Acta Stomatologica Cappadocia

Volume 5, Issue 3
December 2025

ISSN: 2792-047X

https://asc.kapadokya.edu.tr

Acta Stomatologica Cappadocia (ASC) 2025, vol. 5, no. 3

Adress: Cappadocia University, Urgup Campus, Faculty of Dentistry
Urgup / Nevsehir
Phone: +90 (384) 353 5009 Fax: +90 (384) 353 5125

Adress: Cappadocia University, Urgup Campus, Faculty of Dentistry
Urgup / Nevsehir
Phone: +90 (384) 353 5009 Fax: +90 (384) 353 5125

Language Editor

Lecturer Büşra Uyanık (Cappadocia University, Türkiye)

Statistics Editor

Asst. Prof. Selda Öztürk (Cappadocia University, Türkiye)

Adress: Cappadocia University, Urgup Campus, Faculty of Dentistry
Urgup / Nevsehir
Phone: +90 (384) 353 5009 Fax: +90 (384) 353 5125

CAPPADOCIA UNIVERSITY
Logic - Wisdom - Equality - Tradition

Acta Stomatologica Cappadocia

Table of Contents

Research Articles

Case Report

Volume 5 / Issue 3 / December 2025

Research Article

Comparison of the Internal Adaptation of Restorations Manufactured with Different Materials and Techniques

Abdurrahman Şahinbaş[1*], Ladise Ceylin Has[2]

[1]Bayındır Oral and Dental Health Polyclinic, İstanbul, Türkiye.
[2]Atatürk University, Dentistry Faculty, Department of Periodontology, Erzurum, Türkiye,

*Corresponding author: asahinbas83@hotmail.com

Şahinbaş, Abdurrahman., Has, Ladise Ceylin. "Comparison of the Internal Adaptation of Restorations Manufactured with Different Materials and Techniques". *Acta Stomatologica Cappadocia.* 5;3 (December 2025): 1-25.

DOI: https://doi.org/10.54995/ASC.5.3.1
Received: 09.10.2025; Accepted: 25.11.2025

Comparison of the Internal Adaptation of Restorations Manufactured with Different Materials and Techniques

Abdurrahman Şahinbaş, Ladise Ceylin Has

Abstract

Purpose: This study aimed to evaluate and compare the internal adaptation of restorations produced with different materials and techniques.

Material and Method: In the study, tooth 36 was prepared on a dental training model (Kavo Basic study model, KavoGMBH, Germany) by an experienced prosthodontist. Using computer-aided manufacturing methods, 10 feldspathic ceramic crowns (Cerec Blocs, Sirona, Bensheim, Germany), monolithic zirconia crowns (Ceramill ZI CAM, Amann Girrbach, Germany), zirconia frameworks (Aidite, Superfect Zir, USA), metal frameworks (Bego, Germany) by laser sintering, and metal frameworks (using conventional methods) were fabricated. The metal and zirconia frameworks were completed with superstructure ceramics (VITA, Germany) by an experienced technician. The restorations were placed on the prepared teeth, and a silicone replica of the cement gap was obtained using the replica technique with additive-type silicone impression material (Heraeus Kulzer, Germany). Sections obtained from replicas were measured at 10 points using a light microscope. Statistical analysis of the data was performed using SPSS (ver. 21.0; SPSS, Inc., Chicago, IL, USA). ANOVA and post hoc Tukey HSD tests were applied to the obtained data.

Results: A statistically significant difference was observed only between axio-occlusal measurement points ($p<0.05$).

Conclusion: The internal range values were measured at a clinically acceptable range value of less than 200 micrometers. The highest internal range values were observed in the occlusal region and the lowest values in the axio-gingival region. The mean value of the highest internal range was measured at the occlusal measurement point in the monolithic zirconium group. The lowest mean value of internal range was measured at the axio-gingival measurement point in the zirconia-supported ceramic group.

Keywords: CAD/CAM, Dentures, Internal Adaptation, Selective Laser Sintering.

Özet

Amaç: Bu araştırmanın amacı farklı materyal ve teknikler ile üretilen restorasyonların internal uyumlarının değerlendirilmesi ve karşılaştırılmasıdır.

Gereç ve Yöntem: Çalışmada diş hekimliği eğitim modeli (Kavo Basic study model, KavoGMBH, Germany) üzerinde 36 numaralı diş, deneyimli bir protetik diş tedavisi uzmanı tarafından prepare edildi. Bilgisayar destekli üretim yöntemleri kullanılarak her biri 10 adet, feldspatik seramik kron (Cerec Blocs, Sirona, Bensheim, Almanya), monolitik zirkonya kron (Ceramill ZI CAM, Amann Girrbach, Almanya), zirkonya altyapı (Aidite, Superfect Zir, Amerika), lazer sinterizasyon yöntemi ile metal altyapı (Bego, Almanya) ve konvansiyonel yöntemle metal altyapılar elde edildi. Metal ve zirkonya altyapılar deneyimli bir teknisyen tarafından üstyapı seramiği (VITA, Almanya) ile tamamlandı. Restorasyonlar, prepare edilmiş diş üzerine yerleştirilip ilave tipi silikon ölçü maddesi ile (Heraeus Kulzer, Almanya) replika tekniği kullanılarak siman aralığının silikon replikası elde edildi. Replikalardan elde edilen kesitler ışık mikroskobu yardımıyla 10 noktadan internal aralık ölçüldü. Verilerin istatistiksel analizi SPSS (ver.21.0; SPSS, Inc., Chicago, IL, ABD) programı kullanılarak yapıldı. Elde edilen verilere ANOVA ve post Hoc Tukey HSD testleri uygulandı.

Bulgular: Sadece aksiyo-oklüzal ölçüm noktaları arasında istatistiksel anlamlı fark olduğu görüldü. ($p<0.05$).

Sonuç: Örneklerin internal aralık değerleri 200 mikrometreden az olduğu belirlenmiştir. İnternal aralık değerlerinin klinik olarak kabul edilebilir olduğu görülmüştür. Konvansiyonel ve bilgisayar destekli yöntem ile üretilen bütün restorasyonların internal aralık değerleri; en yüksek okluzal, en düşük aksiyo-gingival bölgede gözlenmiştir. En yüksek internal aralık ortalama değeri, monolitik zirkonyum grubunda okluzal ölçüm noktasından; en düşük internal aralık ortalama değeri ise zirkonya destekli seramik grubunda aksiyo-gingival ölçüm noktasından elde edilmiştir.

Anahtar Kelimeler: CAD/CAM, Dental Restorasyonlar, İnternal Uyum, Selektif Laser Sinterleme.

Introduction

The main purpose of prosthetic dentistry is to restore anomalies or losses in the mouth and to eliminate functional disorders caused by these deficiencies. Regardless of the type of restoration, marginal and internal fits are important parameters for long-term success. The wide marginal space causes rapid dissolution of the cement and microleakage. This situation will disrupt the harmony of the restoration and shorten the duration of the restoration in the mouth.

In the process of producing a restoration, it goes through many stages. Different material types and production methods cause differences in restorations. For this reason, researchers are looking for ideal materials and techniques.

Marginal and internal adaptation directly affect the duration of clinical use of restorations (1). The marginal cement film thickness value, which has long been discussed in the literature, is considered to be 120μm for full crowns. Ranges greater than this value increase the risk of exposure of the abutment tooth to oral fluids and make the abutment tooth vulnerable to chemo-mechanical factors (2). Internally, it has been determined in studies that the cement material, which is prepared as a thick layer on the inner surface of the restoration, increases residual stresses and causes fracture formation (3). The production processes are classified under two main headings as traditional and digital measurement methods. Both of these methods have advantages and disadvantages in themselves (4). The CAD/CAM (Computer Aided Design / Computer Aided Manufacturing) system, which is a current method to produce the restorations, is gaining more and more popularity in clinical practice (5).

At the beginning of the advantages of the system is the direct digital impression technique. Some studies show that intraoral scanners used in the direct digital technique are effective to producing more compatible restorations. (6). With this system, the clinician can simultaneously evaluate the procedure applied to the relevant tooth, examine its relationship with the opposite arc, apply the necessary corrections in the same session by taking advantage of technical advantages such as magnification and reduction, and there is no need for 'size renewal' as in the conventional measurement method for all these procedures (7).

In this context, the study aims to evaluate the difference between the internal compatibility of restorations produced using conventional and computer-aided manufacturing methods and to observe the difference between the internal harmony of restorations manufactured using various restorative materials.

The null hypothesis of the study is that the internal adaptations of restorations manufactured using conventional versus computer-aided manufacturing techniques will not differ. The second null hypothesis of this study is that there will be no difference in the internal compatibility of restorations made from different materials.

Materials and Methods

Table 1. Group name, type of material, and sample numbers

Group Name	**Material Type**	**Brand Name and Manufacturer**	**Sample Numbers**
Group 1	Feldspathic ceramic blocks	Cerec Blocs, Sirona, Bensheim, Germany	10
Group 2	Zirconia Supported Ceramic	Superfect Zir, Aidite, USA	10
Group 3	Monolithic zirconia	Ceramill ZI CAM, Amann Girbach, Germany	10
Group 4	Metal-supported ceramic produced by the method of Selective Laser Sintering	Bego, Germany	10
Group 5	Metal-supported ceramic produced by the lost wax casting method	VITA, Germany	10

Table 2. Impression materials and instruments utilised for research

Material	**Product Name(Manufacturer)**
Impression material	Variotime Easy Putty Base-Catalyst (Heraeus Kulzer, Germany)
Impression material (silicone replica)	Variotime Easy Putty Base-Catalyst (Heraeus Kulzer, Germany)
Impression material (silicone replica)	(Variotime Light Flow Refil, Heraeus Kulzer, Germany)
Light microscope	Nikon(Eclipse 920248,USA)
Camera	Nikon(DS-Fi2-U3,USA)
CAD/CAM milling device	IMES-ICORE Coritec 550i CAD/CAM milling machine
3D Scanner	Identica T300
Design Program	Exocad(Darmstadt, Germany)

Tooth Preparation

The research employed a mandibular first molar tooth model. The tooth was placed within a phantom study model (Kavo Basic study model, Kavo GMBH, Germany). This model is designed to replicate a mandible and includes gum tissue. The teeth that remain in the phantom jaw are composed of a thermoset material that possesses rigidity, rendering it suitable for both analogue and digital impressions.

An experienced prosthodontist prepared tooth number 36 for a single crown restoration using a modified shoulder step technique. In addition, the axial walls will prepared at an

angle of 6 degrees using a milling machine (Paraskop M - precision milling device, Bego, Germany) with a step width of 1 millimetre. On the surface of the prepared phantom tooth, sharp edges, corners, and rough surfaces were removed using finishing and polishing rubber. The primary model to be created had a smooth surface structure, and any potential stresses were minimised. The silicone matrix obtained before the preparation was used as a guide to control the depth of the preparation.

Impression, Design, and Restoration Production

An extra-oral scanner (Identica T300 model and impression scanner) was used to take the digital impression. A digital impression was taken of the study model, and the data were transmitted to the CAD/CAM system. The resin model was printed with a 3D printer (w2p onex Dental) to be used as a definitive model in the internal fit measurement.

Figure 1. During the scan of the prepared tooth

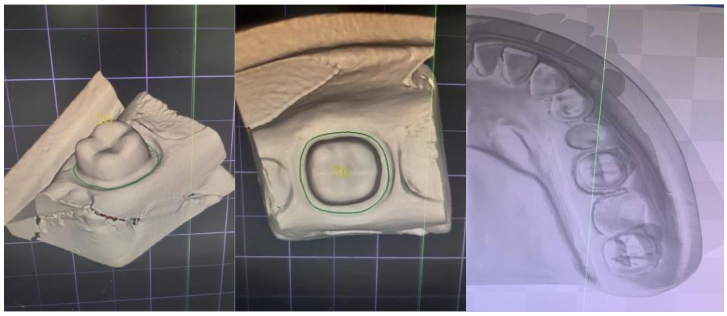


Figure 2. Images of the scanned tooth

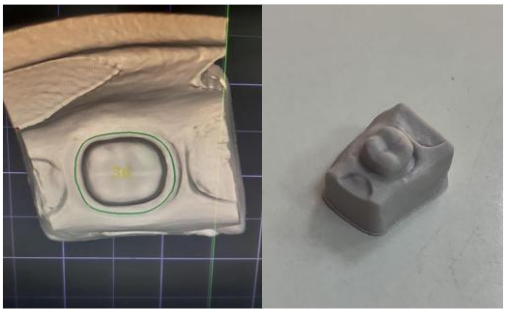


Figure 3. The primary model's digital image and printed resin model

The design process was conducted for each group using the Exocad (Darmstadt, Germany) design software. The cement film thickness was designed to be 40 microns, and the material thicknesses were designed according to the manufacturer's specifications. The same restoration design file was used to produce crown restorations from feldspathic ceramic blocks (Cerec Blocs, Sirona, Bensheim, Germany) for group 1 and monolithic zirconia material (Ceramill ZI

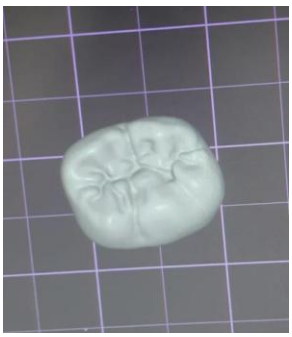


Figure 4. Digitally designed crown restoration

CAM, Amann Girbach, Germany) for group 3. Using the same infrastructure design file, group 2 zirconia (Superfect Zir, Aidite, USA) and group 4 metal (Bego, Germany) infrastructures were produced. Groups 1, 2, and 3 were produced using the subtractive method (IMES-ICORE Coritec 550i), group 4 was produced using the selective laser sintering method, and group 5 was produced using the conventional fabrication method with the assistance of an experienced technician. All infrastructures were completed with porcelain superstructures with the assistance of an experienced technician.

Internal range measurement

After the production of the restorations, the marginal and internal alignment was evaluated using the silicone replica technique. Numerous studies recommend the silicone replica technique because it is simple to perform, cost-effective, quick, and reliable (8, 9). As described by Molin and Karlsson (10, 11), this technique was utilised to evaluate the internal and marginal fit of restorations.

In the silicone replica technique, both fluid and viscous forms of type A silicone (Variotime Easy Putty, Heraeus Kulzer, Germany) were used to fill the space between the restoration and the preparation surface in order to simulate cement.

To ensure standardization, the fluid silicone measuring device was applied to the inner surface of the restoration using a silicone mixing gun (Variotime Light Flow Refil, Heraeus Kulzer, Germany). The flowable silicone used in the restoration was deposited on the resin model with finger pressure to simulate the clinical cement and cementation procedure and allowed to polymerize for two and a half minutes per the manufacturer's instructions.

Figure 5: Prepared model to obtain a silicone replica on the prepared tooth model

Following completion of polymerization, the restorations were removed from the resin model so that the silicone replica remained on the inner surface. To support the silicone replica and stabilise the duplicated interface, the silicone-containing restorations were filled with a dense silicone material (Variotime Easy Putty, Heraeus Kulzer, Germany) of a different colour.

After polymerization was complete, the restorations were removed from the resin model, leaving the silicone replicas on the inner surface. The silicone-containing restorations were

filled with a dense silicone material (Variotime Easy Putty, Heraeus Kulzer, Germany) of a different colour to support the silicone replica and stabilise the dubliqued interface.

After the polymerization of the dense silicone material (Variotime Easy Putty, Heraeus Kulzer, Germany) was complete, the silicone was separated in one piece from the interior surface of the restoration. The replicas for each experimental group were obtained by individually placing the produced crowns on the resin model.

First, the silicone materials were divided into two equal halves in the mesiodistal direction using a sharp scalpel (blade number 11, Braun 78532, Tuebingen, Germany).

The mesial portion was then photographed using a stereomicroscope (Nikon, Eclipse 920248, USA) and divided into buccal and lingual portions in the mesiodistal orientation. Thanks to the initial incision, the silicone replica was divided into two equal sections in the frontal plane, allowing for the measurement of the buccal and lingual regions. Descriptive markers were placed on each incision so that localizations could not be confused.

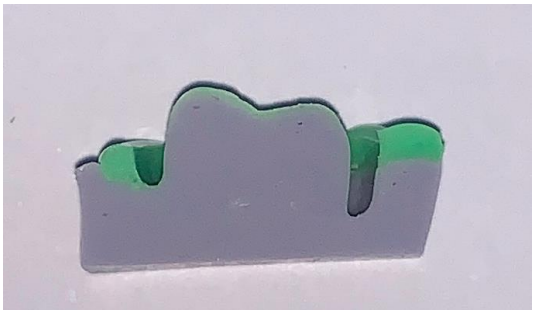


Figure 6: Silicone replica divided into two equal parts with the help of a scalpel in the mesio-distal direction

Under a light microscope (Nikon, Eclipse 920248, USA) with 1x magnification, the acquired replicas were digitised and compared by calculating the distance between the tooth and the crown. As shown in Figure 1, 10 specific points were determined in order to perform calculations. Internal range measurement points, marginal measurement points (from zone 1, 10), intermarginal measurement points (from zone 2, 9), axiogingival measurement points (from zone 3, 8), axio-occlusal measurement points (from zone 4.7), and occlusal measurement points (from region 5, 6) were established.

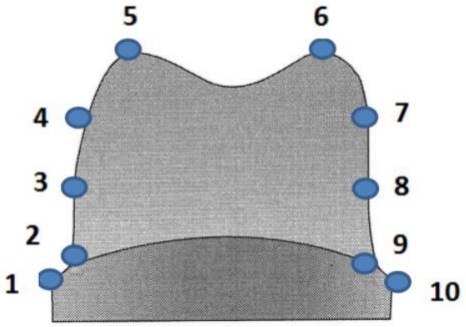


Figure 7. Internal range measuring points: marginal measuring points (1, 10), intermarginal measuring points (2, 9), axiogingival measuring points (3, 8), axio-occlusal measuring points (4.7), occlusal measuring points (5, 6)

Under 1x magnification, the marginal and internal ranges were investigated and photographed with a camera (Nikon, DS-Fi-U3, USA).

After completing the microscopy photography session, the obtained images were transferred to the computer environment using completely compatible software. On a computer, the internal and marginal range values are defined using ImageJ (ImageJ and NIH Image software; National Institutes of Health, Bethesda, Maryland), and the results were saved in an Excel file. For each silicon sample, measurements were taken from a total of 10 different locations. Internal and marginal range measurements were performed on samples from each of the five study groups, yielding a total of 500 numerical values. Transferring the collected data to the SPSS 24.0 programme, statistical analyses were conducted. Due to the homogeneous distribution of data, statistical analyses were conducted with ANOVA and Tukey HSD tests.

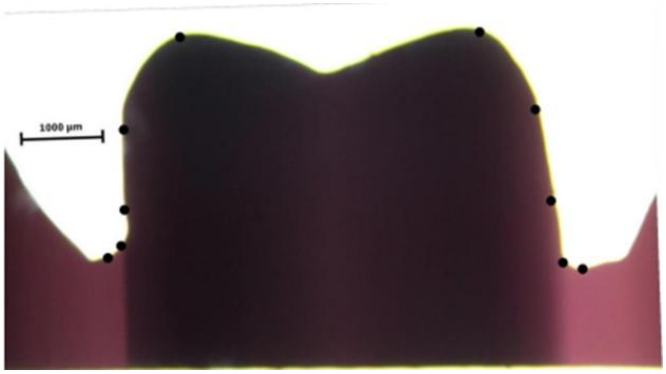


Figure 8: 1x magnified silicone replica under light microscope

Results

Sectioned silicone replicas of each crown were examined under a 1x magnification light microscope, and length measurements were taken at the marked points.

Internal range measuring points:

- Marginal measuring points (1, 10)
- Intermarginal measuring points (2, 9)
- Axiogingival measuring points (3, 8)
- Axiooclusal measuring points (4,7)
- Occlusal measuring points (5, 6)

Table 3. Table of internal range measurement values

Group Name		**Marginal Measuring Points(1)**	**(10)**	**Intermarginal Measuring Points(2)**	**(9)**	**Axiogingival Measuring Points(3)**	**(8)**	**Axiooclusal Measurement Points(4)**	**(7)**	**Occlusal Measuring Points(5)**	**(6)**
Group 1	Avg.	32,31	33,02	33,05	34,61	30,32	31,02	35,47	39,10	38,45	36,72
	Standard deviation	9,81	10,79	13,03	13,36	12,89	8,76	8,93	7,98	9,14	13,08
Group 2	Avg.	33,53	34,11	34,32	34,11	28,92	32,64	32,04	34,14	34,79	34,42
	Standard deviation	5,30	4,37	5,02	5,89	4,48	1,99	3,70	2,74	5,47	3,01
Group 3	Avg.	34,53	30,35	35,66	32,01	34,39	29,56	30,45	32,03	37,21	39,07
	Standard deviation	4,10	4,41	4,90	4,64	6,15	5,12	6,09	3,38	5,59	7,00
Group 4	Avg.	32,48	32,58	37,83	35,66	29,39	33,23	29,41	33,00	35,37	35,67
	Standard deviation	1,62	2,00	2,35	2,30	4,24	2,58	3,68	2,21	2,91	5,17
Group 5	Avg.	33,79	33,87	36,38	35,78	29,77	32,54	33,20	32,82	38,17	36,35
	Standard deviation	2,84	3,47	2,68	1,55	3,73	2,33	3,74	4,74	2,90	3,88

Upon examination of the groups, it was observed that the measurement point 6 (occlusal measurement point) in group 3 (monolithic zirconium group) showed the highest mean value for internal range. The group 2 (zirconia-supported ceramic group) showed the lowest mean value for the internal range at the measurement point 3 (axiogingival measurement point).

