP value ($p< 0.001$), while no significant difference was observed between LD_C and LD_F ($p=0.781$).

Table 1: Composition and Manufacturer of Materials

MATERIAL	CHEMICAL COMPOSITION	MANUFACTURER
LD_C	57–80 % SiO2, 11%–19% Li2O, 0%– 13% K2O, 0%–11% P2O5, 0%–8% ZrO2, 0%–8% ZnO Coloring oxides: 0%–8%	Ivoclar Vivadent, Schaan
LD_A	Li2Si2O5: 90% Li3PO4: 5% Li0.5Al0.5Si2.5O6 (virgilite): 5%	Dentsply Sirona, Charlotte
LD_F	81% SiO2, 8.1% P2O5, 5.9% K2O, 3.8% Al2O3, 0.5% TiO2, 0.6% CeO2	GC Corp

Table 2: Crystallization and Glaze Firing Parameters

		Stand By Temperature	Pre-Drying Time:	Closing Time	Pre-Heating Time	Heating Rate	Firing Temperature	Holding Time	Vacuum On/Off
LD_A	Crystallization	NR	NR	NR	NR	NR	NR	NR	NR
	Glaze Firing	400°C	2 min	2 min	2 min	55°C/min	760°C	2 min	-
LD_C	Crystallization	403°C	-	6 min	-	60°C/min	770°C/850°C	10 min	770/850°C
	Glaze Firing	403°C	-	6 min	-	60°C/min	725°C (Holding)	1 min	450/724°C

Table 3: Mean ± Standard deviation and 95% Confidence Interval (CI) RTP values of materials

	BEFORE STAINING		AFTER STAINING	
STUDY GROUPS	Mean ± Standard Deviation	95% CI Lower-Upper Bound	Mean ± Standard Deviation	95% CI Lower-Upper Bound
LD_C	20.22± 0.93	19.43 - 20.99	23.73± 0.74	23.20-24.26
LD_A	23.07± 0.76	22.43 – 23.70	26.34± 0.51	25.97-26.71
LD-F	21.82± 0.67	21.25-22.38	23.92± 0.58	23.50-24.33

Discussion

Translucency, defined as the amount of light transmitted or diffused from the substrate, is a substantial optical property for dental ceramics (15). This results in a more natural appearance and also allows for the assessment of the extent to which background colour of an object affects the final hue or colour of the prosthesis. The translucency of dental materials under various conditions is therefore considered an important parameter.

Pigments can be applied to dental ceramics to acquire a high translucency look but this can be lost after several months of exposure to different substances such as toothpaste or tea and coffee (15). Coffee, which is the choice of staining solution in this study, is known to have an impact on the translucency of dental materials (16-18). In a study investigating the changes in translucency of materials stained with tea, cola, ginger, and coffee, it was found that the solution causing the greatest change in translucency was coffee (19). Another study using coffee, cola and tea as staining solutions also concluded that exposure to coffee had a greater impact on translucency (20). The higher colour variation caused by coffee compared to tea and cola has been explained by staining due to a yellow pigment with different polarities (21).

The translucency of dental ceramics is affected by various factors, including the number of firing cycles, hydrothermal aging, thickness, chemical composition, and the size and morphology of the crystals. Especially dimension, shape and the percentage of crystal fraction have a substantial impact (22). While there are studies in literature which show that translucency increases as the firing cycle number increases in research carried out with glass ceramics (23, 24), there are also researchers who have concluded that translucency decreases as the firing number increases (25). In different studies, the decrease in translucency after repeated firings was attributed to changes in crystal size and/or orientation (25-27).

Number of crystals in the ceramic composition is a major factor that affects the translucency of ceramics. It has been stated that as the number of crystals in a glass matrix increases, the translucency of the ceramic decreases (28, 29). Moreover, higher translucency is found in lithium silicate-based glass ceramics with smaller crystals and when similar refractive indices exist between glass and crystalline phases. Lithium silicate-based glass ceramics are available in a variety of colour translucencies and shades. The colour shades are adjusted during the manufacturing stage by integrating pigment oxides into the glass matrix, while the translucency is controlled by nanoscaling of the crystals. (30)

Considering the three different lithium-disilicate used in this study, Lisi (0.3μm) had the smallest crystals, followed by Tessera (0.5μm and virgilite crystals of 0.2-0.3 μm) and E-max (1-1.5μm). (3) When examining the relationship between crystal size and translucency, as claimed in the previous paragraph, E-max, which is stated to have the lowest translucency in this study, has the largest crystal sizes. However, Lisi, which has the smallest crystal sizes has lower translucency than Tessera, which contradicts the previous paragraph.

In this presented study, the null hypothesis of the study was rejected since different lithium disilicate materials were found to have different RTP values. An examination of previous studies in the literature reveals that comparisons of E-max and Tessera in terms of translucency have produced differing results. While no statistically significant difference was found in one of the studies (28), it was concluded that there was a statistically difference in the two others, and both of them stated that E-max was more translucent than Tessera. One of the studies in question, the researchers claimed that the higher translucency of E-max is due to the increase in translucency as the crystal size of the materials grows (20, 31). These findings do not support the data obtained in the current study.

In another study focusing on the difference between E-max and Lisi, it was stated that there was a statistically significant difference between these two materials in terms of light transmittance at 1.50 mm thickness, It has been suggested by researchers that the possible reason for this difference is that LiSi had dense crystals approximately 1 to 1.5 μm in size, whereas E-max has long, rod-like crystals about 3 to 4 μm in size. Additionally, LiSi surfaces exhibit more porosity and a rougher surface compared to the E-max group. (32) Findings of the present study do not support the results of the study referenced above. Differences among findings could be attributed to variations in methodology.