Upon comparing the measurement points across the groups, it was found that a statistically significant difference was observed only at measurement point 7 (axio-occlusal measurement point).

Table 4. Table of internal range measurement values

Case Summaries											
Groups		I	X	II	IX	III	VIII	IV	VII	V	VI
1,00	Maximum	37,73	36,45	42,09	46,02	40,02	34,05	39,31	41,81	41,29	46,88
	Minimum	26,86	28,56	24,91	27,75	23,98	28,37	31,82	35,53	34,92	31,76
	Mean	32,316	32,290	33,050	34,612	30,328	31,020	35,474	39,108	38,658	36,72
	Std. Deviation	4,229	3,039	8,242	7,104	6,083	2,059	3,239	2,447	2,570	5,865
	Median	32,44	32,51	30,99	32,88	28,30	30,72	34,56	40,02	39,32	35,28
2,00	Maximum	41,43	40,69	37,06	40,02	32,78	34,47	36,98	35,48	40,85	38,30
	Minimum	29,56	32,71	36,26	29,17	24,73	30,93	30,05	29,57	31,83	33,15
	Mean	34,81	35,46	36,57	35,85	30,31	33,31	33,16	33,47	36,30	35,49
	Std. Deviation	4,456	3,165	0,314	4,451	3,255	1,383	2,755	2,296	4,366	1,837
	Median	34,82	35,24	36,60	35,90	31,39	33,81	33,20	34,27	36,45	35,37
3,00	Maximum	35,98	35,18	37,48	36,56	40,22	34,33	39,41	35,70	38,66	42,97
	Minimum	33,24	25,82	33,40	24,92	26,65	22,02	25,85	28,12	36,23	34,17
	Mean	34,53	30,35	35,66	32,01	34,39	29,56	30,45	32,03	37,21	39,07
	Std. Deviation	1,365	4,419	1,683	4,645	6,153	5,129	6,096	3,381	0,953	3,148
	Median	34,28	28,82	36,14	32,50	35,71	29,28	26,78	33,29	36,98	39,48
4,00	Maximum	34,05	35,41	41,03	36,38	35,05	35,80	30,29	35,61	38,92	42,46
	Minimum	30,37	30,74	34,80	35,03	25,43	30,21	27,78	29,92	32,95	28,81
	Mean	32,48	32,58	37,83	35,66	29,39	33,23	29,41	33,00	35,37	35,67
	Std. Deviation	1,622	2,005	2,358	0,633	4,242	2,585	1,003	2,218	2,919	5,176
	Median	33,41	31,50	37,35	35,43	28,71	34,20	29,43	32,55	33,65	36,95
5,00	Maximum	37,38	37,17	40,29	37,20	34,54	33,20	37,13	34,22	39,25	37,85
	Minimum	30,45	29,63	34,07	33,71	25,50	31,89	27,71	31,62	37,03	34,47
	Mean	33,79	33,87	36,38	35,78	29,77	32,54	33,20	32,82	38,17	36,35
	Std. Deviation	2,846	3,475	2,686	1,558	3,731	,4913	3,748	0,958	0,853	1,219
	Median	34,02	35,61	34,95	36,57	28,96	32,51	34,11	32,94	38,43	36,59

Table 5. Analysis of variance for measurement points

Measurement Point	Sig.
I	,629
X	,202
II	,460
IX	,601
III	,498
VIII	,200
IV	,122
VII	,001
V	,320
VI	,614

Table 6: Tukey HSD test data of the groups

Multiple Comparisons			
Tukey HSD			
Dependent Variable			Sig.
VII	1,00	2,00	,010
		3,00	,001
		4,00	,005
		5,00	,004
	2,00	1,00	,010
		3,00	,874
		4,00	,998
		5,00	,992
	3,00	1,00	,001
		2,00	,874
		4,00	,967
		5,00	,984
	4,00	1,00	,005
		2,00	,998
		3,00	,967
		5,00	1,000
	5,00	1,00	,004
		2,00	,992
		3,00	,984
		4,00	1,000
*. The mean difference is significant at the 0.05 level.			

A significant difference is observed for all groups only at the 7th measurement point.

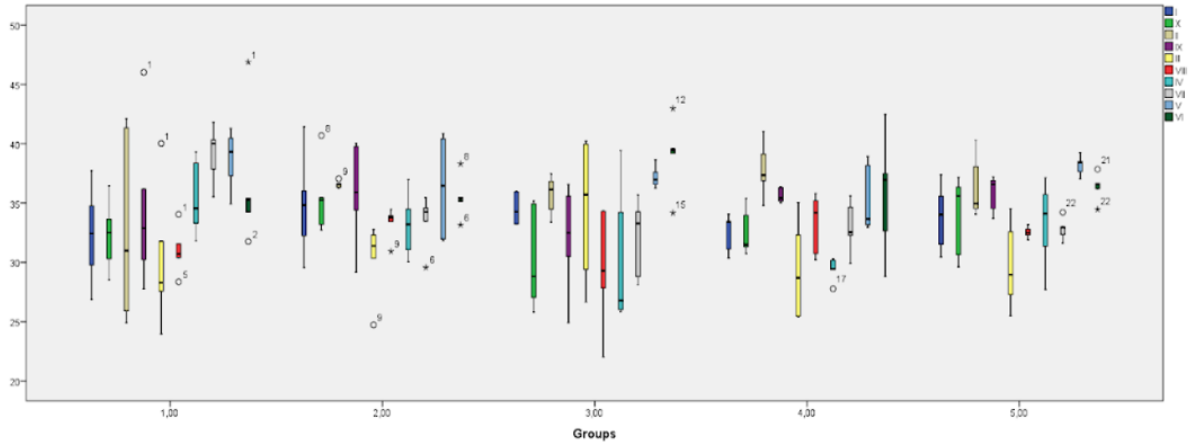


Figure 9. Graph of Internal Range Measurement Values of Research Groups

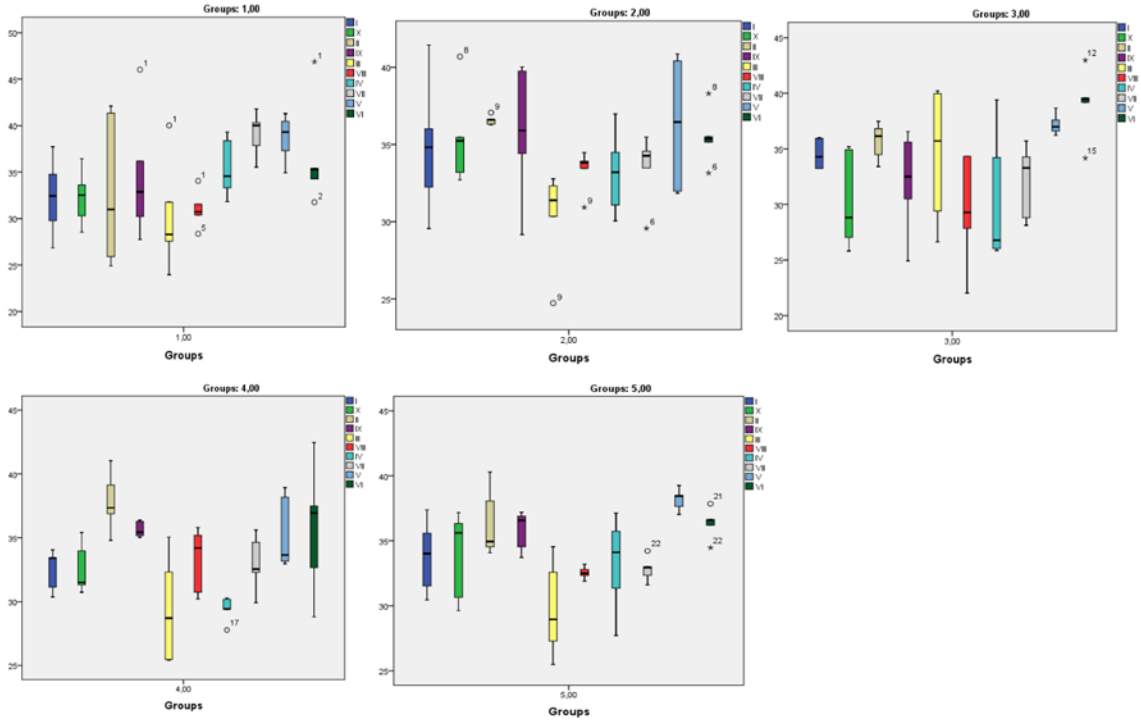


Figure 10. Graph of internal gap measurement values for research groups

When performing a regional comparison of internal range values, it was observed that the occlusal region (specifically, measurement point 6) had the greatest average internal range values across all groups. The computed values for Group 1, Group 2, Group 3, Group 4, and Group 5 were 36.7200 µm, 35.4940 µm, 39.0760 µm, 35.6740 µm, and 36.3520 µm, respectively.

The axiogingival region (measurement point number 3) has the lowest average values of internal range. Specifically, Group 1 has an average of 30,3280 µm, Group 2 has an average

of 30.3120 μm, Group 3 has an average of 34.3900 μm, Group 4 has an average of 29.3960 μm, and Group 5 has an average of 29.7740 μm.

Discussion

Modern dentistry makes extensive use of dental ceramics in order to satisfy the aesthetic and functional expectations of patients. However, the development of computer-aided manufacturing technologies and the search for alternative materials have ushered dentistry into a new era. With the advent of digital systems, a variety of materials began to be used, providing an alternative to conventional porcelain restorations. Due to the advancement of technology, impression systems have made progress, and digital impression and production systems have gained popularity.

However, studies are continuing to investigate the advantages and disadvantages of these innovations. In this context, the effects of crowns obtained from different materials using digital and traditional manufacturing methods on internal compatibility were investigated.

The final outcome of a restoration is inevitably influenced by variations in production methods arising from different workflows. The emergence of varying outcomes among distinct groups is believed to be influenced by the structural characteristics of the materials utilised in crown manufacture. The impact of this on the internal adaptation metrics, which are the focus of this investigation, is documented in the existing literature and is acknowledged as a limitation of the study (12, 13).

Nakamura et al., in their research examining the effect of the preparation angle of the fully ceramic crowns produced with the Cerec 3 CAD-CAM system on the marginal fit, stated that the marginal gap between the crowns produced on the main model with a preparation angle of 4 degrees was statistically significantly less than the other two groups (preparation angle 8 and 12 degrees), and that there was no statistically significant difference between the teeth with a preparation angle of 8 and 12 degrees in terms of marginal gap (14).

According to Shillingburg et al. suggested that an appropriate preparation angle ranging from 2 to 6 degrees can provide favourable outcomes in terms of restorative retention and resistance. The results derived from these studies have been acknowledged as fundamental concepts in the field of tooth preparation (15). In this study, the preparation angle of the master resin model was conducted in accordance with the studies mentioned above. To achieve this,

a 6-degree preparation angle was created using a precision milling device and a diamond bur with an angle of 6 degrees.

In the studies that were performed on marginal compliance, different sample numbers were preferred. Beschnidt and Strub (16) used 10 samples for each group, while May et al. (17) used 5 samples for each group, and Schaerer et al. (18) used 6 samples for each group. In this study, 10 samples were used for each group.

Luthart et al. (19) in 2005, in their study, compared the accuracy of replicating a model situation using intraoral digitization versus the conventional method of impression taking, model production, and extraoral digitization. This study recommended that extraoral digitization with impression taking and model production was more accurate than intraoral digitization, and since the inaccuracies of the conventional impression under real clinical conditions may be greater than the values determined above, a clinical comparison should be performed in the future. In their study comparing digital and conventional impression methods, Ender and Mehl (20,46) also found that the conventional impression method is more sensitive and reliable than the digital impression method. According to current literature, a deviation of around 10 μm occurs during conventional measurement and obtaining the plaster model, and this value is thought to be negligible in a clear restoration process (21).

In other studies where the intraoral scanner is used, it is emphasized that the direct digital technique has more advantageous qualities in terms of precision and trueness (22). A systematic review by Abduo et al. found that the results obtained in different studies using the same systems in the literature have significant variations (23,47). This requires method homogenization in order to make an objective evaluation and reduce standard deviation. Based on this information, an extraoral scanner was used in the research.

Laurent et al. compared the marginal and internal range values obtained by the replication method they applied using silicone impression material with the values obtained after cementation with zinc phosphate cement. As a result, there was no difference between cervical, axial, occlusal, and marginal range values measured by zinc phosphate cement and silicone, and they reported that the silicone replica method is a successful method among internal range measurement methods (24). Kahramanoğlu and Özkan applied the replica technique by using light-bodied silicone impression material in their studies (25).Reich et. Al., filled the samples with a light-bodied silicone and affixed them to the abutment tooth. After the silicone

material was polymerized, it was stabilized by injecting a heavy-bodied silicone impression material (26). In their study evaluating the internal compatibility of all-ceramic and metal-ceramic systems, Martins and colleagues mimicked cement thickness by using a silicone impression material with a light-bodied silicone impression material (27). Renne et al.; they maintained the restorations filled with heavy-bodied silicone impression material on the support tooth with finger pressure until the material polymerized (28). Studies have demonstrated that measuring cement thickness with light-bodied silicone impression material is an accurate technique. In addition, because the samples are not cut and can be stored, reproducible measurements are possible (29).

For this purpose, in the study, the 'silicone replica technique', which is the most widely used method in the literature to evaluate the compatibility between tooth and restoration, was preferred (30).

To mimic the cementation procedure, the light-bodied silicone impression material was applied to the inner surface of the restoration and placed on the tooth surface with finger pressure. Weaver et al. stated that although a standardized pressure cannot be applied with finger pressure, this does not produce a significant change in the thickness of the silicone material (31).

The material used in marginal and internal adaptation studies, where the replica technique is applied, also affects the result to a significant extent. In this study, the inner surface of the restorations was filled with light-bodied silicone impression material in vitro and placed on the teeth with finger pressure. After the light-bodied silicone impression material polymerized, a heavy-bodied silicone impression material was injected to stabilize it and prevent its deterioration.

Other factors affecting the results of the study are the sample size, type of tooth, and localizations measured. In studies where marginal fit assessment was carried out, there was no consensus on how many points should be measured (32, 33).

In addition, there is no consensus on how many micrometres the cement spacing will be during the design of CAD/CAM restorations. Numerous authors (34-36) have determined in their investigations (37) that the cement range is 30 m. In their study comparing the marginal and internal harmony of all-ceramic restorations with cement spacing of 10 μm, 30 μm, and 50

μm produced by CEREC 3, they found that the group with cement spacing of 30 μm had the finest edge fit (38).

In marginal fit assessment, there is no established standard for the number of measurement points (39-41). In our investigation, ten distinct points were measured on the silicone replica sections obtained, and the results were statistically analysed.

Various types of microscopes are frequently used in marginal and internal adaptation assessment because they provide a precise and accurate evaluation at specified measurement points (42). Some researchers preferred the digital microscope (43-46) while others preferred the stereomicroscope (44,48-51). Some researchers have preferred light microscopes (52-54). In the study conducted by Groten et al. (55), the reliability of the light microscope was evaluated. And they stated that the data obtained by the light microscope method were reliable. In accordance with the conducted research, light microscopy was selected for accurate examination of the study data.

One notable limitation of the study is that no measurements were made regarding the effect of the intraoral environment. This limitation stems from the fact that the study was conducted in vitro; therefore, potential differences between intraoral temperature (32°C) and room temperature, which significantly impact the accuracy of standard impression techniques, were ignored.

For all groups, the highest internal range measurement was calculated from the occlusal measurement point, and the lowest internal range measurements were calculated from the occlusal and axial measurement points. According to research, the occlusal surface seems to be affected by factors that can be interpreted differently regarding the accuracy of the optical images obtained (56-58). Kokubo et al. reported that the scanner sensitivity of the CAD/CAM system affected the internal harmony of the final restoration. They reported that the internal spaces of the crowns produced by the CAD/CAM system were largest in the occlusal region and smallest in the proximal and marginal regions (57).

Ueda et al. evaluated the marginal gaps of zirconia fixed partial dentures produced using the conventional impression method after using the digital impression method (59). They stated that there was no significant difference between the crowns produced with the conventional impression technique (mean, 141 μm) and the digital impression technique (mean, 121 μm). Silva et al. investigated the internal harmony of zirconia substructures and

stated that there was no statistically significant difference between the conventional impression technique and digital impression techniques (60).

In their study, Syrek et al. performed a comparison of impression techniques, reporting that the digital impression technique exhibited a notably superior internal fit in comparison to the conventional impression technique (55). The digital impression technique showed an average internal range of 49 μm, while the conventional impression technique showed an average internal range of 71 μm ($p<0.05$) (61). According to the findings of Ender and Mehl's investigation, it was concluded that the conventional impression technique shows more accuracy and reliability compared to the digital measurement technique (62). Nevertheless, the digital impression technique has demonstrated a higher level of preference as a viable substitute for the conventional impression technique owing to its streamlined workflow, economic advantages, and enhanced patient comfort.

According to McLean and von Fraunhofer (63), for the long-term efficacy of the prosthetic restoration, the clinical internal range values should be 120 μm. Brojn et al. (64) determined that this value cannot exceed 200 μm. As a result of this study, the average internal range values in all groups were calculated below the values determined by McLean and Brojn.

For all restorations in the study, the occlusal region (measurement points 5 and 6) had the highest average internal range values, while the axiogingival region (measurement points 3 and 8) had the lowest internal range values.

Limitations Of The Study

The most significant limitation of this study is that its effect in the oral environment could not be measured because it was conducted in vitro. The conventional impression technique is affected by the difference between the intraoral temperature (32°) and the outside temperature. The structure of the material used in crown construction is a further factor that contributes to differences in outcomes between groups. This is a limitation of the research because there is evidence in the literature that this circumstance affects the internal harmony parameters discussed in the study. The measurement precision is affected by the polymerization shrinkage of the impression materials used in internal compliance measurements. In addition, the investigation was limited by the fact that internal range measurement values were obtained using the optical microscope method.

Conclusions

Within the limitations of this in vitro study:

1. There is no difference between the internal adaptation of crowns manufactured using digital workflow and crowns manufactured using traditional workflow.
2. Internal range values of all samples produced with digital and conventional manufacturing methods were measured to be less than 200 micrometres, which is clinically acceptable.
3. In the highest occlusal region and the lowest axiogingival region, the internal range values of all samples generated by digital and conventional workflows were observed.
4. Between axiooclusal measurement points, only statistically significant differences were observed.
5. In the monolithic zirconium group, the highest internal range mean value was measured at the occlusal measurement point.
6. At the axiogingival measurement point, the zirconia-supported ceramic group exhibited the lowest mean value of internal range.

Contributions of the authors involved in the research

A.Ş.: Author, Researcher, **L.C.H.:** Co-Author, Researcher

Presentation Location: Icp-Tpid Joint Meeting and 25th Scientific Congress of the Turkish Prosthodontic and Implantology Association,Dalaman,Turkey between November 4-7,2021 (Oral Presentation)

Financial Support Statement: This research was supported by the TUBITAK 2209-A University Student Research Projects Support Program. Application Number 1919B012005107

(Bu araştırma Tubitak 2209-A Üniversite Öğrencileri Araştırma Projeleri Destekleme Programı tarafından desteklenmiştir. Başvuru Numarası 1919B012005107)

Acknowledgements:

This research was supported by the TÜBİTAK 2209-A University Student Research Projects Support Program. Application Number: 1919B012005107. We would like to thank TÜBİTAK for their support and contributions to science, and Bezmialem Foundation University Faculty of Dentistry for the equipment and devices used in the research.

Conflict of Interest Statement:

There is no conflict of interest regarding the materials, techniques and support received in the research.

References

1. Beuer, F., Naumann, M., & Gernet, W. (2009). Precision of fit: Zirconia three-unit fixed dental prostheses. Clinical Oral Investigations, 13(4), 343–349.
2. Kokubo, Y., Ohkubo, C., Tsumita, M., Miyashita, A., Vult von Steyern, P., & Fukushima, S. (2005). Clinical marginal and internal gaps of Procera All Ceram crowns. Journal of Oral Rehabilitation, 32(7), 526–530.
3. Rekow, D., & Thompson, V. P. (2005). Near-surface damage—a persistent problem in crowns obtained by computer-aided design and manufacturing. Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine, 219(4), 233–243.
4. Beuer, F., Schweiger, J., & Edelhoff, D. (2008). Digital dentistry: An overview of recent developments for CAD/CAM generated restorations. British Dental Journal, 204(9), 505–511.
5. Van Noort, R. (2012). The future of dental devices is digital. Dental Materials, 28(1), 3–12.
6. Syrek, A., Reich, G., Ranftl, D., Klein, C., Cerny, B., & Brodesser, J. (2010). Clinical evaluation of all ceramic crowns fabricated from intraoral digital impressions based on the principle of active wavefront sampling. Journal of Dentistry, 38(7), 553–559.
7. Galhano, G. A., Pellizzer, E. P., & Mazaro, J. V. (2012). Optical impression systems for CAD CAM restorations. Journal of Craniofacial Surgery, 23(e5), e575–e579.
8. Molin, M., & Karlsson, S. (1993). The fit of gold inlays and three ceramic inlay systems: A clinical and in vitro study. Acta Odontologica Scandinavica, 51(4), 201–206.
9. Karlsson, S. (1993). The fit of Procera titanium crowns: An in vitro and clinical study. Acta Odontologica Scandinavica, 51(3), 129–134.
10. Boening, K. W., Wolf, B. H., Schmidt, A. E., Kastner, K., & Walter, M. H. (2000). Clinical fit of Procera AllCeram crowns. Journal of Prosthetic Dentistry, 84(4), 419–424.

11. Ural, C., Burgaz, Y., & Sarac, D. (2010). In vitro evaluation of marginal adaptation in five ceramic restoration fabricating techniques. Quintessence International, 41(7), 585–590.

12. Guazzato, M., Albakry, M., Ringer, S. P., & Swain, M. V. (2004). Strength, fracture toughness, and microstructure of a selection of all ceramic materials. Part I: Pressable and alumina glass infiltrated ceramics. Dental Materials, 20(5), 441–448.

13. Stappert, C. F., Att, W., Gerds, T., & Strub, J. R. (2006). Fracture resistance of different partial coverage ceramic molar restorations: An in vitro investigation. Journal of the American Dental Association, 137(4), 514–522.

14. Nakamura, T., Dei, N., Kojima, T., & Wakabayashi, K. (2003). Marginal and internal fit of CEREC 3 CAD/CAM all ceramic crowns. International Journal of Prosthodontics, 16(3), 244–248.

15. Shillingburg, H. T., Hobo, S., Whitsett, L. D., Jacobi, R., & Brackett, S. E. (1997). All ceramic restorations. In L. A. Bateman (Ed.), Fundamentals of fixed prosthodontics (3rd ed., pp. 433–455). Quintessence Publishing Co.

16. Beschnidt, S. M., & Strub, J. R. (1999). Evaluation of the marginal accuracy of different all ceramic crown systems after simulation in the artificial mouth. Journal of Oral Rehabilitation, 26(6), 582–593.

17. May, K. B., Russell, M. M., Razzoog, M. E., & Lang, B. R. (1998). Precision of fit: The Procera AllCeram crown. Journal of Prosthetic Dentistry, 80(4), 394–404.*

18. Schaerer, P., Sato, T., & Wohlwend, A. (1988). A comparison of the marginal fit of three cast ceramic crown systems. Journal of Prosthetic Dentistry, 59(5), 534–542.

19. Luthardt, R. G., Loos, R., & Quass, S. (2004). Accuracy of intraoral data acquisition in comparison to the conventional impression. International Journal of Computerized Dentistry, 8(3), 283–294.

20. Ender, A., & Mehl, A. (2013). Accuracy of complete arch dental impressions: A new method of measuring trueness and precision. Journal of Prosthetic Dentistry, 109(2), 121–128.

21. Abbate, F. M., Tjan, A. H., & Fox, W. M. (1989). Comparison of the marginal fit of various ceramic crown systems. Journal of Prosthetic Dentistry, 61(5), 527–531.

22. Pera, P., Gilodi, S., Bassi, F., Bresciano, M., & Carossa, S. (1994). In vitro marginal adaptation of alumina porcelain ceramic crowns. Journal of Prosthetic Dentistry, 72(6), 585–590.

23. Laurent, M., Scheer, P., Dejou, J., & Laborde, G. (2008). Clinical evaluation of the marginal fit of cast crowns—Validation of the silicone replica method. Journal of Oral Rehabilitation, 35(2), 116–122.

24. Kahramanoglu, E., & Ozkan, Y. (2013). Marginal and internal adaptation of different superstructure and abutment materials using two different implant systems for a five-unit implant-supported fixed dental prosthesis: An in vitro study. International Journal of Oral & Maxillofacial Implants, 28, 1207–1216.

25. Reich, S., Wichmann, M., Nkenke, E., & Proeschel, P. (2005). Clinical fit of all-ceramic three-unit fixed partial dentures generated with three different CAD/CAM systems. European Journal of Oral Sciences, 113, 174–179.

26. Martins, L. M., Lorenzoni, F. C., Melo, A. O., Silva, L. M., Oliveira, J. L., Oliveira, P. C., & Bonfante, G. (2010). Internal fit of two all-ceramic systems and metal-ceramic crowns. Journal of Applied Oral Science, 20, 235–240.

27. Renne, W., McGill, S. T., Forshee, K. V., DeFee, M. R., & Mennito, A. S. (2012). Predicting the marginal fit of CAD/CAM crowns based on the presence or absence of common preparation errors. Journal of Prosthetic Dentistry, 108, 310–315.

28. Att, W., Komine, F., Gerds, T., & Strub, J. R. (2009). Marginal adaptation of three different zirconium dioxide three-unit fixed dental prostheses. Journal of Prosthetic Dentistry, 101, 239–247.

29. Sulaiman, F., Chai, J., Jameson, L. M., & Wozniak, W. T. (1997). A comparison of the marginal fit of In-Ceram, IPS Empress and Procera crowns. International Journal of Prosthodontics, 10(5), 478–484.

30. Lopes, M. B., Consani, S., Sinhoreti, M. A., & Correr-Sobrinho, L. (2005). Influence of recasting palladium-silver alloy on the fit of crowns with different marginal configurations. Journal of Prosthetic Dentistry, 94, 430–434.

31. Suarez, M. J., Gonzalez de Villaumbrosia, P., Pradies, G., & Lozano, J. F. (2003). Comparison of the marginal fit of Procera AllCeram crowns with two finish lines. International Journal of Prosthodontics, 16, 229–232.

32. Kim, K. B., Kim, J. H., Kim, W. C., Kim, H. Y., & Kim, J. H. (2013). Evaluation of the marginal and internal gap of metal-ceramic crown fabricated with a selective laser sintering technology: Two- and three-dimensional replica techniques. Journal of Advanced Prosthodontics, 5, 179–186.

33. Hamza, T. A., Ezzat, H. A., El-Hossary, M. M., Katamish, H. A., Shokry, T. E., & Rosenstiel, S. F. (2013). Accuracy of ceramic restorations made with two CAD/CAM systems. Journal of Prosthetic Dentistry, 109, 83–87.

34. Jacobs, M. S., & Windeler, A. S. (1991). An investigation of dental luting cement solubility as a function of the marginal gap. Journal of Prosthetic Dentistry, 65, 436–442.*

35. Aboushelib, M. N., Elmahy, W. A., & Ghazy, M. H. (2012). Internal adaptation, marginal accuracy and microleakage of a pressable versus a machinable ceramic laminate veneers. Journal of Dentistry, 40, 670–677.

36. Saber, F. S., Abolfazli, N., Mahboub, F., & Razavi, F. E. (2013). The effect of occlusal surface relief of dies on marginal adaptation of metal-ceramic casting copings. Journal of Prosthodontics, 22, 287–291.

37. Cho, S. H., Nagy, W. W., Goodman, J. T., Solomon, E., & Koike, M. (2012). The effect of multiple firings on the marginal integrity of pressable ceramic single crowns. Journal of Prosthetic Dentistry, 107, 17–23.

38. Colpani, J. T., Borba, M., & Della Bona, A. (2013). Evaluation of marginal and internal fit of ceramic crown copings. Dental Materials, 29, 174–180.

39. Albert, F. E., & El-Mowafy, O. M. (2004). Marginal adaptation and microleakage of Procera AllCeram crowns with four cements. International Journal of Prosthodontics, 17, 529–535.

40. Groten, M., Axmann, D., Probster, L., & Weber, H. (2000). Determination of the minimum number of marginal gap measurements required for practical in-vitro testing. Journal of Prosthetic Dentistry, 83(1), 40–49.

41. Luthardt, R. G., Kühmstedt, P., & Walter, M. H. (2003). A new method for the computer-aided evaluation of three-dimensional changes in gypsum materials. Dental Materials, 19, 19–24.

42. Ender, A., & Mehl, A. (2011). Full arch scans: Conventional versus digital impressions—An in vitro study. International Journal of Computerized Dentistry, 14, 11–21.*

43. Abduo, J., Lyons, K., & Swain, M. (2010). Fit of zirconia fixed partial denture: A systematic review. Journal of Oral Rehabilitation, 37, 866–876.

44. Weaver, J. D., Johnson, G. H., & Bales, D. J. (1991). Marginal adaptation of castable ceramic crowns. Journal of Prosthetic Dentistry, 66, 747–753.

45. Huang, Z., Zhang, L., Zhu, J., Zhao, Y., & Zhang, X. (2014). Clinical marginal and internal fit of crowns fabricated using different CAD/CAM technologies. Journal of Prosthodontics, 1–5.

46. Kim, K. B., Kim, J. H., Kim, W. C., & Kim, J. H. (2014). In vitro evaluation of marginal and internal adaptation of three-unit fixed dental prostheses produced by stereolithography. Dental Materials Journal, 33, 504–509.

47. Mously, H. A., Finkelman, M., Zandparsa, R., & Hirayama, H. (2014). Marginal and internal adaptation of ceramic crown restorations fabricated with CAD/CAM technology and the heat-press technique. Journal of Prosthetic Dentistry, 112, 249–256.

48. Yildiz, C., Vanlioğlu, B. A., Evren, B., Uludamar, A., & Ozkan, Y. K. (2013). Marginal-internal adaptation and fracture resistance of CAD/CAM crown restorations. Dental Materials Journal, 32, 42–47.

49. Ueda, K., Beuer, F., Stimmelmayr, M., Erdelt, K., Keul, C., & Güth, J. F. (2016). Fit of 4-unit FDPs from CoCr and zirconia after conventional and digital impressions. Clinical Oral Investigations, 20, 283–289.

50. Almeida e Silva, J. S., Erdelt, K., Edelhoff, D., Araújo, É., Stimmelmayr, M., Vieira, L. C., & Güth, J. F. (2014). Marginal and internal fit of four-unit zirconia fixed dental prostheses based on digital and conventional impression techniques. Clinical Oral Investigations, 18, 515–523.

51. McLean, J. W., & von Fraunhofer, J. A. (1971). The estimation of cement film thickness by an in vivo technique. British Dental Journal, 131, 107–111.

52. Björn, A. L., Björn, H., & Grkovic, B. (1970). Marginal fit of restorations and its relation to periodontal bone level. II. Crowns. Odontologisk Revy, 21, 337–346.

Volume 5 / Issue 3 / December 2025

Research Article

Effect of Antimicrobial Agent-Applied Brackets and Resins on Plaque Accumulation: An In Vivo Study

Nursel Arıcı[1*]

[1]Ondokuz Mayıs University, Faculty of Dentistry, Department of Orthodontics, Samsun, Turkey.

*Corresponding author: nurselarici@omu.edu.tr

Arıcı, Nursel. "Effect of Antimicrobial Agent-Applied Brackets and Resins on Plaque Accumulation: An In Vivo Study". *Acta Stomatologica Cappadocia.* 5;3 (December 2025): 26-37.

DOI: https://doi.org/10.54995/ASC.5.3.2
Received: 15.11.2025; Accepted: 28.12.2025

Effect of Antimicrobial Agent-Applied Brackets and Resins on Plaque Accumulation: An In Vivo Study

Nursel Arıcı

Abstract

Objective: In order to prevent plaque formation during fixed orthodontic treatment, bracket and band surfaces have been coated with a selenium-containing antimicrobial agent, and the same agent has been incorporated into adhesive resin materials. The aim of this study is to evaluate and compare the clinical performance, in terms of plaque accumulation, of the combination of selenium-coated brackets and selenium-enhanced adhesive resin (research group) versus the combination of conventional brackets and light-cured adhesive resin (control group) during fixed orthodontic treatments.

Materials and Methods: Seventeen female subjects with skeletal Class I malocclusion were included in this study. A total of 142 selenium-coated brackets and 145 conventional brackets were bonded by the same researcher using a split-mouth design. Selenium-enhanced adhesive resin was used with the selenium-coated brackets, while a conventional adhesive resin was used with the conventional brackets. In all patients, the incidence of plaque accumulation was determined using a computerized image analysis system based on monthly photographic records during the first three months of fixed orthodontic treatment.

Results: After three months, the average plaque percentage in the selenium-coated bracket group was not significantly lower" veya "did not differ significantly compared to the conventional bracket group. In intra-group comparisons, time and jaw had a statistically significant effect ($p < 0.05$), while no statistically significant difference was found between the groups for the bonded teeth" veya "between the test and control teeth ($p > 0.05$).

Conclusion: No statistically significant difference in plaque accumulation was found between the selenium-coated and conventional bracket combinations.

Keywords: Adhesive resin, Conventional bracket, Plaque accumulation, Selenium-coated bracket.

Introduction

It is difficult for patients undergoing fixed orthodontic treatment to effectively remove plaque from their teeth through brushing and maintain good oral hygiene (1,2). The placement of fixed orthodontic appliances in the oral cavity leads to changes in the oral environment and causes both quantitative and qualitative alterations in dental plaque (3,4). The fixed orthodontic appliances used create retentive surfaces, which increase the amount of plaque (5) and the number of microorganisms in the plaque6, alter the microbial composition (4), and due to the inability to remove plaque, lead to demineralization (7). As a result of demineralization, persistent white discolorations (white spot lesions), which are initial carious lesions, appear around the brackets on the enamel (7). Fixed appliances facilitate the continuous accumulation and retention of bacterial plaque, which creates a risk for the development of white spot lesions during orthodontic treatment (6,7). Typically, this permanent whitish discoloration is caused by decalcification of the enamel surrounding the brackets (3).

Among the microorganisms in plaque, Streptococcus mutans is particularly significant, as it cannot adhere to soft tissues in the oral cavity (8) and instead attaches to hard surfaces like teeth and prostheses (9). In patients undergoing fixed orthodontic treatment, the increase in hard surfaces within the mouth enhances the adhesion and proliferation of microorganisms such as Streptococcus sanguis and Streptococcus mutans (4,8,9). Even though patients are given oral hygiene instructions prior to treatment, it has been found that microbial levels increase following the placement of fixed orthodontic appliances (10). Especially in areas where bands are placed and in locations where adhesive resin overflows near the gingival margin and bracket surroundings, the amount of plaque increases, making these regions most susceptible to demineralization (10,11). Streptococcus mutans plays the most significant role in the initiation of carious lesions. Additionally, while the number of Lactobacillus also increases, it tends to appear in the later stages of lesion progression (10).

Various orthodontic materials and agents have been developed to achieve successful orthodontic treatment by maintaining good oral hygiene. In an effort to prevent caries, fluoride-releasing varnishes, fluoride-containing solutions and gels, cements, adhesives, and brackets and bands coated with agents that inhibit the proliferation of cariogenic microorganisms have been used. Studies have shown that topical fluoride agents used in fixed orthodontic treatments reduce caries formation (12,13). However, since the effectiveness of topical fluoride

application depends on patient cooperation, it cannot always be used as the clinician intends (13). Furthermore, when used, it may negatively affect the bonding strength of orthodontic brackets (12-15). To eliminate patient compliance issues and protect the facial surfaces of teeth bonded with brackets, enamel varnishes were developed, but these have shown limited success in preventing caries during long treatment periods (16,17).

To prevent caries, fluoride-releasing cements have also been developed. Glass ionomer cements (GICs) and resin-modified glass ionomer cements (RMGICs) have been reported to halt caries progression and remineralize demineralized enamel (16,18). GICs have the ability to release additional fluoride during and after setting, as well as in acidic environments (19). On the other hand, fluoride-releasing adhesive resins used in orthodontic treatments have been reported to release smaller and shorter-term amounts of flüoride (20,21) and are ineffective in preventing caries (22). Although fluoride-releasing adhesives provide less protection against caries compared to cements, they offer stronger bond strengths and lower failure rates for bracket adhesion (22). Moreover, fluoride has been incorporated into various orthodontic agents (23), ligature wires (24), and brackets (25) to prevent demineralization during treatment.

Another orthodontic material developed to improve oral hygiene in orthodontic patients is the SeLECT Defense technology introduced by Class One Orthodontics. This mechanism was developed to prevent bacterial plaque formation around orthodontic brackets due to its antibacterial properties and, thus, to prevent demineralization (white spot formation) around the brackets (26). This technology utilizes selenium for its antibacterial function. It has been reported that the selenium compounds contained in the material are released in small doses during treatment, come into contact with the treated surfaces, and kill bacterial strains such as Streptococcus mutans and Lactobacilli. The SeLECT technology incorporates this antibacterial feature into brackets, bands, archwires, and adhesive resins (26-33). However, there are no existing in vivo studies evaluating the effects of these selenium-enhanced materials on plaque accumulation.

The aim of this study is to investigate, in vivo, the plaque-inhibitory effects of using antibacterial selenium-coated brackets combined with selenium-containing adhesive resin, and to compare these effects with those of a conventional bracket and adhesive resin combination.

Materials and Methods

This prospective in vivo study included individuals undergoing fixed orthodontic treatment at the Department of Orthodontics, Faculty of Dentistry, Ondokuz Mayıs University. Ethical approval for the study was obtained from the Clinical Research Ethics Committee of Ondokuz Mayıs University. Both the individuals and their parents were informed about the study, and informed consent forms were signed.

In determining the sample size, a power analysis was performed using the GPower software (GPower 3.1.9.7; Germany 2020) with $\alpha = 0.05$ and power of 95%, which indicated that each group should consist of at least 11 subjects. A total of 17 individuals with Angle Class I malocclusion, who were next in line for fixed orthodontic treatment at the Orthodontics Department of Ondokuz Mayıs University Faculty of Dentistry, were included in the study. All participants were female patients with a mean chronological age of 14 ± 2 years before treatment. The inclusion criteria were: individuals who had not undergone previous orthodontic treatment, had no missing permanent teeth, had no periodontal disease or attachment loss, maintained good oral hygiene, and had no restorations on the surfaces of the teeth to which brackets would be bonded.

Based on clinical and radiological evaluations, fixed orthodontic treatment was applied as follows: six of the 17 participants underwent upper and lower premolar extractions, six were treated without extractions, and five underwent single-arch premolar extractions. Two patients were excluded from the study — one due to relocation to a distant city and the other because treatment was performed only in the upper jaw. For fixed orthodontic treatment, selenium-coated (S) orthodontic metal brackets (SeLECT Defense, ClassOne Orthodontics, USA) and conventional metal brackets (K) (Freedom, ClassOne Orthodontics, USA) were used. Both bracket systems were produced by the same manufacturer and had identical morphological features, designs, and base characteristics. A total of 142 S brackets and 145 K brackets were bonded by the same researcher using the split-mouth technique. To avoid variation in bond failure rates due to unilateral chewing habits, S brackets were bonded to the upper right and lower left quadrants of half the patients, while K brackets were bonded to these quadrants in the other half. S brackets were bonded using selenium-enhanced adhesive resin (SeLECT Defense, ClassOne Orthodontics, USA), while K brackets were bonded with Transbond XT adhesive resin (3M Dental Products, St. Paul, Minnesota, USA).

All brackets were bonded in accordance with the manufacturer's recommendations. Prior to bonding, teeth were cleaned with pumice. All teeth were etched for 30 seconds using 37% phosphoric acid (3M Scotchbond™ Etchant, 3M Dental Products, St. Paul, Minnesota, USA), rinsed, and dried with an air-water spray until a chalky appearance was observed. The primer of the S adhesive was applied to half of the etched teeth, while the Transbond XT primer was applied to the other half. After the adhesive was applied to the bracket base, the bracket was placed on the tooth. Care was taken to ensure a uniform adhesive thickness. Excess adhesive was removed, and light curing was performed for a total of 20 seconds (5 seconds each on mesial, distal, occlusal, and gingival sides) using a light-curing unit (3M Dental Products, USA). To avoid affecting bond failure rates, care was taken to prevent contact between brackets and opposing teeth. Archwires (16 HANT, 3M Unitek, USA) were placed at least 10 minutes after all brackets were bonded. At the end of the bonding session, patients were informed about dietary guidelines during orthodontic treatment. Each patient was provided with an orthodontic toothbrush, an interdental brush (Pro-Expert, Oral-B, Istanbul, Turkey), and toothpaste (Sensodyne, GlaxoSmithKline, UK) of the same brand, which were demonstrated on a bracketed model and used throughout the study.