This current study has several limitations. One of these limitations was being an in-vitro study which means that the study was conducted in an environment different from real life conditions. Another limitation is that the study was carried out using discs of the same shape instead of dental crown forms, and all the discs had the same thickness, meaning that variations in thickness were not evaluated. The use of only one measuring device in the study can also be considered as a limitation. As an in vitro study, the findings may not fully represent clinical conditions, such as the effects of mixed beverages or long-term oral environment exposure. Future studies could explore these materials under more complex oral conditions, including varying pH levels and abrasive forces.

Conclusion

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

1. Different lithium disilicate glass ceramics show different RTP values.
2. LD_A exhibited the highest RTP value regardless of coffee staining.
3. LD_F had an RTP change below the clinically acceptable threshold after coffee staining (ΔRTP=2.10).

Declarations

Author Contributions: *Conception/Design of Study- A.A.D.T., M.D.; Data Acquisition- A.A.D.T., M.D.; Data Analysis/Interpretation- A.A.D.T., M.D., E.K.; Drafting Manuscript- A.A.D.T., E.K.; Critical Revision of Manuscript- A.A.D.T.; Final Approval and Accountability- A.A.D.T., M.D.; Material and Technical Support- M.D.; Supervision- A.A.D.T.*

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Investigation of the Internal Structure and Radiological Characteristics of Distant Metastases to the Jaws: A Retrospective Study

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Abstract

Aim Distant metastases to the jaws are uncommon but carry a grave prognosis, with an average survival of only a few months. This study aimed to investigate the internal structure and radiological features of metastatic lesions in the jaws, as well as their clinical presentations, to better understand their diagnostic characteristics and guide appropriate management.

Material and method Among 4,908 patients who underwent cone beam computed tomography (CBCT), 14 cases with histopathologically confirmed metastatic tumors to the jaws were identified. Clinical data, imaging modalities (orthopantomography, CBCT, magnetic resonance imaging, ultrasound), and histopathological findings were reviewed. The primary tumor sites, radiographic appearances (osteolytic vs. osteoblastic lesions), and histopathological patterns were examined.

Results Thirteen lesions were located in the mandible and one in the maxilla. The most common primary tumors originated from the breast, prostate, lung, kidney, and colon. While breast and prostate metastases appeared mostly as sclerotic (radiopaque) lesions, lung, kidney, and colon metastases typically presented as osteolytic (radiolucent) defects. In some cases, pathologic fractures and cortical destruction were evident. Histopathological evaluation confirmed metastatic carcinoma in all cases, demonstrating characteristic osteoblastic activity in breast and prostate cancers.

Conclusion Recognizing the radiological and histopathological features of distant metastases to the jaws is crucial for prompt diagnosis, accurate identification of the primary tumor, and appropriate treatment planning. Awareness of these lesions aids clinicians in differentiating metastases from other jaw pathologies and underscores the importance of multidisciplinary collaboration.

Keywords Cone-Beam computed tomography, Diagnostic imaging, Jaw neoplasms, Neoplasm metastasis, Oral cancer

Introduction

Metastatic tumors involving the jaws are quite rare, accounting for less than 1% of all malignancies affecting the oral cavity. Despite their low incidence, such lesions pose a significant clinical challenge due to their frequently aggressive behavior and poor prognosis—reports indicate an average survival of roughly seven months following diagnosis (1-7). The mandible is more commonly affected than the maxilla, which has been attributed to its richer vascular supply and higher concentration of hematopoietic marrow (1, 3, 5-7).

Metastases can originate from various primary tumors, most notably the breast, prostate, lung, kidney, and colon (2-9). These lesions often present with nonspecific symptoms such as pain, paresthesia, swelling, and sometimes pathologic fractures, thus mimicking common odontogenic conditions like periapical abscesses or benign tumors (1, 2, 4, 6, 7, 9).

Radiologically, metastatic lesions can manifest as osteolytic or osteoblastic defects. Breast and prostate cancers frequently induce osteoblastic changes, while lung, kidney, and colon cancers tend to result in osteolytic lesions (2-6). Proper recognition of these patterns, combined with histopathological confirmation, is essential for timely diagnosis. This study provides an overview of the radiological features of distant metastases to the jaws, with the aim of increasing clinician awareness and improving early detection.

Material and Methods

Study design and study population

A retrospective review was conducted using the patient database of the Department of Oral and Maxillofacial Radiology, covering the period from January 2016 to December 2020. During this time, 4,908 patients underwent Cone-Beam Computed Tomography (CBCT) for various clinical indications. Among these, 14 patients were identified with histopathologically confirmed metastatic lesions in the jaws.

Patients were included if they had radiological evidence of metastatic lesions in the jaws (confirmed through CBCT, orthopantomography [OPG], magnetic resonance imaging [MRI], or ultrasound [US]), sufficient clinical data indicating a definitive primary tumor diagnosis, and histopathological confirmation of metastatic carcinoma. Patients with benign primary tumors, pri-

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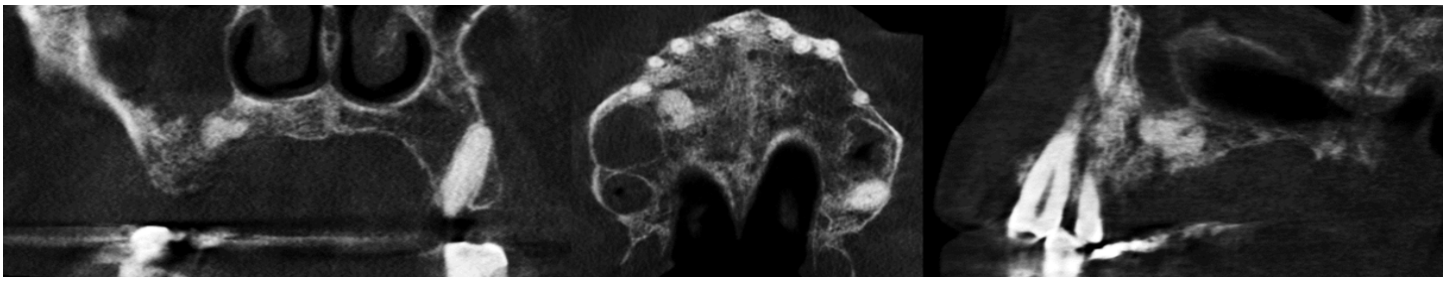

Figure 1: CBCT images showing a prostate cancer metastasis in the maxilla. The lesion demonstrates a hyperdense internal structure with ill-defined borders. Destruction of the floor of the maxillary sinus is evident and closely associated with the lesion.

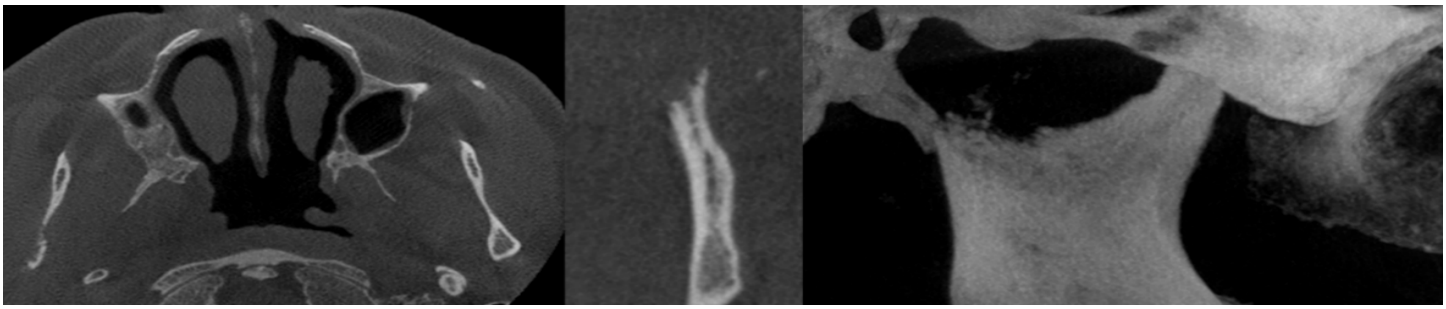

Figure 2: CBCT images demonstrating a lung cancer metastasis involving the right condyle. The lesion is hypodense with significant bone destruction, and an associated pathologic fracture.

mary malignant tumors originating within the jaws, or incomplete imaging or clinical data were excluded from the analysis.

Data Collection

The following parameters were collected and analyzed for each patient: age, sex, primary tumor location, metastatic lesion location in the jaws, and the radiological characteristics of the metastatic lesions (including their internal structure—osteoblastic or osteolytic—and peripheral structure—well-defined or ill-defined borders). Histopathological diagnoses of the lesions were retrieved from the database to confirm metastatic carcinoma and provide details of tumor morphology. Additionally, clinical findings such as paresthesia, pain, swelling, pathologic fractures, and soft tissue involvement were documented to provide a comprehensive overview of each case.

Results

Demographics

A total of 14 patients (10 males, 4 females) aged between 51 and 75 years were identified with metastatic tumors in the jaws. Thirteen of these lesions involved the mandible, whereas one was located in the maxilla.

Primary Tumor Sites

The most common primary tumors identified in this study were prostate cancer and lung cancer, each accounting for four cases. Breast cancer was the next most frequent, with three cases observed. Colon cancer contributed two cases, while renal cell carcinoma was identified in a single patient. These findings highlight the diverse origins of metastatic lesions to the jaws, with a predominance of cancers commonly associated with skeletal metastases.

Clinical Presentations

In our series, the most frequently observed clinical presentations included paresthesia and anesthesia in the lower lip and chin region, particularly in cases where the mandible was involved. Pathologic fractures occurred mainly in advanced lesions arising from lung and colon cancers. Nearly all patients presented with swelling, pain, and varying degrees of local bone expansion; in four cases, the destructive process progressed to the extent that soft tissue masses extended into the oral cavity.

Radiological Features

Radiologically, sclerotic or osteoblastic lesions were most often associated with prostate and breast metastases. On OPG and CBCT, these lesions appeared as poorly defined radiopaque or mixed radiolucent-radiopaque defects, sometimes accompanied by spiculated periosteal reactions or a Codman's triangle, both indicative of an aggressive periosteal response (Figure 1). In contrast, osteolytic or radiolucent lesions predominated in metastatic tumors originating from the lung, kidney, or colon. These lesions were characterized by significant bone destruction with irregular, ill-defined borders and visible cortical perforation. MRI often demonstrated infiltration into surrounding soft tissues, highlighting the destructive potential of these metastases (Figure 2).