Baseline plaque scores were reset for all individuals, oral hygiene instruction was given, and clinical check-ups were conducted every four weeks. At monthly clinical check-ups during the first three months, the teeth of all patients were stained with a plaque disclosing solution (Hager & Werken GmbH and Co. KG, Duisburg, Germany) (Figure 1).

Figure 1. Photograph of teeth stained with plaque disclosing solution.

Following plaque staining, intraoral photographs were taken from a total of 12 different regions, including the central incisor, canine, and premolar areas in both the upper and lower jaws. The total surface area of the observed plaque on these photographs was measured using a specialized computer image analysis program (Figure 2).

For data analysis, the SPSS 21.0 software (IBM SPSS Statistics 21.0, IBM, New York, USA) was used. The Shapiro-Wilk normality test was applied to determine whether the obtained data followed a normal distribution. Since the analysis showed that the data were normally distributed, the Independent Student's t-test was used for intergroup comparisons at a 95% confidence level. For intragroup comparisons, One-Way Analysis of Variance (One-Way ANOVA) was applied, and the Tukey HSD post-hoc test was used to determine which months showed significant differences.

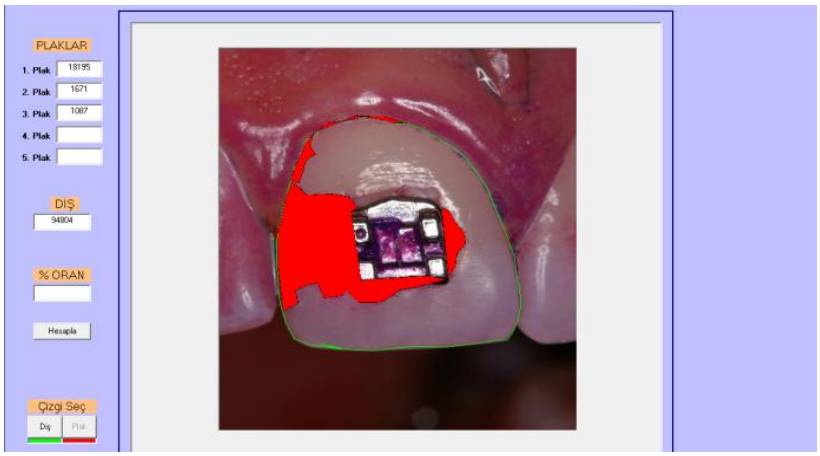


Figure 2. Computer image analysis software and calculation of total plaque surface area.

Results

Descriptive statistical values for the variables measured each month are presented in Table 1. The amount of plaque accumulation was measured at each time point over the 3-month period (T1–T2–T3). In the control group (teeth with K brackets), the mean plaque accumulation was 43.79 mm² in the maxillary teeth and 41.69 mm² in the mandibular teeth. In the research group (teeth with S brackets), plaque accumulation was 49.78 mm² in the maxillary teeth and 40.35 mm² in the mandibular teeth. No statistically significant difference was found between the two groups in terms of plaque accumulation (P > 0.5) (Table 1).

Table 1. Monthly changes and comparisons in plaque scores.

	T1			T2			T3		
	K	S		K	S		K	S	
	Mean(±)	Mean(±)	p	Mean(±)	Mean(±)	p	Mean(±)	Mean(±)	p
Maxilla	42.75(21.6)	48.37(24.4)	.791	48.37(22.1)	54.56(24.3)	.457	40.25(17.8)	46.43(23.3)	.407
Mandible	36.26(25.7)	36.26(16.1)	1.00	46.16(23.5)	43.06(23.6)	.696	42.66(23.7)	41.73(20.7)	.909

In intragroup comparisons, no statistically significant differences were found between the 1st, 2nd, and 3rd months within each group. A slight increase in plaque accumulation was observed in both groups and in both jaws during the second month of treatment. However, this increase was not persistent throughout the entire observation period, and the mean plaque amount was found to decrease in the third month (Figure 3).

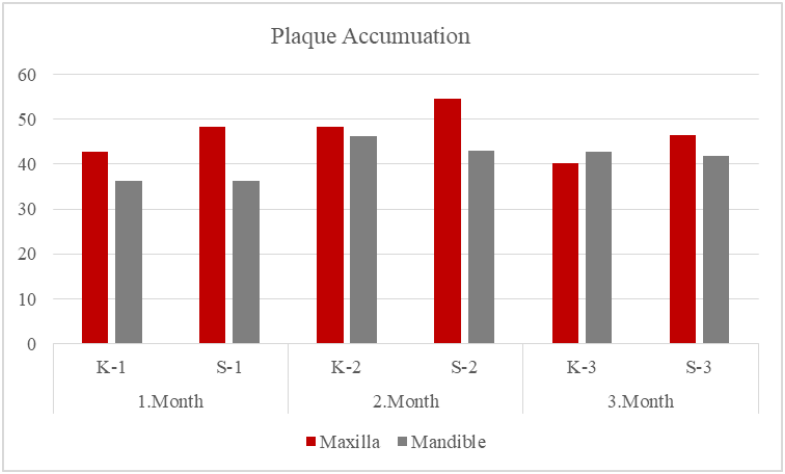


Figure 3. Monthly plaque accumulation in the maxillary and mandibular arches by group.

Discussion

The aim of this study was to determine, using a computerized image analysis system, whether the use of selenium-coated brackets and selenium-infused adhesives is more effective than conventional brackets in preventing dental plaque accumulation. Soder et al. (34) used a similar system to assess dental plaque area. In this study, the computerized image analysis system used by Arici et al. (35) was employed to measure dental plaque. Although not a practical tool in clinical settings, this system is useful for obtaining reproducible quantitative measurements in studies comparing the efficacy of different orthodontic attachments.

In this study, all patients were treated with fixed orthodontic appliances (S and K) using a split-mouth technique. The split-mouth design is commonly used in dentistry (36) and allowed meaningful results to be obtained with fifteen patients in this study.

The manufacturer of the SeLECT® Defense orthodontic system claims that the product inhibits bacterial plaque growth and, due to its antimicrobial properties, prevents demineralization (white spot lesions) around orthodontic brackets (26). It is also claimed that the system utilizes the element selenium to kill Streptococcus mutans and Lactobacillus upon contact with the treated surface (26). However, in this study, the antimicrobial effect claimed by the manufacturer was not observed. After a 3-month in vivo evaluation period, plaque accumulation between the K and S groups was not statistically significantly different ($P > 0.5$). In an in vitro

study, Clark (26) found no significant difference between SeLECT® Defense and three other restorative materials in terms of reducing enamel demineralization. However, Amaechi (37) reported that SeLECT® Defense technology reduced enamel demineralization around orthodontic brackets by 86% when teeth were brushed twice daily, and by 80% in an artificial mouth study where teeth were not brushed.

Only patients whose initial plaque scores were reset and who were given oral hygiene instructions were included in this study. To ensure a standardized and homogeneous study group, identical brushing instructions were provided to all patients. This allowed for a more precise comparison of plaque removal efficacy between the two groups. All patients were given a toothbrush, interdental brush, and toothpaste by the researcher. Patients were instructed to use the same brand of toothbrush, interdental brush, and toothpaste throughout the study to minimize variability between the first three appointments. At each evaluation, toothbrushing was supervised by the same clinician to ensure that patients brushed effectively before photographs were taken. The use of a split-mouth technique in which both bracket and adhesive combinations were applied in the same patient's mouth helps ensure that the results are not significantly influenced by individual variation or other external factors, thereby enhancing the reliability of the findings.

Conclusion

In this study comparing the clinical performance selenium coated and uncoated brackets in terms of plaque accumulation, a slight increase in plaque levels was observed in both groups and both jaws during the second month of treatment. However, this increase was not sustained throughout the observation period, and the average plaque amount decreased by the third month. As a result of the study, no statistically significant difference was found between the two types of brackets and adhesives.

References

1. Ciancio S, Cunat J, Mather M, Harvey D. A comparison of plaque accumulation in bonded versus banded teeth [abstract]. J Dent Res 1985;64.
2. Hegarty DJ, Macfarlane TV. In vivo bracket retention comparison of a resin-modified glass ionomer cement and a resin-based bracket adhesive system after a year. Am J Orthod Dentofac Orthop 2002;121:496-501.

3. Shinaishin SF, Ghobashy SA, El-Bialy TH. Efficacy of light-activated sealant on enamel demineralization in orthodontic patients: an atomic force microscope evaluation. Open Dent J 2011;5:179-186.

4. Chatterjee R, Kleinberg I. Effect of orthodontic band placement on the chemical composition of human incisor tooth plaque. Arch Oral Biol 1979;24(2):97-100.

5. Gwinnett AJ, Ceen F. Plaque distribution on bonded brackets. Am J Orthod 1979;75:667-77.

6. Sukontapatipark W, El-Agroudi MA, Selliseth NJ, Thunold K, Selvig KA. Bacterial colonization associated with fixed orthodontic appliances. A scanning electron microscopy study. Eur J Orthod 2001;23(5):475-484.

7. Gaworski M, Weinstein M, Borislow AJ, Braitman LE. Decalcification and bond failure: A comparison of a glass ionomer and a composite resin bonding system in vivo. Am J Orthod Dentofacial Orthop 1999;116(5):518-521.

8. Carlsson J, Söderholm G, Almfeldt I. Prevalence of Streptococcus sanguis and Streptococcus mutans in the mouth of persons wearing full-dentures. Arch Oral Biol 1969;14(3):243-249.

9. Van Houte J, Gibbons RJ, Pulkkinen AJ. Adherence as an ecological determinant for streptococci in the human mouth. Arch Oral Biol 1971;16(10):1131-1141.

10. Lundström F, Krasse B. Streptococcus mutans and lactobacilli frequency in orthodontic patients; the effect of chlorhexidine treatments. Eur J Orthod 1987;9(1):109-116.

11. O'Reilly MM, Featherstone JDB. Demineralization and remineralization around orthodontic appliances: An in vivo study. Am J Orthod Dentofacial Orthop 1987;92(1):33-40.

12. Øgaard B. White Spot Lesions During Orthodontic Treatment: Mechanisms and Fluoride Preventive Aspects. Semin Orthod 2008;14(3):183-193.

13. Geiger AM, Gorelick L, Gwinnett AJ, Griswold PG. The effect of a fluoride program on white spot formation during orthodontic treatment. Am J Orthod Dentofacial Orthop 1988;93(1):29-37.

14. Gwinnett AJ, Buonocore MG, Sheykholeslam Z. Effect of fluoride on etched human and bovine tooth enamel surfaces as demonstrated by scanning electron microscopy. Arch Oral Biol 1972;17(2):271-279.

15. Merrill JM, Shannon IL. Effect of pretreatment with fluoride solutions on tensile strength between bonding resin and acid-etched enamel. Int J Orthod 1980;18:7-14.

16. Banks PA, Richmond S. Enamel sealants: a clinical evaluation of their value during fixed appliance therapy. Eur J Orthod 1994;16(1):19-25.

17. Wenderoth CJ, Weinstein M, Borislow AJ. Effectiveness of a fluoride-releasing sealant in reducing decalcification during orthodontic treatment. Am J Orthod Dentofacial Orthop 1999;116(6):629-634.

18. Donly KJ, Istre S, Istre T. In vitro enamel remineralization at orthodontic band margins cemented with glass ionomer cement. Am J Orthod Dentofacial Orthop 1995;107(5):461-464.

19. Rezk-Lega F, Øgaard B, Rolla G. Availability of fluoride from glass-ionomer luting cements in human saliva. Scand J Dent Res 1991;99:60-3.

20. Bishara SE, Orth D, Swift Jr EJ, Chan DCN. Evaluation of fluoride release from an orthodontic bonding system. Am J Orthod Dentofacial Orthop 1991;100(2):106-109.

21. Chadwick SM, Gordon PH. An investigation into the fluoride release of a variety of orthodontic bonding agents. J Orthod 1995;22(1):29-33.

22. Ewoldsen N, Demke RS. A review of orthodontic cements and adhesives. Am J Orthod Dentofacial Orthop 2001;120(1):45-48.

23. Knösel M, Bojes M, Jung K, Ziebolz D. Increased susceptibility for white spot lesions by surplus orthodontic etching exceeding bracket base area. Am J Orthod Dentofacial Orthop 2012;141(5):574-82.

24. Øgaard B, Rølla G, Arends J. Orthodontic appliances and enamel demineralization. Part 1. Lesion development. Am J Orthod Dentofacial Orthop 1988;94(1):68-73.

25. Demling A, Demling C, Schwestka-Polly R, Stiesch M, Heuer W. Short-term influence of lingual orthodontic therapy on microbial parameters and periodontal status. A preliminary study. Angle Orthod 2010;80(3):480-4.

26. Clark TJ. The efficacy of ProSeal™, SeLECT Defense™, OrthoCoat™, and Biscover LV™ resin sealants on the prevention of enamel demineralization and white spot lesion formation: Orthodontics, University of Iowa; 2010.

27. Glavind L. Effect of monthly professional mechanical tooth cleaning on periodontal health in adults. J Clin Periodontol 1977;4:100-106.

28. Neely AL, Holford TR, Löe H, Anerud A, Boysen H: The natural history of periodontal disease in humans: risk factors for tooth loss in caries-free subjects receiving no oral health care. J Clin Periodontol 2005;32(9):984-993.

29. Faggion CM, Petersilka G, Lange DE, Gerss J, Flemmig TF: Prognostic model for tooth survival in patients treated for periodontitis. J Clin Periodontol 2007; 34(3):226-231.

30. Siadat H, Alikhasi M, Mirfazaelian A, Geramipanah F, Zaery F: Patient satisfaction with implant-retained mandibular overdentures: a retrospective study. Clin Implant Dent Relat Res 2008;10(2):93-98.

31. Schrott AR, Jimenez M, Hwang JW, Fiorellini J, Weber HP: Five-year evaluation of the influence of keratinized mucosa on peri-implant soft-tissue health and stability around implants supporting full-arch mandibular fixed prostheses. Clin Oral Implants Res 2009;20(10):1170-1177.

32. Zhong Y, Chasen J, Yamanaka R, Garcia R, Kaye EK, Kaufman JS, Cai J, Wilcosky T, Trope M, Caplan DJ: Extension and density of root fillings and postoperative apical radiolucencies in the Veterans Affairs Dental Longitudinal Study. J Endod 2008;34(7):798-803.

33. Vanobbergen J, Lesaffre E, Garcia-Zattera MJ, Jara A, Martens L, Declerck D: Caries patterns in primary dentition in 3-, 5- and 7-year-old children: spatial correlation and preventive consequences. Caries Res 2007;41(1):16-25.

34. Soder PO, Jin LJ, Soder B. Computerized planimetric method for clinical plaque measurements. Scand J Dent Res 1993;101:21-25.

35. Arici S, Alkan A, Arici N. Comparison of different toothbrushing protocols in poor-toothbrushing orthodontic patients. Eur J Orthod 2007;29:488-492.

36. Riordan PJ, fitzgerald PEB. Outcame measures in split mouth caries trials and their ststistical evaluation. Community Dent Oral Epidemiol 1994;22:192-197.

37. Amaechi B. Prevention of Demineralization around Orthodontic Brackets using Se-LECT® antimicrobial orthodontic technology. Study Report for ClassOne Orthodontıcs Dec 2008.

Volume 5 / Issue 3 / December 2025

Research Article

Sistemik Hastalıklara Sahip Bireylerde Dental İmplant Cerrahisi Sonrası Anksiyete ve Ağrı Düzeylerinin Değerlendirilmesi

Yunus Emre Çalık[1], Varol Çanakçı[2], Yunus Emre Güner[2*]

[1]Medisam Ağız ve Diş Sağlığı Polikliniği, Ordu, Türkiye.
[2]Ordu Üniversitesi, Diş Hekimliği Fakültesi, Periodontoloji Anabilim Dalı, Ordu, Türkiye.

**Corresponding author: ynsgnr08@gmail.com*

Çalık, Yunus Emre., Çanakçı, Varol., Güner, Yunus Emre. "Sistemik Hastalıklara Sahip Bireylerde Dental İmplant Cerrahisi Sonrası Anksiyete ve Ağrı Düzeylerinin Değerlendirilmesi". *Acta Stomatologica Cappadocia.* 5;3 (December 2025): 38-54.

DOI: https://doi.org/10.54995/ASC.5.3.3
Received: 28.08.2025; Accepted: 23.10.2025

Sistemik Hastalıklara Sahip Bireylerde Dental İmplant Cerrahisi Sonrası Anksiyete ve Ağrı Düzeylerinin Değerlendirilmesi

Yunus Emre Çalık, Varol Çanakçı, Yunus Emre Güner

Özet

Problemin Açıklanması: Dental implant cerrahisi sonrası ağrı ve dental anksiyete önemli klinik sorunlar olmaya devam etmektedir. Literatürde implant cerrahisiyle ilişkili ağrı ve anksiyeteyi değerlendiren çalışmalar mevcut olmakla birlikte, bu araştırmalar genellikle yalnızca ağrı-anksiyete ilişkisine odaklanmakta ve sistemik hastalıkların etkisini kapsamlı biçimde ele almamaktadır. Oysa sistemik hastalıkların bireylerde anksiyeteyi artırabileceği ve iyileşme sürecini olumsuz yönde etkileyebileceği bilinmektedir.

Amaç: Bu çalışmanın amacı, dental implant cerrahisi uygulanan sistemik olarak sağlıklı ve sistemik hastalığa sahip bireylerde preoperatif ve postoperatif ağrı düzeylerini karşılaştırmak, ağrı seyrini 1., 3. ve 10. günlerde izlemek ve anksiyetenin bu süreçteki etkisini değerlendirmektir. Ayrıca, sistemik hastalıkların postoperatif ağrı ve dental anksiyete üzerine etkisini ortaya koymak hedeflenmiştir.

Malzeme ve Yöntemler: Çalışmaya Ordu Üniversitesi Diş Hekimliği Fakültesi Periodontoloji Kliniği'ne başvuran, dental implant cerrahisi planlanan toplam 83 birey dahil edilmiştir. Katılımcılar sistemik hastalığı bulunan (n=40) ve sistemik olarak sağlıklı (n=43) olmak üzere iki gruba ayrılmıştır. Tüm bireylere cerrahi öncesinde ve sonrasında Spielberger Durumluk-Sürekli Kaygı Ölçeği (STAI-I, STAI-II), Modifiye Dental Anksiyete Skalası (MDAS) ve Vizüel Analog Skala (VAS) uygulanmıştır. Postoperatif ağrı düzeyleri 1., 3. ve 10. günlerde tekrar değerlendirilmiştir. Veriler SPSS 24.0 yazılımı kullanılarak analiz edilmiş, istatistiksel anlamlılık düzeyi $p<0,05$ olarak kabul edilmiştir.

Bulgular: Katılımcıların yaş ortalaması 46,53±14,03 olup, sistemik hastalığı bulunan grupta yaş anlamlı düzeyde daha yüksek bulunmuştur ($p<0,01$). Postoperatif 1. günde en yüksek ağrı skorları kaydedilmiş, ağrı düzeyleri 3. ve 10. günlerde belirgin şekilde azalmıştır. Sistemik hastalıklı bireylerde tedavi sonrası ve 10. gün VAS değerleri anlamlı olarak daha yüksek bulunmuştur ($p<0,05$). Anksiyete parametrelerinde her iki grupta da zaman içinde azalma gözlenmiş, ancak sistemik hastalıklı grupta postoperatif MDAS skorları sağlıklı bireylere göre istatistiksel olarak daha yüksek saptanmıştır ($p<0,05$).

Sonuç: Dental implant cerrahisi sonrası ağrı ve anksiyete düzeyleri zamanla azalmakla birlikte, sistemik hastalıkların bu parametreler üzerinde olumsuz etkisi bulunmaktadır. Sistemik hastalıklı bireyler tüm takip dönemlerinde daha yüksek ağrı ve anksiyete skorları bildirmiştir. Bu nedenle, implant cerrahisi planlanan hastalarda sistemik durumun göz önünde bulundurulması, preoperatif bilgilendirme ve psikolojik desteğin sağlanması klinik açıdan önem taşımaktadır.

Anahtar kelimeler: Ağrı, Anksiyete, İmplant cerrahisi, VAS.

Abstract

Statement of the problem: Postoperative pain and dental anxiety remain significant clinical concerns following dental implant surgery. Although existing studies have evaluated pain and anxiety associated with implant procedures, most have primarily focused on the pain-anxiety relationship without comprehensively addressing the influence of systemic diseases. However, it is well established that systemic diseases may increase anxiety levels in individuals and negatively affect the healing process.

Objective: The aim of this study was to compare preoperative and postoperative pain levels in systemically healthy individuals and patients with systemic diseases undergoing dental implant surgery, to monitor the course of pain on the 1st, 3rd, and 10th postoperative days, and to assess the impact of anxiety during this period. Additionally, the study sought to determine the effect of systemic diseases on postoperative pain and dental anxiety.

Materials and Methods: A total of 83 individuals scheduled for dental implant surgery at Ordu University Faculty of Dentistry, Department of Periodontology, were included in this study. Participants were divided into two groups: patients with systemic diseases (n=40) and systemically healthy individuals (n=43). The Spielberger State-Trait Anxiety Inventory (STAI-I, STAI-II), Modified Dental Anxiety Scale (MDAS), and Visual Analog Scale (VAS) were administered preoperatively and postoperatively. Postoperative pain levels were reassessed on the 1st, 3rd, and 10th days. Data were analyzed using SPSS 24.0 software, and a p-value of <0.05 was considered statistically significant.

Results: The mean age of participants was 46.53±14.03 years, with significantly higher age observed in the systemic disease group ($p<0.01$). The highest pain scores were recorded on the 1st postoperative day, followed by a significant decrease on the 3rd and 10th days. Postoperative and 10th-day VAS values were significantly higher in patients with systemic diseases compared to healthy individuals ($p<0.05$). Anxiety parameters decreased over time in both groups; however, postoperative MDAS scores were significantly higher in the systemic disease group ($p<0.05$).

Conclusion: Although pain and anxiety levels decreased over time after dental implant surgery, systemic diseases were found to negatively influence these parameters. Patients with systemic diseases reported higher pain and anxiety scores throughout the follow-up period. Therefore, systemic conditions should be carefully considered in treatment planning, and providing preoperative information and psychological support is of clinical importance.

Keywords: Anxiety, Pain, Surgery of Implant, VAS.

Giriş

Dental implantlar, tek veya çoklu diş eksikliklerinde protetik tedavilerde sabit veya hareketli protezlere stabilite ve retansiyon sağlamak amacıyla alveoler kemiğin üzerine veya içine yerleştirilen biyomateryallerdir (1). Tam veya kısmi dişsizlik vakalarının dental implantlarla tedavisi, uzun dönem başarı oranlarının kanıtlanmış olması nedeniyle günümüzde sıklıkla tercih edilen bir protetik yaklaşım haline gelmiştir (2,3).

Hasta memnuniyeti ve yüksek başarı oranları açısından tatmin edici sonuçlar sağlasa da (4), bazı çalışmalar implant cerrahisinin postoperatif dönemde ağrılı bir işlem olduğunu ortaya koymuştur (5–7). Ayrıca, implant cerrahisi öncesinde ve sonrasında gelişen ağrıya eşlik eden korku ve anksiyetenin, ağrı algısını olumsuz yönde etkileyebileceği bildirilmiştir (8).

Uluslararası Ağrı Araştırmaları Derneği (IASP), ağrıyı "var olan ya da olası doku hasarına eşlik eden veya bu hasarla tanımlanabilen, hoş olmayan duyusal ve emosyonel bir deneyim" olarak tanımlamaktadır (9). Ağrı, stres ve anksiyete ile yakından ilişkili, kompleks bir duyusal ve duygusal deneyimdir (10).

Anksiyete, istenmeyen durumların öngörülmesi halinde hissedilen olumsuz duygu hali olarak tanımlanır (11). Dental anksiyete ise dış uyaranlardan bağımsız olarak, özellikle dental işlemlere yönelik gelişen endişe hali şeklinde tanımlanmaktadır (12,13). Bu durum, bireylerin dental hizmetlere erişimini engelleyerek tedavi edilmeyen problemlerin artmasına ve dolayısıyla dental anksiyetenin daha da şiddetlenmesine yol açmaktadır (14). Bu nedenle dental anksiyeteye sahip bireylerin demografik özelliklerinin belirlenmesi ve risk grubunda yer alan hastaların önceden tanımlanabilmesi, diş hekimliği hizmetlerinin güvenli, etkin ve kaliteli bir şekilde sürdürülmesi açısından önem taşımaktadır (15).

Kronik hastalıklar; bireyin fonksiyonel kapasitesini azaltan, yaşam kalitesini düşüren ve aile içi ilişkilerde olumsuzluklara yol açan önemli sağlık problemleridir. Bu hastalıkların yarattığı komplikasyonlar, yalnızca fiziksel değil aynı zamanda ruhsal sağlığı da etkilemekte ve bireylerde anksiyete gelişimine zemin hazırlamaktadır (16). Yapılan bazı çalışmalar, kronik hastalıkların anksiyeteye neden olabileceğini, anksiyetenin de kronik hastalıkların klinik seyrini olumsuz yönde etkileyebileceğini göstermektedir (17–20).

Mevcut literatürde dental implant cerrahisi ile ilişkili ağrı ve anksiyete düzeylerini değerlendiren çalışmalar bulunsa da bu araştırmalar genellikle yalnızca anksiyete-ağrı ilişkisine odaklanmakta ve sistemik hastalıkların etkisini kapsamlı şekilde ele almamaktadır. Oysa bazı

araştırmacılar, postoperatif ağrı ve anksiyetenin değerlendirilmesinde sistemik hastalıkların da dikkate alınması gerektiğini vurgulamıştır (21).

Bu çalışmanın amacı; dental implant cerrahisi uygulanacak sistemik olarak sağlıklı ve sistemik hastalığa sahip bireylerde, tedavi öncesi ve sonrasında oluşan ağrı düzeylerini ve postoperatif 1., 3. ve 10. gündeki ağrı seyrini belirlemek, ayrıca anksiyetenin bu süreçteki etkisini incelemektir.

Malzeme ve Yöntemler

Bu çalışma, Ordu Üniversitesi Diş Hekimliği Fakültesi Periodontoloji Kliniği'ne başvuran ve dental implant cerrahisi planlanan bireyler üzerinde gerçekleştirilen anket temelli bir araştırmadır. Çalışma, Ordu Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından onaylanmıştır (Tarih: 01.10.2020, Karar No: 201). Tüm katılımcılara çalışma hakkında ayrıntılı bilgi verilmiş, bilgilendirilmiş gönüllü onam formu okutulup imzalatılmıştır.

Çalışmanın güvenilirliğini sağlamak amacıyla öncesinde istatistiksel power analizi yapılmıştır. Anlamlı sonuç elde edilebilmesi için minimum örneklem sayısı 70 olarak belirlenmiş, toplamda 83 hasta çalışmaya dahil edilmiştir.

Dahil Edilme Kriterleri

- Çalışmaya gönüllü olarak katılmayı kabul etmek,
- 18 yaşından büyük olmak,
- En az 6 aydır kronik hastalık tanısı bulunmak (çalışma grubu),
- Kronik hastalık olarak hipertansiyon, diabetes mellitus, KOAH, astım, hiper/hipotiroidi veya koroner arter hastalıklarından en az birine sahip olmak (çalışma grubu),
- Sorulara bilinçli yanıt vermeyi engelleyecek herhangi bir rahatsızlığın bulunmaması,
- Psikiyatrik hastalık öyküsünün bulunmaması,
- Daha önce implant cerrahisi geçirmemiş olmak,
- Çene kemiklerinde klinik veya radyografik patolojik bulgunun olmaması,
- Kontrol grubunda herhangi bir sistemik hastalık bulunmaması,
- Hamilelik veya emzirme döneminde olmamak.

Dışlanma Kriterleri

- 18 yaşından küçük olmak,
- Çalışmaya katılmayı reddetmek,

- Daha önce implant cerrahisi geçirmiş olmak,
- Bilinçli yanıt vermeyi engelleyecek rahatsızlıkların bulunması,
- Menopoz döneminde olmak,
- Çene kemiklerinde patolojik bulguların varlığı,
- Hamilelik veya emzirme döneminde olmak,
- Türkçe bilmeyen veya kooperasyon kurulamayan bireyler.

Çalışma Grupları

Toplam 83 birey iki gruba ayrılmıştır:

- Grup 1 (n=40): Sistemik hastalığı bulunan ve dental implant cerrahisi yapılan bireyler.
- Grup 2 (n=43): Sistemik olarak sağlıklı olup dental implant cerrahisi yapılan bireyler.

Preoperatif Kayıtlar

Tüm bireylere cerrahi öncesinde demografik veri formu, medikal ve dental anamnez formu doldurtuldu. Ayrıca Spielberger Durumluk-Sürekli Kaygı Ölçeği (STAI-I, STAI-II) (22,23) ve Modifiye Dental Anksiyete Skalası (MDAS) (24,25) uygulandı.

Tedavi Öncesi ve Sonrası Kayıtlar

Cerrahi öncesinde her hastanın tansiyon, nabız ve oksijen satürasyonu ölçüldü. Ayrıca Vizüel Analog Skala (VAS) üzerinde (26) ameliyat sırasında hissedileceği düşünülen ağrı beklentisi kaydedildi.

İmplant cerrahisi tamamlandıktan hemen sonra aynı parametreler tekrar ölçüldü ve hastalardan STAI-I, MDAS ve VAS üzerinde ağrı düzeylerini bildirmeleri istendi. Tüm vital bulgular aynı hemşire tarafından sağ el işaret parmağından pulse oksimetre (Yonker) yardımıyla kaydedildi.

Cerrahiyi gerçekleştiren hekim, her hasta için periodontal durum, uygulanan implant sayısı, implant tasarımı ve implantın yerleştirildiği bölgeye ilişkin bilgileri ayrı bir forma kaydetti.

Postoperatif Ağrı Kaydı

Her iki gruptaki bireylerden operasyon sonrası 1., 3. ve 10. günlerde VAS yardımıyla ağrı düzeylerini değerlendirmeleri istendi.

Postoperatif 10. Gün Kontrolü

Dikiş alma amacıyla kliniğe başvuran hastalardan, postoperatif 10. günde STAI-I ve MDAS ölçeklerini yeniden doldurmaları istendi.

Uygulanan Ölçekler

- Modifiye Dental Anksiyete Skalası (MDAS): Dental anksiyete şiddetini değerlendirmek için preoperatif, postoperatif hemen sonrası ve 10. günlerde uygulandı (24,25).
- Spielberger Sürekli Kaygı Ölçeği (STAI-II): Bireylerin genel kaygı düzeylerini belirlemek için yalnızca preoperatif dönemde uygulandı (22,23).
- Spielberger Durumluk Kaygı Ölçeği (STAI-I): Anlık kaygı düzeylerini değerlendirmek amacıyla preoperatif, postoperatif hemen sonrası ve 10. günlerde uygulandı (22,23).
- Vizüel Analog Skala (VAS): Ağrı düzeyini değerlendirmek için kullanıldı (5). (Tablo 1)

Tablo 1. Çalışmada uygulanan ölçekler ve zamanlamaları özetlenmiştir.

PREOPERATİF KAYIT	**TEDAVİNİN HEMEN ÖNCESİ**	**TEDAVİNİN HEMEN SONRASI**	**TEDAVİNİN 10 GÜN SONRASI**
Hasta Demografik Veri ve Medikal&Dental Hikaye Formu	Uygulayıcı hasta hakkındaki bilgi formu	Postoperatif ağrı değerlendirme	Modifiye Dental Anksiyete Skalası
Modifiye Dental Anksiyete Skalası	Preoperatif değerlendirme	Modifiye Dental Anksiyete Skalası	Spielberger Durumluk Kaygı Ölçeği Skalası
Spielberger Durumluk Kaygı Ölçeği Skalası		Spielberger Durumluk Kaygı Ölçeği Skalası	
Spielberger Sürekli Kaygı Ölçeği Skalası			

İstatistiksel Analiz

Tüm veriler SPSS 24.0 (IBM Corp., Armonk, NY, ABD) yazılımı ile analiz edildi. Tanımlayıcı istatistikler ortalama, standart sapma, medyan, frekans, oran, minimum ve maksi-

mum değerler olarak sunuldu. İkili tekrarlayan ölçümler arasındaki farklılıklar Paired Samples t-testi ile değerlendirildi. Üç veya daha fazla tekrarlayan ölçüm arasındaki fark için Repeated Measures ANOVA uygulandı. Zamanlar arası farklılıklar için Bonferroni düzeltmesi yapıldı. Gruplara göre demografik verilerin karşılaştırılmasında Pearson Ki-Kare testi kullanıldı. Gruplar arası VAS, STAI ve MDAS sonuçları Independent Samples t-testi ile analiz edildi. İstatistiksel anlamlılık düzeyi p<0,05 olarak kabul edildi.

Bulgular

Aralık 2019 – Kasım 2021 tarihleri arasında Ordu Üniversitesi Diş Hekimliği Fakültesi Periodontoloji Bölümüne diş eksikliği nedeniyle başvuran toplam 83 birey çalışmaya dahil edilmiştir. Katılımcıların 43'ü (%51,8) sistemik olarak sağlıklı, 40'ı (%48,2) sistemik hastalığa sahip bireylerden oluşmaktadır. Bulgular, demografik veriler, medikal hikâye, implant tedavisi ile ilişkili değişkenler, ağrı düzeyleri, vital bulgular ve anksiyete parametrelerinden elde edilen sonuçlara dayanmaktadır.

Demografik Bulgular

Katılımcıların yaşları 19–77 arasında değişmekte olup, ortalama yaş 46,53±14,03 olarak bulunmuştur. Yaş ortalaması sistemik hastalıklı grupta anlamlı düzeyde daha yüksektir (p=0,001; p<0,01). (Tablo 2)

Tablo 2. Gruplara göre yaş ortalamalarının karşılaştırılması.

	Sistemik Sağlıklı Grup (n=43)		**Sistemik Hastalıklı Grup (n=40)**		
	Mean±SD	**Min-Max (Median)**	**Mean±SD**	**Min-Max (Median)**	**[b]p**
Yaş	41,40±13,02	19-64 (41)	52,02±13,10	19-77 (53,5)	**0,001****

[b]Indepedent Sample T Testi **p<0,05* ***p<0,01*

Cinsiyet dağılımı incelendiğinde katılımcıların 37'si (%44,6) erkek, 46'sı (%55,4) kadındır ve gruplar arasında anlamlı farklılık gözlenmemiştir (p>0,05).

Eğitim durumu açısından gruplar arasında istatistiksel olarak anlamlı fark bulunmuştur (p=0,005; p<0,01). Sistemik hastalıklı grupta ilkokul/ortaokul mezunu oranı daha yüksek iken, sistemik sağlıklı grupta üniversite mezunlarının oranı yüksektir.

Aylık gelir düzeyi dağılımında gruplar arasında anlamlı farklılık saptanmamıştır (p>0,05). Ancak genel olarak katılımcıların %48,2'si yüksek gelir düzeyine sahiptir.

Katılımcıların büyük çoğunluğu sigara (%71,1) ve alkol (%83,1) kullanmadığını bildirmiştir. Bireylerin %84,3'ü ağız sağlığı açısından tedavi ihtiyacı olduğunu ifade etmiştir. Katılımcıların %83,1'i son altı ay içinde diş hekimine başvurmuştur.

En son diş hekimi ziyaret nedenleri arasında en sık görülenler kontrol (%22,9), diş eksikliği (%22,9) ve ağrı (%18,1) olmuştur. Katılımcıların en son geçirdiği dental işlemler incelendiğinde, diş taşı temizliği (%36,1) ve diş çekimi (%27,7) en sık bildirilen işlemler olarak kaydedilmiştir.

Bireylerin %98,8'i dişlerini düzenli olarak fırçaladığını belirtmiş olup, %59'u günde en az iki kez fırçalamaktadır. Diğer dental hijyen araçlarını kullananların oranı ise %41'dir. Katılımcıların kendi ağız sağlıklarını değerlendirme puanlarının ortalaması 5,35±2,24 bulunmuştur.

Medikal Hikâye ve Uygulanan Tedavi

Eksik diş sayısı dağılımına göre katılımcıların %51,8'inde dört veya daha az diş eksikliği vardır. Sistemik hastalıklı grupta ≥10 diş eksikliği oranı anlamlı olarak daha yüksek bulunmuştur (p=0,001; p<0,01).

Uygulanan implant sayısı incelendiğinde, katılımcıların %63,9'una üç veya daha az implant uygulanmıştır. Ancak sistemik hastalıklı grupta ≥6 implant uygulama oranı anlamlı olarak daha yüksek bulunmuştur (p=0,030; p<0,05).

İmplant uygulanan bölge sayısı bakımından sistemik hastalıklı grupta iki veya daha fazla bölgede implant uygulama oranı anlamlı olarak daha yüksek saptanmıştır (p=0,025; p<0,05).

İmplant tasarımları açısından konik (%77,1) ve silindirik (%22,9) tipler arasında gruplar arasında anlamlı fark bulunmamıştır (p>0,05).

Ekstra cerrahi işlemler (kapalı sinüs yükseltme %21,7, immediat implantasyon %14,5 vb.) açısından gruplar arasında anlamlı fark gözlenmemiştir (p>0,05).

Ağrı ile İlişkili Bulgular

Tedavi öncesi ortalama VAS değeri 5,6±2,65 iken, tedavi sonrası ortalama VAS değeri 3,19±2,63 bulunmuştur. Ağrı düzeyleri postoperatif 1. günde artış göstermiş (4,08±2,4), 3.

günde belirgin şekilde azalmış (1,76±1,88) ve 10. günde minimum seviyeye inmiştir (0,37±0,79).

Gruplar arası karşılaştırmalarda;

- Tedavi sonrası ağrı düzeyi sistemik hastalıklı grupta anlamlı olarak daha yüksek bulunmuştur (p=0,011; p<0,05).
- Postoperatif 10. gün ağrı düzeyi sistemik hastalıklı grupta istatistiksel olarak daha yüksektir (p=0,024; p<0,05). (Tablo 3)
- Tedavi öncesi ağrı beklentisi ile tedavi sonrası ağrı değerleri her iki grupta da anlamlı düzeyde azalmıştır (p=0,001; p<0,01).

Tablo 3. Gruplara göre tedavi öncesi ağrı tahmini, tedavi sonrası ağrı, 1.gün ağrı takibi, 3.gün ağrı takibi ve 10.gün ağrı takibi VAS değerlerinin karşılaştırılması

	Sistemik Sağlıklı Grup (n=43)		**Sistemik Hastalıklı Grup (n=40)**		**[b]p**
	Mean±SD	**Min-Max (Median)**	**Mean±SD**	**Min-Max (Median)**	
Tedavi Öncesi VAS Değeri	5,21±2,21	1-10 (5)	6,03±3,02	1-10 (6)	**0,162**
Tedavi Sonrası VAS Değeri	2,49±2,22	0-9 (2)	3,95±2,86	0-10 (4)	**0,011***
1.Gün Ağrı değeri	3,79±2,23	0-9 (4)	4,4±2,55	0-9 (4,5)	**0,249**
3.Gün Ağrı değeri	1,44±1,71	0-8 (1)	2,1±2,01	0-6 (2)	**0,111**
10.Gün Ağrı değeri	0,19±0,55	0-2 (0)	0,58±0,96	0-3 (0)	**0,024***

[b]Indepedent Sample T Testi **p<0,05*

Pearson korelasyon analizine göre tedavi öncesi tahmini ağrı değeri ile 1., 3. ve 10. gün ağrı düzeyleri arasında pozitif yönde anlamlı ilişki bulunmuştur (r≈0,31–0,33; p<0,01). Tedavi sonrası ağrı değeri ile 1., 3. ve 10. gün ağrı düzeyleri arasında da güçlü pozitif korelasyon saptanmıştır (r≈0,53–0,59; p<0,01).

Vital bulgular (nabız ve oksijen satürasyonu) açısından gruplar arasında istatistiksel olarak anlamlı fark gözlenmemiştir (p>0,05).

Anksiyete ile İlişkili Bulgular

STAI-I (Durumluluk Kaygı):

Tedavi öncesi ortalama STAI-I değeri 37,99±9,57, tedavi sonrası 34,55±9,4, 10. gün ölçümü ise 31,86±8,52 olarak bulunmuştur. Zaman içinde kaygı düzeylerinde anlamlı azalma saptanmıştır (p<0,05). (Tablo 4)

Tablo 4. Gruplarda tedavi öncesi, tedavi sonrası ve 10.gün STAI-I ölçümlerinin karşılaştırılması

		Tedavi Öncesi		**Tedavi Sonrası**		**10. Gün**		**[d]p**
		Mean ±SD	**Min-Max (Median)**	**Mean ±SD**	**Min-Max (Median)**	**Mean ±SD**	**Min-Max (Median)**	
Sistemik Hastalıklı	**STAI-I**	38,5± 9,9	20-62 (39)	34,8± 10,6	20-59 (34)	32,4±9 ,31	20-50 (29,5)	**0,001****
Sistemik Sağlıklı	**STAI-I**	37,4± 9,26	21-55 (37)	34,2± 8,23	20-49 (35)	31,2±7 ,77	20-49 (31)	**0,001****

[d]Repetead Measure Test **p<0,05*

STAI-II (Sürekli Kaygı):

Ortalama STAI-II değeri 38,71±7,64 olup, gruplar arasında anlamlı fark gözlenmemiştir (p>0,05). (Tablo 5)

Tablo 5. Gruplara göre STAI-II değerlerinin karşılaştırılması

	Sistemik Sağlıklı Grup (n=43)		**Sistemik Hastalıklı Grup (n=40)**		
	Mean±SD	**Min-Max (Median)**	**Mean±SD**	**Min-Max (Median)**	**[b]p**
STAI-II	38,33±7,1 8	23-51 (39)	39,13±8,1 7	20-58 (39,5)	**0,637**

[b]Indepedent Sample T Testi **p<0,05* ***p<0,01*

MDAS (Dental Anksiyete):

Tedavi öncesi ortalama MDAS değeri 10,9±4,4, tedavi sonrası 9,06±3,76, 10. gün ölçümü ise 8,78±3,62 bulunmuştur. Sistemik hastalıklı grupta tedavi sonrası ve 10. gün MDAS değerleri anlamlı olarak daha yüksektir (p=0,014 ve p=0,015; p<0,05).