Discussion

The rarity of jaw metastases demands heightened clinical suspicion, especially when patients present with unexplained jaw pain, paresthesia, or non-healing extraction sites. In the present cohort, the mandible was the predominant site of metastasis, consistent with previous findings attributing this pattern to its robust vascular supply (1, 2, 4, 6, 7, 9).

Metastatic involvement from breast and prostate pri-

maries often produces sclerotic (radiopaque) or mixed radiolucent-radiopaque lesions in the jaw, paralleling the osteoblastic activity typically observed in their axial skeletal metastases. This characteristic can provide a vital diagnostic clue, especially in patients with a known history of breast or prostate cancer (1, 4, 6, 8, 9).

Lung, kidney, and colon metastases typically exhibit osteolytic lesions, leading to radiolucent appearances on OPG and CBCT. These often display aggressive features such as ill-defined borders and cortical destruction, extending into the surrounding soft tissues. Paresthesia is especially common in mandibular lesions, possibly due to involvement of the inferior alveolar nerve (1, 4, 6, 8, 9).

These findings underscore the importance of a thorough clinical evaluation and the inclusion of advanced imaging techniques, such as PET/CT, to screen for metastatic disease. PET/CT offers functional data on metabolic activity, enabling the detection of smaller or occult metastases in both the jaws and distant sites. MRI likewise remains invaluable for assessing soft tissue extension, marrow involvement, and neurovascular compromise. The combined use of multiple imaging modalities improves diagnostic accuracy, allowing clinicians to distinguish metastatic lesions from benign pathologies and thus facilitating prompt intervention (1, 10, 11).

Another crucial consideration in managing jaw metastases is the coordination of care among multiple specialties, including medical oncologists, radiation oncologists, and oral and maxillofacial surgeons. Treatment often entails systemic therapy aimed at the primary cancer site, alongside local interventions such as radiation therapy or surgical resection for symptom palliation and to prevent further skeletal complications. Given the high morbidity and poor prognosis associated with jaw metastases, early detection, a multidisciplinary treatment approach, and attentive follow-up are essential to optimize patient outcomes (11-13).

Finally, these observations emphasize the critical need for clinicians to maintain an index of suspicion for metastatic disease in older adults presenting with atypical jaw lesions, even those initially suggestive of benign odontogenic pathologies. Early detection, guided by radiographic findings and confirmed by histopathology, can prompt timely intervention and may provide an opportunity to identify or monitor an underlying primary malignancy.

Conclusion

Distant metastases to the jaws remain a diagnostic challenge due to their relatively low incidence and nonspecific clinical presentations. Nevertheless, early recognition of radiographic patterns—particularly distinguishing osteoblastic from osteolytic lesions—combined with thorough histopathological evaluation is vital for prompt diagnosis and effective management. Collaboration among oral and maxillofacial radiologists, oncologists, pathologists, and maxillofacial surgeons is paramount in developing a comprehensive treatment strategy, potentially improving outcomes for patients affected by these aggressive tumors.

Declarations

Author Contributions: *Conception/Design of Study- G.U.; Data Acquisition- A.F.E.; Data Analysis/Interpretation- G.U., A.F.E.; Drafting Manuscript- G.U., A.F.E.; Critical Revision of Manuscript- K.O.; Final Approval and Accountability- G.U.; Material and Technical Support- A.F.E.; Supervision- K.O.*

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A Rare Maxillary Case of Calcified Epithelial Odontogenic (Pindborg) Tumor in a Young Patient

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Abstract

Aim The calcified epithelial odontogenic tumor (CEOT) is a rare, benign lesion, accounting for approximately 1% of odontogenic tumors. The primary treatment involves surgical excision, with a documented recurrence rate of 14%. This case report aims to contribute to the literature by presenting the radiological and histopathological findings, along with the surgical management, of a CEOT located in an unusual area in a female patient under 20 years old.

Case Report An 18-year-old female patient was referred to our clinic due to an incidental lesion located between the left maxillary premolar teeth. A delayed positive response was noted in the cold vitality test performed on asymptomatic, caries-free premolars. Cone beam computed tomography (CBCT) revealed a radiolucent lesion between the premolars, displacing the root of tooth 24 buccally and expanding the palatal cortex, with central radiopacity. Under local anesthesia, a palatal mucoperiosteal flap was raised, and a window was created in the palatal cortex using a surgical bur. The lesion was then enucleated with a curette, and the flap was sutured. Histopathological analysis showed polyhedral tumor cells among large and small calcification islands, confirming a diagnosis of CEOT.

Discussion Although treatment options may vary based on CEOT location and size, enucleation remains the most common approach.

Conclusion Given the high recurrence rate, long-term follow-up is essential. The patient has been followed up every six months, with no recurrence observed over a two-year period.

Keywords Calcified epithelial odontogenic tumor, Enucleation, Liesegang rings, Maxilla, Pindborg tumor

Introduction

A calcified epithelial odontogenic tumor (CEOT) is a benign, rare tumor that accounts for approximately 1% of odontogenic tumors (1). It is known as the "Pindborg tumor" because it was described by Pindborg in 1955 (2). CEOT is generally seen in individuals between the 2nd and 6th decades, and the number of cases reported under the age of 20 is quite low. The tumor is most commonly seen in the mandibular premolar and molar regions and is rarely seen in the maxilla. These tumors are generally seen to be associated with unerupted teeth (2, 3).

The aim of this case report is to contribute to the literature by presenting the radiological and histopathological findings and surgical treatment of CEOT, which was detected in the maxilla premolar region with a rare localization in a female patient under 20 years of age.