Her iki grupta da zaman içinde MDAS değerlerinde azalma gözlenmiş olup, bu düşüş istatistiksel olarak anlamlı bulunmuştur (p<0,01). (Tablo 6)

Tablo 6. Gruplara göre MDAS değerlerinin karşılaştırılması

	Sistemik Sağlıklı Grup (n=43)		**Sistemik Hastalıklı Grup (n=40)**		
	Mean±SD	**Min-Max (Median)**	**Mean±SD**	**Min-Max (Median)**	**[b]p**
MDAS Tedavi Öncesi Değeri	10,47±3,64	5-19 (11)	11,38±5,09	5-25 (11)	**0,349**
MDAS Tedavi Sonrası Değeri	8,09±3,05	5-18 (8)	10,1±4,18	5-21 (10)	**0,014***
MDAS 10.Gün Değeri	7,86±2,69	5-16 (7)	9,78±4,22	5-20 (9,5)	**0,015***

[b]Indepedent Sample T Testi **p<0,05*

Tartışma

Diş eksiklikleri, bireylerde estetik, fonksiyonel ve sistemik sağlık açısından önemli sorunlara yol açmaktadır. Eksik dişlerin rehabilitasyonu, eksikliklerin sayısı, lokalizasyonu, hastanın genel durumu ve hekimin tercihine bağlı olarak farklı yöntemlerle sağlanabilmektedir. Günümüzde dental implantlar, tek veya çoklu diş eksikliklerinin yanı sıra tam dişsizlik vakalarında da protezlere destek sağlayan, alveolar kemik içine yerleştirilen konik veya silindirik yapıdaki biyouyumlu materyaller olarak öne çıkmaktadır (1,27). İmplant tedavisinin yüksek başarı oranları (%97'ye kadar) (28), bu tedavi seçeneğinin estetik, fonetik ve psikososyal bütünlüğün yeniden kazandırılmasında önemli bir role sahip olduğunu göstermektedir. Ancak implant uygulamaları cerrahi bir süreç gerektirdiğinden, hastalarda stres ve anksiyete düzeylerinde artışa neden olabilmektedir.

Dental anksiyete, özellikle dental tedavi prosedürlerine karşı gelişen irrasyonel endişe hali olarak tanımlanmaktadır (29,30). Bu anksiyetenin ölçülmesi, klinik değerlendirmeler ve

tedavi planlaması açısından kritik öneme sahiptir. Literatürde en sık kullanılan ölçekler; Spielberger'in Durumluluk-Süreklilik Anksiyete Envanteri (STAI), Corah'ın Dental Anksiyete Skalası (DAS) ve Modifiye Dental Anksiyete Skalası'dır (MDAS) (22,25,31). Türkiye'de yapılan çalışmalarda dental anksiyete prevalansı %21–23 civarında bildirilmiştir (32,33). Ancak implant cerrahilerinde sistemik hastalıkların anksiyete ve ağrı seviyeleri üzerindeki etkisini araştıran çalışma sayısı oldukça sınırlıdır.

Çalışmamızda, sistemik hastalıklı bireylerin implant cerrahisi sonrası tedavi sonrası ve 10. gün MDAS skorlarının sağlıklı bireylere göre anlamlı olarak daha yüksek olduğu saptanmıştır. Bu bulgu, literatürde sistemik hastalıkların (ör. diyabet, hipertansiyon, astım) anksiyete prevalansını artırdığını gösteren çalışmalarla uyumludur (34–37). Ayrıca sistemik hastalıklı grubun tüm anksiyete parametrelerinde klinik olarak daha yüksek değerler göstermesi, sistemik durumun dental tedavi kaygısı üzerinde ek bir yük oluşturabileceğini düşündürmektedir.

Ağrı değerlendirmesinde en yüksek değerlerin postoperatif 1. günde kaydedildiği, sonrasında ise giderek azaldığı görülmüştür. Bu sonuç, daha önceki çalışmalarla paralellik göstermektedir (38,39). Sistemik hastalıklı bireylerin tüm takip dönemlerinde daha yüksek ağrı skorları bildirmeleri, genel sağlık durumunun iyileşme süreci ve ağrı algısı üzerinde etkili olabileceğini düşündürmektedir. Ayrıca çalışmamızda preoperatif ağrı beklentisi ile postoperatif ağrı düzeyleri arasında pozitif korelasyon saptanmıştır. Bu bulgu, literatürde bildirilen "anksiyetenin ağrı algısını artırdığı" yönündeki sonuçlarla örtüşmektedir (40,41).

Çalışmamızda vital bulguların (nabız, oksijen satürasyonu) preoperatif ve postoperatif dönemlerde gruplar arasında istatistiksel farklılık göstermemesi, implant cerrahisinin genel fizyolojik parametreler üzerinde ciddi bir etkisinin olmadığını göstermektedir. Ancak sistemik hastalıklı bireylerde preoperatif nabız değerlerinin daha yüksek bulunması, bu gruptaki hastaların cerrahi öncesinde daha yüksek kaygı seviyelerine sahip olabileceğini düşündürmektedir.

Çalışmamızın bulguları, literatürdeki dental cerrahi prosedürler sırasında anksiyete ve ağrı düzeylerinin değerlendirildiği çalışmalarla benzerlik göstermektedir. Örneğin, Urban ve ark. (38) postoperatif 1. ve 3. gün ağrı skorları arasında anlamlı farklılık saptarken; Al-Khabbaz ve ark. (39) postoperatif 2. ve 7. günlerde ağrı seviyeleri arasında benzer ilişkiler bildirmiştir. Çalışmamız bu sonuçları destekler niteliktedir.

Ölçek seçiminde, dental anksiyeteyi daha kapsamlı değerlendiren MDAS'ın yanında STAI ve VAS kullanılması, sonuçların güvenilirliğini artırmıştır. Daha önce Schuurs ve ark. (42) ile Hakeberg ve ark. (43) birden fazla ölçeğin kullanılmasının anksiyete değerlendirmesinde daha doğru sonuçlar verdiğini belirtmiştir. Çalışmamızda da benzer bir yaklaşım benimsenmiştir.

Sonuç

Çalışmamızda elde edilen bulgular doğrultusunda:

- Tüm bireyler tedavi öncesinde ağrı beklentisi bildirmiş, postoperatif dönemde ağrı skorları giderek azalmıştır.
- En yüksek ağrı skorları postoperatif 1. günde kaydedilmiştir.
- Sistemik hastalıklı bireyler tüm dönemlerde daha yüksek ağrı değerleri bildirmiştir; 10. gün ağrı değerleri istatistiksel olarak anlamlı düzeyde daha yüksek bulunmuştur.
- Preoperatif ağrı beklentisi ile postoperatif ağrı skorları arasında pozitif korelasyon mevcuttur.
- Dental anksiyete ve STAI skorlarında her iki grupta da tedavi sonrası azalma görülmüştür. Ancak sistemik hastalıklı grupta postoperatif MDAS değerleri sağlıklı bireylere göre anlamlı derecede daha yüksektir.
- Sistemik hastalıklar, implant cerrahisi sonrası hem ağrı hem de anksiyete düzeylerini olumsuz yönde etkileyebilmektedir.
- Dental implant cerrahisi planlanan hastalarda sistemik durumun mutlaka göz önünde bulundurulması, anksiyete ve ağrı yönetimi açısından önemlidir.
- Cerrahi öncesinde yapılacak ayrıntılı bilgilendirme ve psikolojik destek, özellikle sistemik hastalığı olan bireylerde kaygıyı azaltabilir.
- Gelecekte yapılacak çalışmaların daha geniş örneklem gruplarıyla, farklı sistemik hastalık tipleri ayrı ayrı ele alınarak gerçekleştirilmesi önerilmektedir.

Kaynakça

1. Ferro KJ, Morgano SM, Driscoll CF, Freilich MA. The Glossary of Prosthodontic Terms. J Prosthet Dent. 2017;117(5S): e1-e105.

2. Steveling H, Kirsch A, Posthoff C. Clinical long-term results with dental implants. Int J Oral Maxillofac Implants. 2001;16(5):617–25.

3. Rasmusson L, Roos J, Bystedt H. A 10-year follow-up study of titanium dioxide–blasted implants. Clin Implant Dent Relat Res. 2005;7(1):36–42.

4. Kronström M, Davis B, Lunsford C, Ismail F, Persson GR. A prospective randomized study on the clinical and microbiological effects of different implant designs. Clin Implant Dent Relat Res. 2004;6(4):220–9.

5. Muller F, Ríos Calvo MP. Postoperative pain after implant placement: A prospective clinical study. Clin Oral Implants Res. 2001;12(6):464–8.

6. Eli I, Schwartz-Arad D, Baht R, Ben-Tuvim H. Effect of anxiety on the experience of pain in implant insertion. Clin Oral Implants Res. 2003;14(1):115–8.

7. González-Santana H, Peñarrocha M, Guarinos J, Sanchis JM. Pain and inflammation in dental implant placement. Clin Oral Implants Res. 2005;16(5):675–81.

8. Chapman CR, Turner JA. Psychological factors in chronic pain: Patient vulnerability and resilience. Curr Rev Pain. 1990;4(5):469–81.

9. Gómez-de Diego R, Cutando A, Montero J, López-Valverde A. Dental implant surgery and postoperative pain: A literature review. Med Oral Patol Oral Cir Bucal. 2014;19(5): e494–8.

10. Von Graffenried B, Weisenberg M, Spielberger CD. Anxiety and pain perception. Psychosom Med. 1977;39(6):486–97.

11. Armfield JM. The extent and nature of dental fear and phobia in Australia. Aust Dent J. 2010;55(4):368–77.

12. Klingberg G, Broberg AG. Dental fear/anxiety and dental behaviour management problems in children and adolescents: A review of prevalence and concomitant psychological factors. Int J Paediatr Dent. 1999;7(2):91–103.

13. Wali A, Suresh S, Kumar M. Dental anxiety among patients visiting a teaching dental hospital in India. J Int Oral Health. 2016;8(4):436–41.

14. Dumitrescu AL, Toma C, Lascu V. Self-reported oral health status, oral health-related behaviours, and dental anxiety in a group of Romanian university students. Int J Dent Hyg. 2009;7(1):41–5.

15. Corson MA, Boyd T, Kind P, Allen PF, Steele JG. Measuring oral health: does your treatment really make a difference? Br Dent J. 1999;187(9):481–4.

16. Özdemir Ü, Taşcı S. The effects of chronic disease on quality of life. J Health Sci. 2013;22(2):89–96.

17. Bailey R. Chronic illness and anxiety. J Psychosom Res. 2004;57(2):109–15.

18. Bogner HR, Morales KH, Reynolds CF, Cary MS, Bruce ML. Anxiety and depression in older adults with chronic diseases: A longitudinal study. J Am Geriatr Soc. 2008;56(1):115–20.

19. Manderson L, Kokanovic R. Chronic illness, anxiety and care. Chronic Illn. 2009;5(1):29–40.

20. Willgoss TG, Yohannes AM. Anxiety disorders in patients with chronic obstructive pulmonary disease: A review. Respir Care. 2011;56(5):769–81.

21. Minakuchi H, et al. Systemic disease considerations in the management of pain and anxiety in dental implant patients. J Prosthodont Res. 2015;59(3):173–8.

22. Spielberger CD, Gorsuch RL, Lushene RE. Manual for the State-Trait Anxiety Inventory. Palo Alto, CA: Consulting Psychologists Press; 1970.

23. Öner N, LeCompte A. Süreksiz-Sürekli Kaygı Envanteri El Kitabı. İstanbul: Boğaziçi Üniversitesi Yayınları; 1998.

24. Corah NL, Gale EN, Illig SJ. Assessment of a dental anxiety scale. J Am Dent Assoc. 1978;97(5):816–9.

25. Humphris GM, Morrison T, Lindsay SJ. The Modified Dental Anxiety Scale: validation and United Kingdom norms. Community Dent Health. 1995;12(3):143–50.

26. Huskisson EC. Measurement of pain. Lancet. 1974;2(7889):1127–31.

27. Kirsch A, Mentag PJ. The IMZ two-phase implant system: Oral rehabilitation concept. J Oral Implantol. 2001;27(2):134–44.

28. Busenlechner D, Fürhauser R, Haas R, Watzek G, Mailath G, Pommer B. Long-term implant success at the Academy for Oral Implantology: 8-year follow-up and risk factor analysis. Clin Oral Implants Res. 2014;25(3):517–25.

29. Klingberg G, Broberg AG. Dental fear/anxiety and dental behaviour management problems in children and adolescents: A review. Int J Paediatr Dent. 1998;8(3):135–50.

30. Wali A, Siddiqui TM, Ali A. Dental anxiety among patients attending dental hospitals of Karachi. J Pak Dent Assoc. 2016;25(2):47–52.

31. Corah NL. Development of a dental anxiety scale. J Dent Res. 1969;48(4):596.

32. Tunc EP, Firat D, Onur OD, Sar V. Reliability and validity of the Modified Dental Anxiety Scale in a Turkish population. Community Dent Oral Epidemiol. 2005;33(5):357–62.

33. Fırat D, Tunc EP, Sar V. Dental anxiety among adults in Turkey. J Contemp Dent Pract. 2006;7(3):75–82.

34. Bakare MO, Omigbodun OO, Kuteyi OB, et al. Psychological complications of diabetes mellitus in Nigerian patients. Ann Afr Med. 2008;7(3):128–33.

35. Butwicka A, Fendler W, Zalepa A, Szadkowska A, Mlynarski W. Psychiatric morbidity and quality of life in children with type 1 diabetes mellitus. Psychosomatics. 2016;57(2):185–93.

36. Player MS, Peterson LE. Anxiety disorders, hypertension, and cardiovascular risk: a review. Int J Psychiatry Med. 2011;41(4):365–77.

37. Bussing R, Burket RC, Kelleher ET. Prevalence of anxiety disorders in asthmatic children. J Am Acad Child Adolesc Psychiatry. 1996;35(10):1310–6.

38. Urban T, Nagy K, Varga E. Comparative study of postoperative pain after dental implantation. Fogorv Sz. 2010;103(3):85–9.

39. Al-Khabbaz AK, Griffin TJ, Al-Shammari KF. Assessment of pain associated with the surgical placement of dental implants. J Periodontol. 2007;78(2):239–46.

40. Kindler CH, Harms C, Amsler F, Ihde-Scholl T, Scheidegger D. The visual analog scale allows effective measurement of preoperative anxiety. Anesth Analg. 2000;90(3):706–12.

41. Bringuier S, Dadure C, Raux O, Dubois A, Picot MC, Capdevila X. The perioperative validity of the visual analog anxiety scale in children. Anesth Analg. 2009;109(3):737–44.

42. Schuurs AHB, Hoogstraten J. Appraisal of dental anxiety and fear questionnaires: A review. Community Dent Oral Epidemiol. 1993;21(6):329–39.

43. Hakeberg M, Berggren U, Carlsson SG. Prevalence of dental anxiety in an adult population in Sweden. Community Dent Oral Epidemiol. 1992;20(2):97–101.

Volume 5 / Issue 3 / December 2025

Research Article

Subspinal Minimal İnvaziv SARME Sonrası Nazolabial Yumuşak Doku Parametrelerinin 3dMD Stereofotogrametri ile Değerlendirilmesi

Nizami Gayıbov[1*], Ahmet Emin Demirbaş[2]

[1]Erciyes University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Kayseri, Türkiye,

*Corresponding author: nizamigayibov@gmail.com

Gayıbov, Nizami., Demirbaş, Ahmet Emin. "Subspinal Minimal İnvaziv SARME Sonrası Nazolabial Yumuşak Doku Parametrelerinin 3dMD Stereofotogrametri ile Değerlendirilmesi". *Acta Stomatologica Cappadocia.* 5;3 (December 2025): 55-71.

DOI: https://doi.org/10.54995/ASC.5.3.4
Received: 17.09.2025; Accepted: 24.11.2025

Subspinal Minimal İnvaziv SARME Sonrası Nazolabial Yumuşak Doku Parametrelerinin 3dMD Stereofotogrametri ile Değerlendirilmesi

Nizami Gayıbov, Ahmet Emin Demirbaş

Özet

Amaç: Bu çalışmanın amacı, minimal invaziv subspinal SARME (MISARME) ve konvansiyonel SARME (CSARME) yöntemlerinin nazolabial ve yüz yumuşak doku parametreleri üzerindeki etkilerini 3D stereofotogrametri yöntemi ile karşılaştırmaktır.

Yöntem: Prospektif, randomize ve çift kör tasarıma sahip bu çalışmaya maksiller transvers darlık tanısı konulan 35 hasta dahil edilmiştir. Çalışma grubuna MISARME, kontrol grubuna ise CSARME uygulanmıştır. Yumuşak doku değişiklikleri preoperatif ve postoperatif farklı zaman dilimlerinde 3D stereofotogrametri ile değerlendirilmiştir.

Bulgular: MISARME tekniğinin nazolabial estetik üzerinde daha sınırlı değişikliklere yol açtığı, özellikle üst dudak uzunluğunun korunmasında daha stabil sonuçlar sağladığı belirlenmiştir. Nazolabial açı, nasal tip açısı, kolumella yüksekliği ve supratip kırılma açısı açısından gruplar arasında istatistiksel olarak anlamlı fark bulunmamıştır.

Sonuç: Minimal invaziv subspinal yaklaşım; cerrahi morbiditeyi azaltan, estetik sonuçları koruyan ve hasta konforunu artıran güvenilir bir alternatiftir. Estetik beklentisi yüksek erişkin maksiller transvers darlık hastalarında MISARME'nin tercih edilmesi önerilmektedir.

Anahtar kelimeler: CSARME, Maksiller enine yetersizlik, MISARME, Nazal yumuşak doku, 3D stereofotogrametri.

Abstract

Objective: The aim of this study was to compare the effects of minimally invasive subspinal SARME (MISARME) and conventional SARME (CSARME) on nasolabial and facial soft tissue parameters using 3D stereophotogrammetry.

Methods: This prospective, randomized, double-blind study included 35 patients diagnosed with maxillary transverse deficiency. MISARME was performed in the study group, while CSARME was applied in the control group. Soft tissue changes were evaluated preoperatively and postoperatively at different time intervals using 3D stereophotogrammetry.

Results: The MISARME technique was found to cause more limited changes in nasolabial aesthetics, providing more stable outcomes particularly in the preservation of upper lip length. No statistically significant differences were observed between the groups regarding the nasolabial angle, nasal tip angle, columella height, and supratip break angle.

Conclusion: The minimally invasive subspinal approach is a reliable alternative that reduces surgical morbidity, preserves esthetic outcomes, and improves patient comfort. MISARME is recommended for adult patients with maxillary transverse deficiency who have high esthetic expectations.

Keywords: CSARME, Maxillary transverse deficiency, MISARME, Nasolabial soft tissue, 3D stereophotogrammetry.

Giriş

Maksiller transvers darlık (MTD), erişkin popülasyonda sık karşılaşılan bir dentofasiyal deformitedir ve prevalansının %4 ile %23 arasında değiştiği bildirilmektedir (1). Klinik olarak MTD; maksiller dişlerde çapraşıklık, tek taraflı veya bilateral çapraz kapanış, belirgin bukkal koridor, paranazal çöküklük ve V-şeklinde dental ark ile karakterizedir (2,3). Çocuk ve adölesanlarda hızlı üst çene genişletme (RME) ortodontik olarak başarıyla uygulanabilmekte iken, erişkinlerde sutürlerin kapanması ve iskeletsel dirençlerin artması nedeniyle başarısı azalmaktadır (4). Bu nedenle erişkin hastalarda cerrahi destekli hızlı üst çene genişletme (SARME) yöntemleri geliştirilmiştir (5).

Konvansiyonel SARME, maksillanın transversal yönde genişletilmesi için kullanılan güvenilir ve etkili bir tekniktir. Bununla birlikte, SARME'nin bazı dezavantajları vardır. Literatürde %1 ile %50 arasında değişen komplikasyon oranları bildirilmiştir. Bu komplikasyonlar arasında diş ekstrüzyonu, yanlış yönde maksiller genişleme, pterigomaksiller ayrışma ile ilişkili ciddi kanamalar ve alveoler kemik kayıpları yer almaktadır (6–8). Ayrıca operasyon süresi, intraoperatif kanama miktarı, postoperatif ağrı, ödem ve nazolabial yumuşak doku değişiklikleri hasta memnuniyetini olumsuz etkileyebilmektedir (9).