Case Report

An 18-year-old female patient was referred to Istanbul University, Department of Oral and Maxillofacial Surgery after a lesion was observed between the roots of teeth 24 and 25 on orthopantomography (Figure 1). There were no symptoms, and no caries were seen on both premolars (Figure 2). However, a delayed positive response was obtained on the cold sensitivity test. A lesion resembling an inverted water drop was detected between teeth 24 and 25 on cone beam computed tomography (CBCT). This well-defined lesion pushed the root of tooth 24 towards the buccal side, caused expansion of the palatal cortex and contained radiopacity in its internal structure (Figure 3).

Figure 1: Orthopantomography showing the lesion

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Figure 2: Preoperative intraoral radiograph

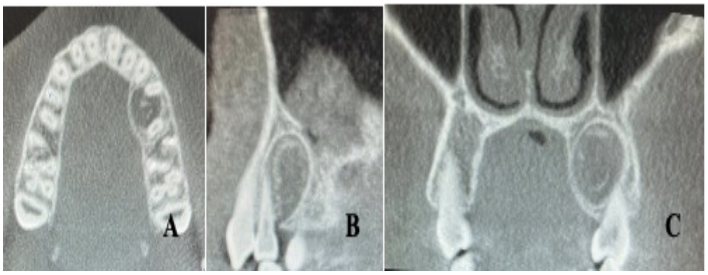

Figure 3: CBCT images A) Widening of the palatal cortex without disturbing the cortical border in the axial section. B) Inverted water drop shape with regular borders in sagittal section. C) Radiopaque foci in the internal structure in the coronal view.

The patient underwent surgery under local anesthesia in appropriate conditions. A mucoperiosteal flap was raised through a palatal sulcular incision. The enucleation of the lesion was performed with a curette through a window opened in the palatal cortex using a handpiece and a round bur. No luxation was observed in the teeth after enucleation. Peripheral bone curettage was carried out, and the operation area was cleaned by irrigation with isotonic saline solutions (Figure 4). The flap was primarily closed by vertical matrix suturing with 3/0 silk (Figure 5). The radiopacity observed on CBCT was confirmed to be calcifications in the lesion. Therefore, the lesion's preliminary diagnosis was suggested by CEOT. The tissue sample was examined histopathologically. In the histopathological examination, polyhedral tumor cells were identified among large and small calcification islands. The diagnosis was confirmed as CEOT (Pindborg tumor) (Figure 6).

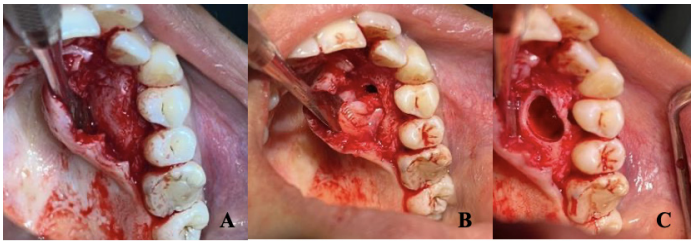

Figure 4: Images during surgery A) Mucoperiosteal flap removal with sulcus incision in the palatal region. B) Enucleation of the lesion using a curette through the window opened in the palatal cortex. C) After peripheral bone curette

At the follow-up visit one week later, it was observed that the wound had healed without any complications, and the sutures were removed. The patient has been under our follow-up for two years, during which no recurrence has been detected clinically or radiologically (Figure 7).

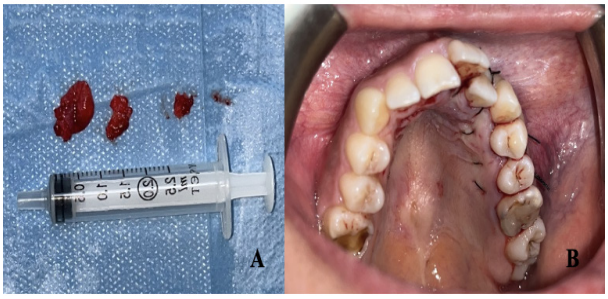

Figure 5: A) The removed lesion and calcified tissue B) The flap was closed primarily with vertical matrix sutures.

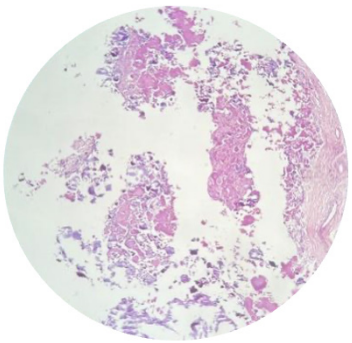

Figure 6: CEOT showing sheets of polyhedral epithelial cells with evidence of calcified areas. (Hematoxylin-eosin stain; original magnification x100)

Figure 7: Control orthopantomography

Discussion

The World Health Organization (WHO) classified CEOT as a benign, epithelial odontogenic tumor in 2017 (1). It is a rare neoplasm, accounting for 1% of all odontogenic tumors (4). 90% of CEOT cases are intraosseous and are often seen in the mandible. It has been reported that there is no significant difference between men and women in gender distribution (5).

These tumors are generally slow-growing, painless lesions and have been associated with an impacted tooth in 58% of cases

(6, 7). The case explained in this article was discovered incidentally and is not related to an impacted tooth. It displaced tooth roots 24 and 25 in the lesion area. According to the literature, the radiographic features of these tumors are defined as regularly circumscribed, unilocular or multilocular lesions, and radiopacities characteristically seen in the internal structure (4). In the radiological images in this case, radiopacities were observed in the internal structure of the lesion and are compatible with the literature. CEOT was considered a preliminary diagnosis.

Histopathologically, CEOT is characterized by the presence of varying-sized calcifications, forming concentric laminations known as Liesegang rings (6). Liesegang rings were observed in the histopathological examination of the case explained in this article. Although the treatment of CEOT varies depending on its location and size, the generally preferred method is enucleation (8, 9). There are also cases where the impacted tooth was maintained after enucleation (10). In cases of CEOT, the prognosis is generally good, but recurrence may occur in 14%. Therefore, it is very important to keep such cases under regular follow-up (11).

Conclusion

Although there are different treatment options depending on the location and size of the CEOT, the most commonly used treatment method is enucleation. Since the relapse rate is high, long-term follow-up with patients at short intervals is recommended. The patient is followed up every 6 months, and no recurrence has been observed over a 2-year period.

Declarations

Author Contributions: *Conception/Design of Study- M.B.B., M.S.T., M.K.; Data Acquisition- M.B.B., M.K.; Data Analysis/Interpretation- M.B.B., M.S.T., M.K.; Drafting Manuscript- M.B.B.; Critical Revision of Manuscript- M.B.B., M.S.T., M.K.; Final Approval and Accountability- M.B.B., M.S.T., M.K.; Material and Technical Support- M.B.B.; Supervision- M.S.T., M.K.*

Conflict of Interest: *Authors declared no conflict of interest.*

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Long-Term Treatment of Dentigerous Cyst Developing as a Result of Incorrect Total Amputation of Primary Tooth

Oyku PEKER[1], Ahmet Can HASKAN[2]

Abstract

Aim Cysts are pathological formations lined with epithelium that may show different characteristics depending on the epithelial tissue from which they originate, filled with liquid or semi-liquid material, showing localized development, usually with a connective tissue wall. Dentigerous cysts are often associated with impacted teeth and are benign developmental lesions. Rarely, they may occur due to inflammatory causes. Our aim was to report the management of inflamatuar dentigerous cycst related with total amputation in mixt dentition.

Case Report In this case report, we present the three-year clinical follow-up after surgical marsupialization of an eight-year-old young patient who applied to our clinic with a complaint of swelling in the lower jaw.

Discussion Inflammatory dentigerous cysts could occur in immature permanent teeth as a result of inflammation from a non-vital primary tooth. In cases of dentigerous cysts in children, various appliances and methods can be used for marsupialization. Marsupialization consists of uniting the cyst lining to the oral mucosa. This method has fewer complications than enucleation regarding the preservation of important anatomical structures and developing tooth germs.

Conclusion Although the development of odontogenic cysts in children is rare, their formation and progression can be much more rapid and aggressive than in adults. In the treatment of lesions observed in childhood, marsupialization has been reported to be an effective treatment method for the protection of erupting permanent teeth and surrounding tissues.

Keywords Deciduous teeth, Dentigerous cyst, Impacted teeth, Marsupialization, Odontogenic cyst

Introduction

Dentigerous cysts, radicular cysts, odontogenic keratocyst, eruption cysts and calcified odontogenic cysts are an important group of cystic lesions seen in the jaws in pediatric age groups (1). Dentigerous cysts are the second most common form of benign developmental odontogenic cysts that result from the accumulation of fluid between reduced enamel epithelium and the crown of an unerupted tooth (2).

In its histopathology, dentigerous cyst epithelium consists of 2-4 layers of smooth nonkeratinized cells, and the interface of epithelium and connective tissue is smooth. There may be mucous, ciliated columnar, and fat cells in dentigerous cyst epithelium (3). Although dentigerous cysts are considered to be developmental, it has been reported that inflammatory dentigerous cysts may also form when periapical infection from a devitalized deciduous tooth adversely affects the underlying permanent tooth germ for a long time (4).

In childhood, the three-dimensional growth of the maxillofacial skeletal structure and the development process, including the odontogenesis of the teeth, affect the distribution of cysts (1).

Dentigerous cysts usually appear in male patients and the mandibular region (6). Clinically, a dentigerous cyst is asymptomatic unless it is inflamed and grows, causing tooth displacement and jawbone expansion (6).

Radiographically, dentigerous cysts appear as well-demarcated, unilocular radiolucency located at the cementoenamel junction of the tooth. They may appear radiographically similar to an odontogenic keratocyst or ameloblastoma (6).

The presence of dentigerous cysts can cause severe consequences, such as pathological fracture and facial asymmetry (7).

Nevertheless, their surgical removal might present complications, such as nerve injuries, post-operative infections, and iatrogenic mandibular fractures. Therefore, the clinical conduct regarding those cysts should weigh the risks of removal and the benefits of tooth preservation (8). Hence, the interest of surgical marsupialization or decompression is the two most conservative treatment options described for the management of dentigerous cysts (9). Dentigerous cysts can be treated by enucleation or marsupialisation. While enucleation is a treatment method that can be applied in the treatment of small cysts, marsupialization, and decompression procedures, which can be applied in large cysts that can cause damage to the surrounding tissue, are minimally invasive procedures characterized by draining the cyst content and opening it into the mouth and based on patient follow-up (10).

The treatment decision takes into account different cri-

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teria, including cyst size, cyst location, removal of an unerupted tooth, and follow-up possibilities (2). In the treatment of lesions observed in childhood, it has been reported that marsupialization is an effective treatment method for the protection of erupting permanent teeth and surrounding tissues (11).

The aim of this article is to present the treatment of dentigerous cysts caused by infected primary teeth with marsupialization and its long-term prognosis.