Son yıllarda, minimal invaziv cerrahi yaklaşımların farklı branşlarda olduğu gibi maksillofasiyal cerrahide de yaygınlaşmaya başladığı görülmektedir. Hernandez ve ark. tarafından tanımlanan minimal invaziv subspinal SARME (MISARME) tekniği, daha sınırlı insizyonlarla, daha kısa cerrahi süre ve daha düşük morbidite ile uygulanabilmektedir (10). MISARME'nin en önemli avantajlarından biri, nazolabial yumuşak dokular üzerine daha az olumsuz etki yapmasıdır. Çünkü subspinal osteotomi daha sınırlı bir alanı etkiler ve yumuşak dokulara olan cerrahi travmayı azaltır (11).

SARME sonrası nazal taban genişlemesi, alar kanat genişliği artışı, kolumella yüksekliği ve nasolabial açı değişiklikleri çeşitli çalışmalarda rapor edilmiştir (12–14). Estetik açıdan özellikle burun ve üst dudak bölgesindeki bu değişiklikler, hasta memnuniyetini düşüren önemli faktörlerdir (15). MISARME tekniğinin ise bu değişiklikleri daha minimal seviyede tuttuğu yönünde sınırlı sayıda çalışma bulunmaktadır (16,17).

Günümüzde 3D stereofotogrametri, nazolabial ve yüz yumuşak doku değişimlerinin objektif olarak değerlendirilmesinde en güvenilir yöntemlerden biridir. Bu yöntem non-invaziv, tekrarlanabilir ve yüksek doğrulukta ölçüm imkânı sağlamaktadır (18). Önceki araştırmalarda SARME sonrası yüz yumuşak dokularında meydana gelen değişiklikler 2D sefalometrik radyografiler veya alçı modeller üzerinden incelenmiş, ancak bu yöntemler 3D yumuşak doku analizine olanak vermemiştir (19).

Bu çalışmanın amacı, minimal invaziv subspinal SARME (MISARME) ve konvansiyonel SARME (CSARME)yöntemlerinin nazolabial ve yüz yumuşak doku parametreleri üzerindeki etkilerini 3D stereofotogrametri ile karşılaştırmaktır. Hipotezimiz, çalışma grubunda kontrol grubuna kıyasla yumuşak doku değişikliklerinin daha sınırlı olacağı ve bunun estetik açıdan daha üstün sonuçlar sağlayacağı yönündedir.

Malzeme ve Yöntemler

Çalışma Tasarımı ve Etik Onay

Bu çalışma, prospektif, randomize ve çift kör tasarıma sahip bir klinik araştırma olarak planlanmıştır. Araştırma protokolü Erciyes Üniversitesi Klinik Araştırmalar Etik Kurulu tarafından onaylanmıştır (Etik Onay No: 2022/65). Tüm bireylere çalışma amacı ve süreç hakkında ayrıntılı bilgi verilmiş; katılımları için yazılı aydınlatılmış onamları alınmıştır. Çalışma, Helsinki Bildirgesi'nin etik ilkelerine uygun olarak yürütülmüştür.

Çalışma Popülasyonu ve Örneklem Seçimi

Araştırmaya, 2022–2023 yılları arasında Erciyes Üniversitesi Diş Hekimliği Fakültesi Ağız, Diş ve Çene Cerrahisi Kliniği'nde, maksiller darlığa bağlı fonksiyonel ve estetik sorunların giderilmesi amacıyla genel anestezi altında Cerrahi Destekli Hızlı Maksiller Genişletme (SARME) operasyonu planlanan hastalar dahil edilmiştir.

Dahil edilme kriterleri şunlardır:

- 16–35 yaş aralığında olmak,
- ASA I sınıfında yer alan sistemik sağlık durumuna sahip olmak,
- Son bir hafta içinde nonsteroid antiinflamatuar ilaç (NSAİİ) kullanmamış olmak,
- Herhangi bir sistemik hastalığın, ilaç/analjezik intoleransının veya alerjik reaksiyon öyküsünün bulunmaması,
- Önceden rinoplasti veya septoplasti geçirmemiş olmak,
- Dentofasiyal deformite (DDY) tanısının bulunmaması.

Bu kriterleri karşılayan toplam 36 birey çalışmaya dahil edilmiştir. Çalışma öncesinde yapılan power analizi, her grupta en az 15 katılımcının yeterli istatistiksel gücü sağlayacağını göstermiş olup, gücü artırmak amacıyla her gruba 18'er birey alınmıştır. Çalışma grubunda yer alan bir katılımcı, veri yetersizliği nedeniyle analiz dışı bırakılmıştır.

Dışlama Kriterleri

- ASA II ve üzeri sistemik durum
- Dudak-damak yarığı veya nazal cerrahi öyküsü (rinoplasti vb.)
- Gebelik veya emzirme
- Kronik ilaç kullanımı (opioid, NSAİİ, kortikosteroid)
- Baş-boyun bölgesinde akut inflamasyon

Cerrahi Prosedürler:

Kontrol Grubu: Tüm olgularda genel anestezi altında orotrakeal entübasyonu takiben faringeal tampon yerleştirildi. Üst çenenin anterior-posterior bölgelerine yaklaşık 6 cc Ultracaine D-S forte ile bukkal infiltrasyon anestezisi uygulandı. Mukogingival bileşkeden başlayan yatay insizyon ile mukoperiosteal flep kaldırıldı ve lateral nazal açıklık, zigomatik destek ile tuber maksilla bölgeleri ortaya kondu. Piezoelektrik cerrahi testere yardımıyla bu bölgelerde yatay osteotomiler gerçekleştirildi ve osteotom ile segmentasyon sağlandı. Benzer cerrahi prosedür karşı tarafta da tekrarlandı. Orta hatta frenilum hizasından yapılan dikey insizyon sonrasında anterior nazal spina ekspoze edilerek piezoelektrik testere ile vertikal osteotomi tamamlandı. Operasyon sonunda aparey anahtar yardımıyla aktive edilerek genişleme sağlandı ve ardından kısmi geri dönüş yapılarak hedeflenen açıklık bırakıldı. Cerrahi alan 4-0 rezorbe sütür materyali (Polyglactin-910) ile primer olarak kapatıldı ve hemostaz sonrası faringeal tampon çıkarılarak işlem sonlandırıldı.

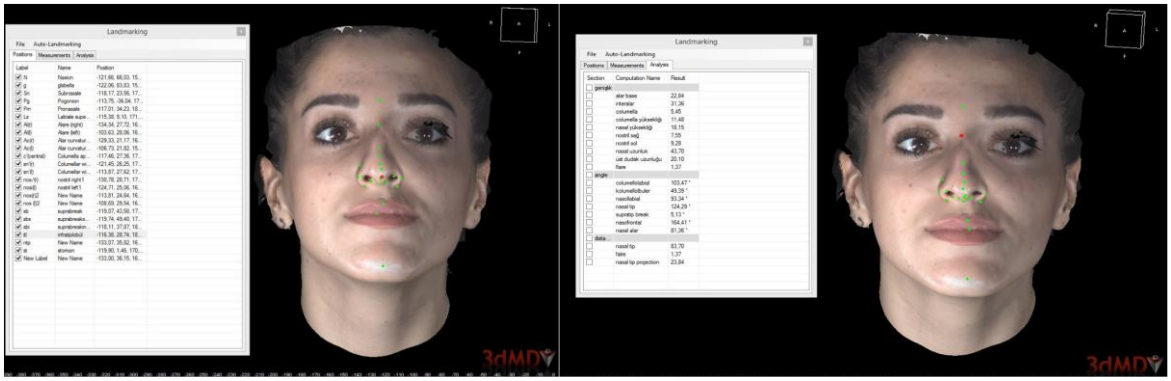
Çalışma Grubu: Hastalar genel anestezi altında orotrakeal entübasyonla entübe edildikten sonra faringeal tampon yerleştirildi. Tuber bölgelerine yaklaşık 6 cc Ultracaine D-S forte ile infiltrasyon anestezisi uygulandı. Vestibüler sulkustan yapılan yatay insizyon sonrası, lateral maksiller duvar üzerindeki yumuşak dokular apertura piriformisten maksiller tüberositas yönüne tünel tekniği ile kaldırıldı. Piezoelektrik testere kullanılarak lateral osteotomiler gerçekleştirildi ve PMS ayrılmadan osteotom ile segmentasyon sağlandı. Subspinal osteotomi anterior nazal spinanın hemen altından, midpalatal osteotomi ise santral dişler arasına kadar uzanacak şekilde yapıldı. Ortodontik aparey anahtar yardımıyla aktive edilerek genişleme doğrulandı. Cerrahi saha 4-0 rezorbe sütür materyali (Polyglactin-910) ile primer olarak kapatıldı ve işlem hemostazın sağlanmasıyla tamamlandı.

Ölçümler

Yüz Yumuşak Doku Parametreleri

Üç boyutlu yüz görüntüleri, stereofotogrametri tekniği ile 3dMD Face System (3dMD, Atlanta, GA, ABD) kullanılarak elde edilmiştir. Tüm görüntüler, hastaların dudakları gevşek, gözleri açık ve maksimum interkuspidasyon konumunda olduğu sırada aynı klinisyen tarafından alınmıştır. Görüntülemeler; preoperatif dönem (T0), postoperatif 1. gün (T1), postoperatif 7. gün (T2) ve postoperatif 6. ay (T3) zaman noktalarında gerçekleştirilmiştir. Görüntülere dayanarak nasolabial açı,nasal tip açısı,kolumella yüksekliği,supratip kırılma açısı,üst dudak

uzunluğunun ölçümüyapılmıitır.Yumuşak doku değişimleri ve ödem ölçümleri, 3dMD Vultus yazılımı (3dMD, Atlanta, GA, ABD) kullanılarak analiz edilmiştir. (Şekil 1)



Şekil 1. Stereofotogrametri ile ölçüm yapılan anatomik noktalar.

İstatistiksel Analiz

Tüm veriler SPSS v26.0 (IBM, New York, ABD) kullanılarak analiz edilmiştir. Verilerin normal dağılıma uygunluğu Shapiro–Wilk testi ile değerlendirilmiş; gruplar arası karşılaştırmalarda Mann–Whitney U testi ve bağımsız örneklem t-testi kullanılmıştır. Zaman içindeki değişimleri incelemek için Mixed ANOVA uygulanmış ve çoklu karşılaştırmalar Bonferroni düzeltmesi ile yapılmıştır. Kategorik değişkenler Pearson ki-kare testi ile analiz edilmiş; istatistiksel anlamlılık düzeyi $p < 0.05$ olarak kabul edilmiştir.

Bulgular

Araştırmaya, Erciyes Üniversitesi Diş Hekimliği Fakültesi Ağız, Diş ve Çene Cerrahisi Kliniği'nde, maksiller darlığa bağlı fonksiyonel ve estetik sorunların giderilmesi amacıyla genel anestezi altında Cerrahi Destekli Hızlı Maksiller Genişletme (SARME) operasyonu planlanan hastalar dahil edilmiştir. Çalışmaya 16–50 yaş aralığında, ASA I sınıfında değerlendirilen, daha önce rinoplasti veya septoplasti öyküsü bulunmayan ve dentofasiyal deformite (DDY) tanısı olmayan toplam 36 birey katılmıştır. Çalışma öncesinde yapılan power analizi, her grupta en az 15 katılımcının yeterli olacağını göstermiştir. İstatistiksel gücü artırmak amacıyla her gruba 18'er hasta alınmıştır. Bununla birlikte, çalışma grubundaki bir olgu veri yetersizliği nedeniyle değerlendirme dışı bırakılmıştır.

Nazolabial Parametreler

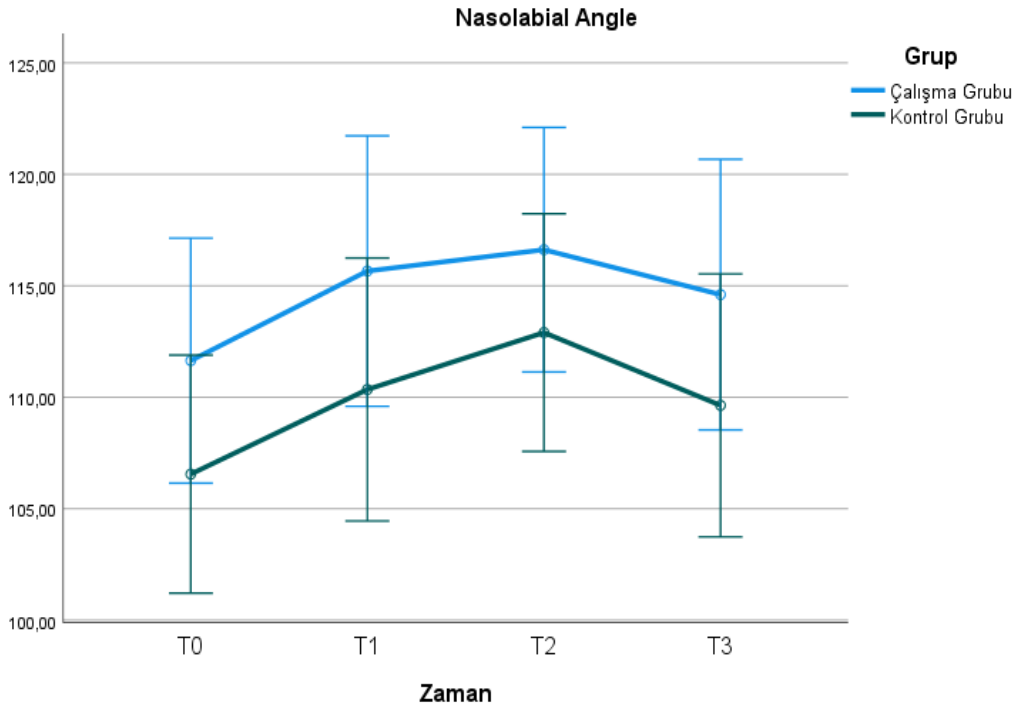
Tablo 2. Nasolabial açı (Nasolabial Angle) Değerlerinin Grup içi ve Gruplar arası karşılaştırılması

	Grup		**Test İstatistikleri †**		
	Çalışma	**Kontrol**	*F*	*p*	η^2
Nasolabial Angle					
T0	111, 64±11, 93	106, 55±10, 33^{a}	1, 828	0, 186	0, 052
T1	115, 66±13, 09	110, 35±11, 50^{ab}	1, 632	0, 210	0, 047
T2	116, 62±10, 99	112, 90±11, 22^{b}	0, 977	0, 330	0, 029
T3	114, 60±13, 48	109, 63±11, 07^{ab}	1, 427	0, 241	0, 041
Test İstatistikleri ¥	*F*=2, 148; *p*=0, 114; η^2=0, 172	**F=3, 449; p=0, 028; η^2=0, 250**			
F=3821, 440; p<0, 001; η^2=0, 991					

F: Mixed Desing ANOVA, Etki Büyüklüğü (**η2**),¥Grup içi karşılaştırma,

†Gruplar arası karşılaştırma, Tanıtıcı istatistikler *ortalama ± standart sapma* olarak verildi.

Koyu olarak belirlenen bölümler istatistiksel olarak anlamlıdır, a ve b üst simgeleri istatistiksel olarak farklı olan değerleri temsil etmektedir (*p*<0, 05).



Tablo 2'ye göre nasolabial angle değeri çalışma grubunda T0, T1, T2 ve T3 zamanlarında istatistiksel olarak benzerdir. Kontrol grubunda nasolabial angle değeri T2 zamanda T0'dan yüksektir ve bu değer istatistiksel olarak anlamlıdır.

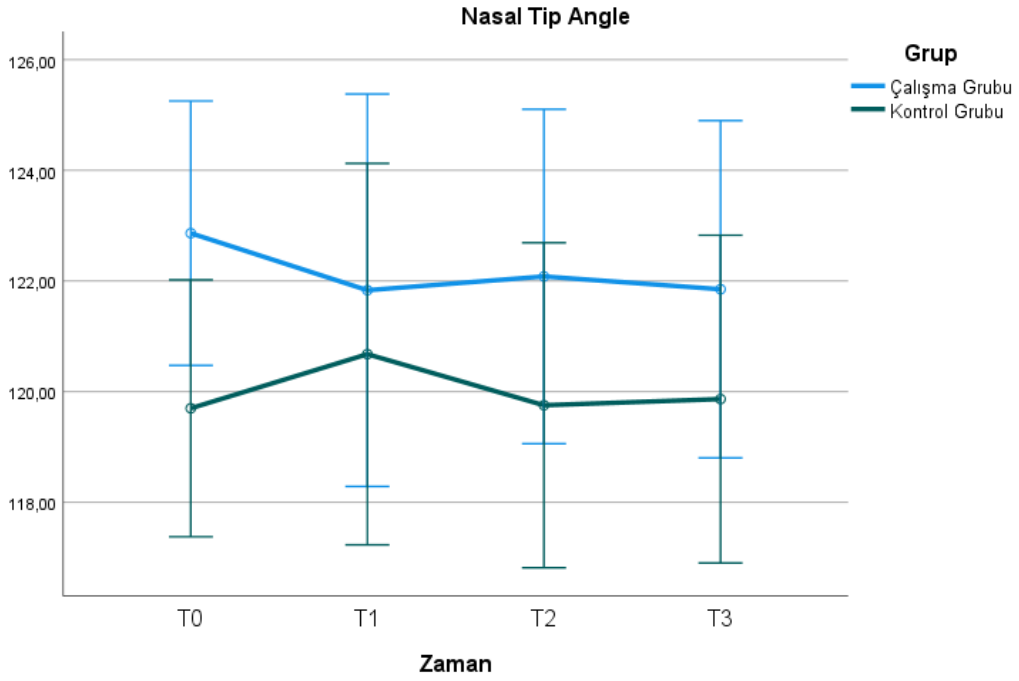
T0, T1, T2 ve T3 zamanında çalışma ve kontrol gruplarında nasolabial angle değeri istatistiksel olarak benzerdir.

Tablo 3. Nasal Tip Açı(Nasal Tip Angle) Değerlerinin Grup İçi ve Gruplar arası Karşılaştırılması

	Grup		**Test İstatistikleri †**		
	Çalışma	**Kontrol**	*F*	*p*	η^2
Nasal Tip Angle					
T0	122, 86±4, 65	119, 70±5, 01	3, 734	0, 062	0, 102
T1	121, 83±7, 29	120, 67±7, 09	0, 226	0, 638	0, 007
T2	122, 08±6, 18	119, 75±6, 06	1, 263	0, 269	0, 037
T3	121, 85±7, 46	119, 86±4, 64	0, 903	0, 349	0, 027
Test İstatistikleri ¥	F=0, 245; p=0, 865; η^2=0, 023	F=0, 149; p=0, 929; η^2=0, 014			
***F*=22108, 976; *p*<0, 001; η^2=0, 999**					

F: Mixed Desing ANOVA, Etki Büyüklüğü (η^2),

¥Grup içi karşılaştırma, †Gruplar arası karşılaştırma, Tanıtıcı istatistikler *ortalama ± standart sapma* olarak verildi. Koyu olarak belirlenen bölümler istatistiksel olarak anlamlıdır (p<0, 05).



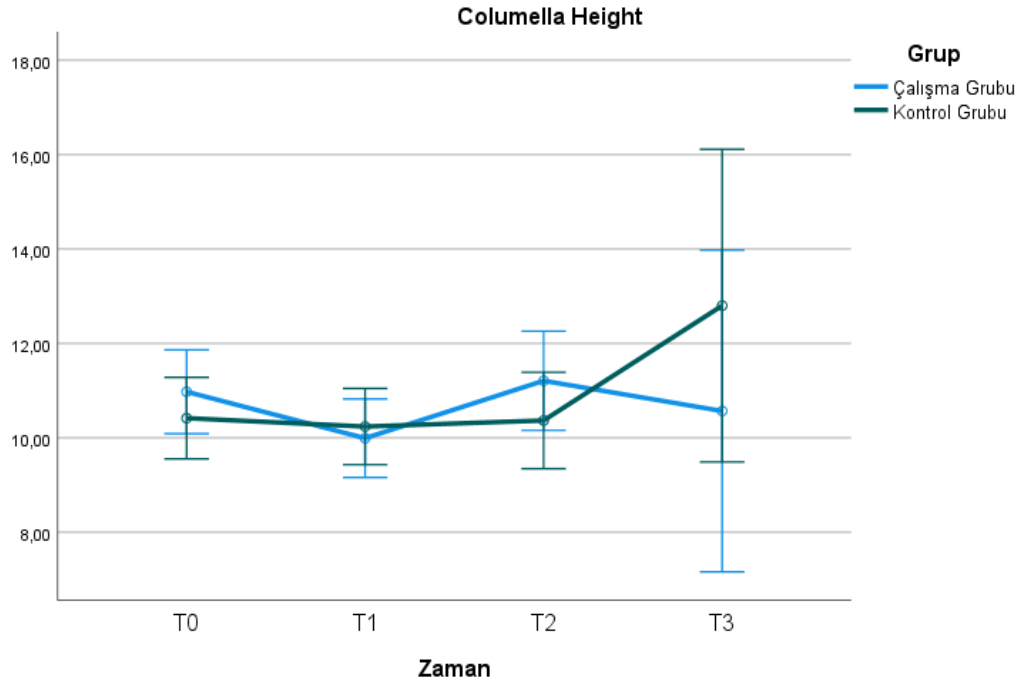
Tablo 3 'e göre nasal tip angle değeri çalışma grubunda T0, T1, T2 ve T3 zamanlarında istatistiksel olarak benzerdir. Kontrol grubunda nasal tip angle değeri T0, T1, T2 ve T3 zamanlarında istatistiksel olarak benzerdir. T0, T1, T2 ve T3 zamanında çalışma ve kontrol gruplarında nasal tip angle değerleri istatistiksel olarak benzerdir.