Case Report

An eight-year-old young patient was referred to our department with a complaint of facial swelling in his lower jaw. An intraoral examination revealed a bone expansion in the region of the right mandibular primary first and second molars and primary molars with broken restorations. The patient's right vestibular mucosa showed painless swelling due to bone expansion. There were no lymph nodes palpable and no active discharge of pus. Radiographic examination revealed a large, circular, clearly circumscribed, unilocular radiolucent area starting from the right mandibular deciduous first molar and extending to the mesial aspect of the right mandibular permanent first molar (Figure 1). Three-dimensional Dental Volumetric Tomography images obtained from the patient showed that the lesion grew expansively and caused thinning of the cortical bone layer on the buccal side (Figure 2).

Figure 1: Pre-Operatif Panoramic Radiography

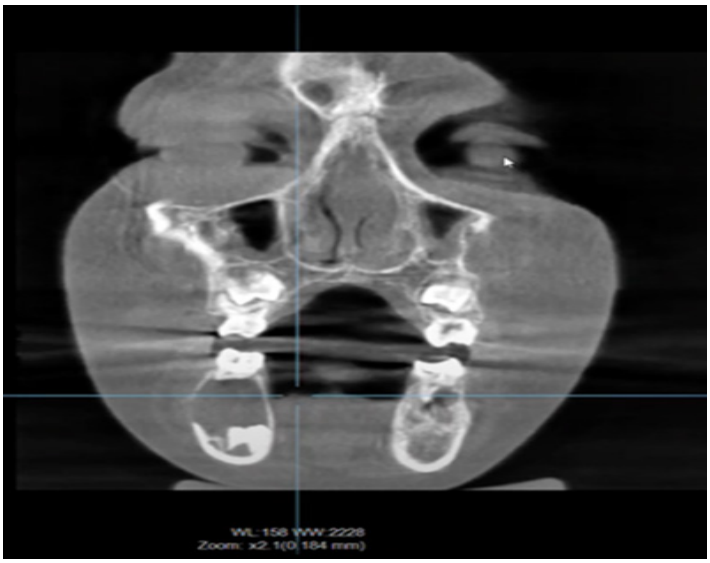

Figure 2: Pre-Operatif CBCT Coronal Section

The cystic lesion surrounded the impacted and displaced right permanent premolars (Figure 3). No signs of root resorption were observed in the neighboring teeth. The lesion, which was presumed to be a dentigerous cyst, was also associated with an improperly/incompletely treated and infected deciduous second molar in this area. Informed consent was obtained from the patient and his family regarding the surgical treatment. The primary right first and second molars were extracted, and the cyst was marsupialized. A tissue sample was also taken for the biopsy. A silicone tube was inserted into the extraction socket of the second primary molar to relieve the pressure (Figure 4).

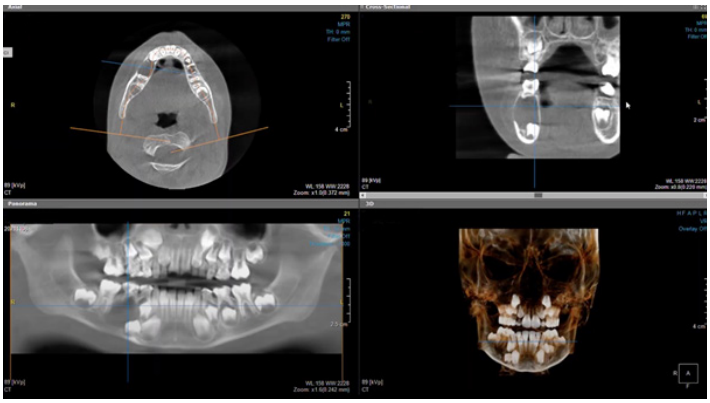

Figure 3: Pre-Operatif CBCT

Figure 4: Post-Operatif Panoramic Radiography

A histopathologic examination of the sample confirmed our initial diagnosis as a dentigerous cyst. The silicone tube was replaced weekly for one month postoperatively. The drain was fixed to the adjacent teeth with a composite wire so that it would not move. It was renewed every two weeks during the next five months post-operative period. Monthly control films were taken. The patient was advised to keep the relevant area clean and wash it regularly with saline. The radiograph taken during the first month's follow-up visit showed a decrease in the radiolucency at the cyst site and the impacted teeth straightening. After five months, the impacted teeth were in a vertical position, and new bone formation was evident at the former cyst site. The drain was removed at the six-month follow-up (Figure 5). The panoramic radiograph taken at the 36-month follow-up revealed the spontaneous eruption of the impacted first and second primary premolars with no radiolucency around the teeth (Figure 6). The vital response was observed in the vitalometer test performed on the related teeth. The patient is being followed up in terms of continued root development and

apex closure.

Figure 5: Post-Operatif 3th Month Panoramic Radiography

Figure 6: Post-Operatif 36th Month Panoramic Radiography

Follow-up appointments were scheduled to monitor the patient's dental health and ensure successful treatment outcomes. The asymptomatic PFs on both sides were observed and deemed clinically insignificant, requiring no immediate intervention.

Discussion

Cysts are pathological formations that may be filled with a liquid or semi-liquid material, lined with epithelium, and surrounded by a connective tissue capsule, expanding from the center to the periphery (12). Dentigerous cysts are the most common type of developmental odontogenic cysts. It is also stated that a dentigerous cyst can be caused by inflammation of the periapical tissues due to necrosis or a periapical infection originating from the primary tooth, which could stimulate the developing tooth germ follicle (13). Benn and Altini categorized dentigerous cysts as developmental and inflammatory cysts (14). Inflammatory dentigerous cysts could occur in immature permanent teeth as a result of inflammation from a non-vital primary tooth (14). Similarly, in our case, the patient's age and the clinical, radiographic, and histological findings suggest an inflammatory dentigerous cyst. In this case, painless buccal expansion was clear when the patient was referred to our clinic. The growth of odontogenic cysts is very slow, and asymmetries and deformations may be observed in adjacent tissues as a result of their growth. Although odontogenic cysts grow towards the vestibular, lingual, and palatinal sides, it has been reported that they often grow towards the vestibular side (15).

As in the treatment of most odontogenic cysts, dentigerous cysts are treated with surgical methods such as marsupialization, decompression, and enucleation (16). Marsupialization and decompression procedures have been reported to be effective treatments for large dentigerous cysts, especially in pediatric patients, to prevent damage to permanent tooth germs (8). Koca et al. reported in a study of 35 pediatric patients that all dentigerous cysts were successfully treated with marsupialization; no further treatment was needed for the eruption of permanent teeth, and bone regeneration was successful after five years of follow-up (11). In cases of dentigerous cysts in children, various appliances and methods can be used for marsupialization.

In the study by Koca et al., in which they evaluated 35 dentigerous cysts in 35 patients aged 8-13, it was reported that a custom acrylic obturator was used for marsupialization (11). In various studies, A space maintainer with an acrylic and wire extension was applied to keep the cystic cavity open after marsupialization, this appliance was followed up at 3-week intervals and removed after 6 months (17). In another study by Ryu et al., they placed a 16-gauge needle metal tube connected to the adjacent tooth in the extraction socket after marsupialization and extraction of primary teeth (18). In the study by Taysi et al. they use a silicone tube to the extraction socket to relieve the pressure (19).

In our study, we used a biocompatible silicone tube and renewed it every 2 weeks due to the cystic structure with a large defect and in order not to create resistance to the eruption of neighboring teeth and teeth to come.

Marsupialization consists of uniting the cyst lining to the oral mucosa. This method has fewer complications than enucleation regarding the preservation of important anatomical structures and developing tooth germs (20).

The size of dentigerous cysts is an important factor in the choice of treatment method. In their literature review, Hou et al. reported that marsupialization is the first choice for the treatment of large cysts regardless of the diagnosis. They also reported that the risk of recurrence after marsupialization was low, and no malignant transformation was detected in any of the cases (21).

It is a known fact that, although dentigerous cysts inhibit the eruption of the cyst-associated permanent teeth, maturation of the roots of these teeth continues (22). Miyawaki et al. reported that an impacted tooth might erupt faster if marsupialization is performed at a time when the tooth has the ability to erupt (23).

In the literature, it has been reported that radicular cysts can be seen together with dentigerous cysts, and thus, the lesions can become infected and cause symptoms such as pain and swelling (24).

It is mentioned that three different mechanisms may be effective in the development of inflammatory dentigerous cysts. The first one is that; intrafollicular developmental dentigerous cysts become infected due to periapical inflammation spreading from devital deciduous teeth; the second one is that the inflammatory exudate spreading from devital deciduous teeth causes separation of the reduced enamel epithelium from the enamel, and the third one is that extrafollicular dentigerous cysts may rarely form when radicular cysts formed in devital deciduous teeth merge with the underlying permanent tooth germ (25). After pulp treatments, dentigerous cysts may develop due to stimulation in the periradicular region, affecting the underlying permanent tooth germ

follicle. They are most commonly seen in relation to deciduous mandibular second molars because the distance between the permanent tooth germ follicle is the smallest, and the risk of caries is the highest (26). In children and adolescents, the formation and growth of cysts can occur more rapidly (27).

Cysts in children can cause bone expansion and resorption, delayed eruption, malposition of teeth, enamel defects, or damage to developing permanent tooth germs. Even if the position of the underlying permanent teeth is considered to be very unfavorable for eruption due to the effect of cysts, it is observed that in most cases, the teeth can erupt spontaneously after the causative cyst is removed (28).

In some cases, tooth eruption does not always occur spontaneously after decompression or marsupialization, especially when there is not enough space to allow eruption or no favorable axis is available (29).

Thus, orthodontic traction can be performed later. Combined orthodontic-surgical techniques may help promote cyst-related tooth eruption (30). In our case, the eruption of the related teeth was measured using a standardized radiographic method before treatment, and no space restriction was detected. Therefore, no eruption problem was experienced in the related teeth.

Conclusion

Although the development of odontogenic cysts in children is rare, their formation and progression can be much more rapid and aggressive than in adults. The treatment decision takes into account different criteria, including cyst size, cyst location, removal of an unerupted tooth, and follow-up possibilities. In the treatment of lesions observed in childhood, marsupialization has been reported to be an effective treatment method for the protection of erupting permanent teeth and surrounding tissues. In this case, the marsupialization protocol was applied and it was observed that the cyst shrank and disappeared over time and the impacted permanent teeth erupted.

Declarations

Author Contributions: *Conception/Design of Study- O.P., A.H.; Data Acquisition- O.P.; Data Analysis/Interpretation- O.P.; Drafting Manuscript- O.P., A.H.; Critical Revision of Manuscript- O.P., A.H.; Final Approval and Accountability- O.P., A.H.; Material and Technical Support- O.P., A.H.; Supervision- O.P.*

Conflict of Interest: *Authors declared no conflict of interest.*

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