Tablo 4. Columella yükseklik (Columella Height) Değerlerinin Grup içi ve Gruplar arası Karşılaştırılması

	Grup		**Test İstatistikleri †**		
	Çalışma	**Kontrol**	*F*	*p*	η^2
Columella Height					
T0	10, 97±2, 06	10, 41±1, 50	0, 843	0, 365	0, 025
T1	9, 99±1, 63	10, 24±1, 72	0, 188	0, 667	0, 006
T2	11, 21±2, 44	10, 36±1, 78	1, 366	0, 251	0, 040
T3	10, 56±2, 13	12, 80±9, 39	0, 913	0, 346	0, 027
Test İstatistikleri ¥	F=2, 492; p=0, 079; η^2=0, 194	F=0, 790; p=0, 509; η^2=0, 071			
F=811, 942; p<0, 001; η^2=0, 961					

F: Mixed Desing ANOVA, Etki Büyüklüğü ($\eta 2$),

¥Grup içi karşılaştırma,†Gruplararası karşılaştırma, Tanıtıcı istatistikler *ortalama ± standart sapma* olarak verildi. Koyu olarak belirlenen bölümler istatistiksel olarak anlamlıdır (p<0, 05).



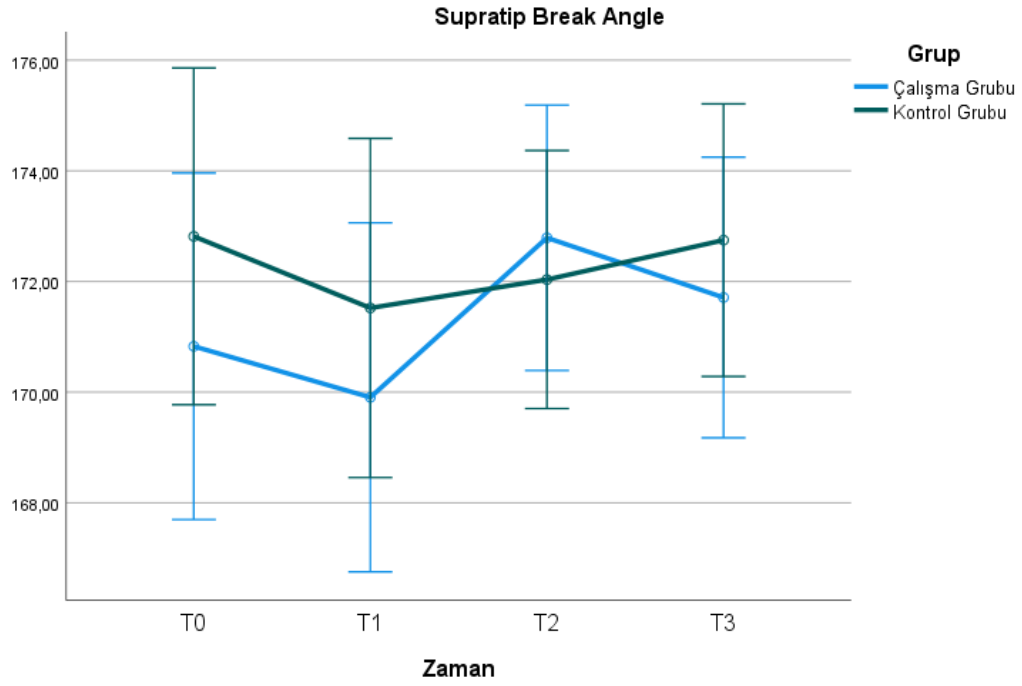
Tablo 4'e göre columella height değeri çalışma grubunda T0, T1, T2 ve T3 zamanlarında istatistiksel olarak benzerdir. Kontrol grubunda columella height değeri T0, T1, T2 ve T3 zamanlarında istatistiksel olarak benzerdir.

T0, T1, T2 ve T3 zamanında çalışma ve kontrol gruplarında columella height değeri istatistiksel olarak benzerdir.

Tablo 5. Supratip Kırılma Açısı (Supratip Break Angle) Değerlerinin Grup İçi ve Gruplar arası Karşılaştırılması.

	Grup		**Test İstatistikleri †**		
	Çalışma	**Kontrol**	*F*	*p*	η^2
Supratip Break Angle					
T0	170, 82±7, 65	172, 81±4, 79	0, 857	0, 361	0, 025
T1	169, 90±8, 51	171, 52±3, 32	0, 558	0, 460	0, 017
T2	172, 79±5, 15	172, 03±4, 56	0, 211	0, 649	0, 006
T3	171, 71±5, 69	172, 74±4, 55	0, 355	0, 555	0, 011
Test İstatistikleri ¥	*F*=1, 096; *p*=0, 365; η^2=0, 096	*F*=0, 469; *p*=0, 706; η^2=0, 043			
F=63834, 969; p<0, 001; η^2=0, 999					

F: Mixed Desing ANOVA, Etki Büyüklüğü (η^2), ¥Grup içi karşılaştırma, †Gruplar arası karşılaştırma, Tanıtıcı istatistikler *ortalama ± standart sapma* olarak verildi. Koyu olarak belirlenen bölümler istatistiksel olarak anlamlıdır (p<0, 05).



Tablo 5'e göre supratip break angle değeri çalışma grubunda T0, T1, T2 ve T3 zamanlarında istatistiksel olarak benzerdir. Kontrol grubunda supratip break angle değeri T0, T1, T2 ve T3 zamanlarında istatistiksel olarak benzerdir.

T0, T1, T2 ve T3 zamanında çalışma ve kontrol gruplarında supratip break angle değerleri istatistiksel olarak benzerdir.

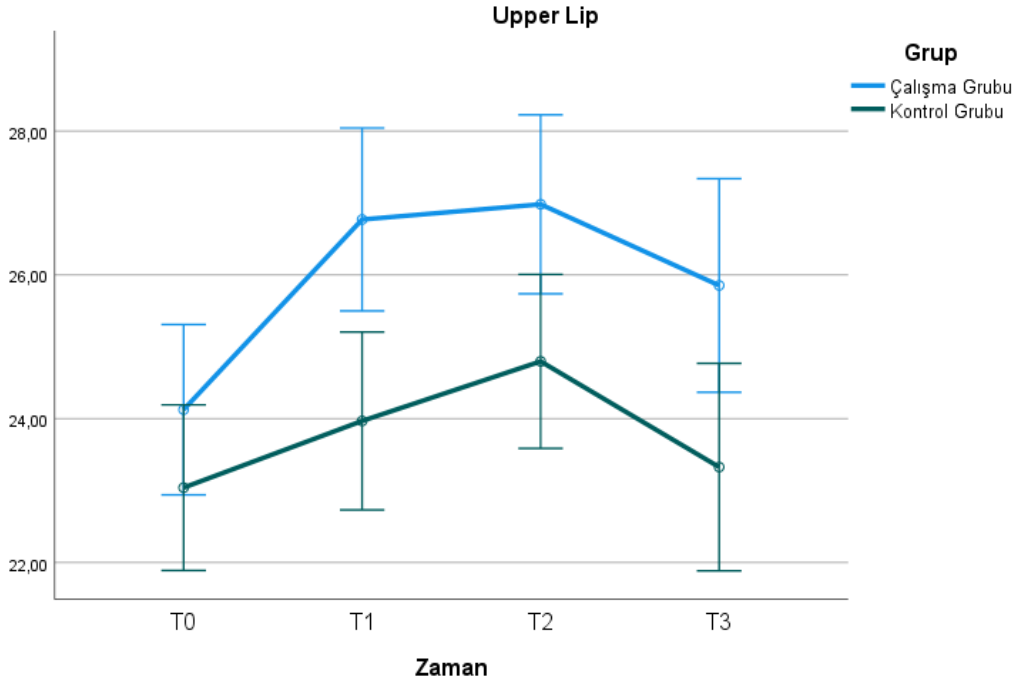
Tablo 6. Üst dudak uzunluk (Upper Lip) Değerlerinin Grup içi ve Gruplar arası karşılaştırılması.

	Grup		**Test İstatistikleri †**		
	Çalışma	**Kontrol**	*F*	*p*	η^2
Upper Lip					
T0	24, 12±2, 63^{a}	23, 04±2, 15^{a}	1, 785	0, 191	0, 051
T1	26, 77±3, 01^{bc}	23, 96±2, 08^{abc}	**10, 319**	**0, 003**	**0, 238**
T2	26, 98±2, 76^{b}	24, 79±2, 27^{b}	**6, 556**	**0, 015**	**0, 166**
T3	25, 85±3, 22^{c}	23, 32±2, 79^{ac}	**6, 160**	**0, 018**	**0, 157**
Test İstatistikleri ¥	***F*=8, 807; *p*<0, 001; η^2=0, 460**	***F*=4, 121; *p*=0, 014; η^2=0, 285**			
***F*=4405, 532; *p*<0, 001; η^2=0, 993**					

F: Mixed Desing ANOVA, Etki Büyüklüğü ($\eta 2$),¥Grup içi karşılaştırma,

†Gruplararası karşılaştırma, Tanıtıcı istatistikler *ortalama ± standart sapma* olarak verildi.

Koyu olarak belirlenen bölümler istatistiksel olarak anlamlıdır, a ve b üst simgeleri istatistiksel olarak farklı olan değerleri temsil etmektedir (*p*<0, 05).



Tablo 6' ya göre çalışma grubunda üst dudak uzunluk değeri T0 zamanında diğer zamanlardaki ölçümlerden istatistiksel olarak düşüktür. Kontrol grubunda upper lip değeri T3 zamanında diğerlerinden yüksektir.

T0 zamanında çalışma ve kontrol gruplarında upper lip değeri istatistiksel olarak benzerdir. T1, T2 ve T3 zamanlarında upper lip değeri çalışma grubunda kontrol grubundan istatistiksel olarak yüksektir.

Tartışma

Bu çalışmada, subspinal minimal invaziv SARME (Çalışma grubu) ile konvansiyonel SARME (Kontrol grubu) yöntemlerinin nazolabial ve yüz yumuşak doku parametreleri üzerindeki etkileri karşılaştırmalı olarak değerlendirildi. Elde edilen bulgular, minimal invaziv yaklaşımın nazolabial estetiği koruma açısından daha avantajlı olduğunu göstermektedir. Özellikle üst dudak uzunluğu ve pozisyonu bakımından çalışma grubunda daha stabil sonuçlar elde edilmiş; cerrahi sonrası estetik değişikliklerin kontrol grubuna kıyasla daha sınırlı düzeyde olduğu saptanmıştır.

Nazolabial açı ve kolumella yüksekliği, SARME sonrası değişim göstermesi en muhtemel estetik parametreler arasında yer alır. Literatürde kontrol grubunda uygulanan klasik SARME'nin bu bölgelerde belirgin değişikliklere neden olduğu çeşitli araştırmalarla desteklenmiştir. Magnusson ve ark. (12), operasyon sonrası nazolabial açıda ortalama 2.5°'lik bir artış bildirmiştir. Benzer şekilde Zupan ve ark. (13), kolumella yüksekliğinde anlamlı artışlar tespit etmişlerdir. Bu çalışmalar, klasik SARME'nin üst çene bölgesinde daha geniş disseksiyon gerektirmesi nedeniyle yumuşak doku gerilimini artırdığını göstermektedir. Çalışmamızda ise kontrol ve çalışma grupları arasında bu parametrelerde istatistiksel olarak anlamlı bir farklılık saptanmamış; minimal invaziv subspinal yaklaşımın yumuşak dokuları daha fazla koruduğu yönündeki görüşler desteklenmiştir. Bu durum, subspinal osteotominin anatomik yapılara daha sınırlı müdahale gerektirmesi ve nazal valv–kolumella kompleksini daha az etkilemesi ile açıklanabilir.

Üst dudak uzunluğu estetik açıdan kritik öneme sahip olup, cerrahi sonrası meydana gelen değişimler yüz harmonisini doğrudan etkilemektedir. Bastos ve ark. (14), konvansiyonel SARME sonrasında üst dudakta retraksiyon eğilimi olduğunu ve bazı olgularda dudak desteğinin azaldığını bildirmiştir. Bizim çalışmamızda da kontrol grubunda üst dudak uzunluğunda hafif retraksiyon benzeri değişimler görülmüş; buna karşın çalışma grubunda üst dudak pozisyonunun daha iyi korunduğu belirlenmiştir. Üst dudağın stabil kalması, özellikle genç erişkin kadın hastalarda estetik memnuniyeti artıran önemli bir faktördür.

Yüz estetiği, ortognatik cerrahi ve genişletme prosedürlerinin başarı değerlendirmesinde temel ölçütlerden biridir. Literatürde minimal invaziv SARME tekniklerinin, nazolabial yumuşak dokular üzerindeki etkilerinin klasik yönteme kıyasla daha sınırlı olduğu belirtilmektedir (10). Bulgularımız bu görüşle uyumlu olup, çalışma grubunun estetik açıdan daha

koruyucu bir profil sunduğunu ortaya koymaktadır. Özellikle nazolabial bölgenin doğal konturlarının korunması, postoperatif dönemde hasta memnuniyetini belirgin şekilde artırmaktadır.

Bu araştırmanın güçlü yönleri arasında prospektif çalışma tasarımı, randomizasyon uygulanması ve yüz yumuşak dokularının değerlendirilmesinde yüksek doğruluğa sahip 3D stereofotogrametri yönteminin kullanılması yer almaktadır. Üç boyutlu yüz analizleri, geleneksel fotoğraf veya 2D ölçümlere kıyasla çok daha hassas ve tekrarlanabilir veri sağlamaktadır. Bununla birlikte, çalışmamızın bazı sınırlılıkları bulunmaktadır. Örneklem büyüklüğünün görece sınırlı olması ve araştırmanın tek merkezde yürütülmesi bulguların genellenebilirliğini kısmen azaltabilir. Ayrıca takip süresinin iki yıldan kısa olması nedeniyle uzun dönem stabilite, nüks olasılığı ve nazolabial bölgedeki geç dönem adaptasyonlar değerlendirilememiştir. Bu nedenle, daha geniş örneklemli, çok merkezli ve uzun dönem takip içeren gelecekteki çalışmaların alandaki bilgi birikimine önemli katkılar sağlayacağı düşünülmektedir.

Bu çalışma, minimal invaziv subspinal yaklaşım ile uygulanan SARME yöntemi ile konvansiyonel SARME tekniğinin nazolabial bölge ve yüz yumuşak doku parametreleri üzerindeki etkilerini karşılaştırmalı olarak değerlendirmiştir. Elde edilen bulgular, minimal invaziv subspinal yaklaşımın özellikle üst dudak uzunluğu ve dudak pozisyonu açısından daha stabil sonuçlar sunduğunu ortaya koymaktadır. Çalışma grubunda üst dudak desteğinin büyük ölçüde korunduğu ve nazolabial bölgedeki değişimlerin kontrol grubuna kıyasla belirgin şekilde daha sınırlı olduğu görülmüştür. Bu durum, subspinal yaklaşımın daha dar bir disseksiyon alanı gerektirmesi ve kolumella ile çevre yumuşak dokulara minimal düzeyde müdahale etmesiyle açıklanabilir.

Estetik açıdan değerlendirildiğinde, nazolabial bölgenin cerrahi sonrası stabilitesi; yüz harmonisi, hasta memnuniyeti ve özellikle genç erişkin bireylerde sosyal yaşam kalitesi açısından kritik bir parametredir. Minimal invaziv yaklaşımın bu bölgedeki doğal konturları daha başarılı bir şekilde koruması, yöntemin klinik etkinliğini destekleyen önemli bir avantajdır. Ayrıca minimal doku travması ve sınırlı cerrahi alan, postoperatif ödemin daha az olmasına ve iyileşme sürecinin daha konforlu ilerlemesine katkı sağlamaktadır.

Sonuç

Sonuç olarak, minimal invaziv subspinal SARME yaklaşımı; cerrahi morbiditeyi azaltan, yüz estetik parametrelerini daha iyi koruyan ve hasta konforunu artıran güvenilir bir tedavi seçeneği olarak öne çıkmaktadır. Özellikle estetik beklentisi yüksek olan erişkin MTD hastalarında bu yöntemin tercih edilmesinin hem fonksiyonel hem de estetik açıdan daha tatmin edici sonuçlar sağlayabileceği düşünülmektedir. Bu bulgular doğrultusunda minimal invaziv subspinal tekniğin, uygun endikasyonlarda konvansiyonel yönteme alternatif olarak güçlü bir seçenek olduğu söylenebilir. Estetik beklentisi yüksek, nazolabial bölgeye duyarlı hastalarda minimal invaziv yaklaşımın tercih edilmesi klinik açıdan önemli bir avantaj sunmaktadır.

Kaynakça

1. Proffit WR, Fields HW, Sarver DM. Contemporary Orthodontics. 6th ed. St. Louis: Mosby; 2019.
2. Betts NJ, Vanarsdall RL, Barber HD, Higgins-Barber K, Fonseca RJ. Diagnosis and treatment of transverse maxillary deficiency. Int J Adult Orthodon Orthognath Surg. 1995;10(2):75-96.
3. Suri L, Taneja P. Surgically assisted rapid palatal expansion: a literature review. Am J Orthod Dentofacial Orthop. 2008;133(2):290-302.
4. Handelman CS. Nonsurgical rapid maxillary alveolar expansion in adults: a clinical evaluation. Angle Orthod. 1997;67(4):291-305.
5. Lines PA. Adult rapid maxillary expansion with corticotomy. Am J Orthod. 1975;67(1):44-56.
6. Bays RA, Greco JM. Surgically assisted rapid palatal expansion: an outpatient technique with long-term stability. J Oral Maxillofac Surg. 1992;50(2):110-113.
7. Mezzomo CL, Weissheimer A, de Menezes LM, da Silva Dalben G, de Almeida MA, de Oliveira RB. Immediate effects of surgically assisted rapid maxillary expansion with different types of anchorage. J Oral Maxillofac Surg. 2011;69(6):e77-83.
8. Pogrel MA, Kaban LB, Vargervik K, Baumrind S. Surgically assisted rapid maxillary expansion in adults. Int J Adult Orthodon Orthognath Surg. 1992;7(1):37-41.

9. Magnusson A, Bjerklin K, Nilsson P, Bondemark L. Surgically assisted rapid maxillary expansion: long-term stability. Am J Orthod Dentofacial Orthop. 2009;135(6):700.e1-700.e10.

10. Hernández-Alfaro F, Mareque-Bueno J, Díaz A. Minimally invasive surgically assisted rapid palatal expansion with limited approach under sedation: a report of 283 cases. J Oral Maxillofac Surg. 2010;68(9):2156-2162.

11. Cappellette M Jr, de Carvalho RWF, de Moraes M, et al. Subspinal osteotomy in surgically assisted rapid maxillary expansion. Oral Surg Oral Med Oral Pathol Oral Radiol. 2013;115(5):555-561.

12. Magnusson A, Bjerklin K, Nilsson P, Bondemark L. Three-dimensional computed tomographic analysis of changes after surgically assisted rapid maxillary expansion. Am J Orthod Dentofacial Orthop. 2013;144(6):872-879.

13. Zupan J, Drevenšek M, Jarc A, Farčnik F, Fidler A. Three-dimensional evaluation of soft tissue changes after surgically assisted rapid maxillary expansion. BMC Oral Health. 2022;22(1):113.

14. Bastos BV, Ribeiro AN, da Cunha TC, et al. Soft tissue changes after surgically assisted rapid maxillary expansion: systematic review and meta-analysis. J Craniomaxillofac Surg. 2024;52(1):34-44.

15. Anttila A, Finne K, Keski-Nisula K, Peltomäki T. Feasibility and long-term stability of surgically assisted rapid maxillary expansion with lateral osteotomy and total pterygomaxillary disjunction. Int J Adult Orthodon Orthognath Surg. 2004;19(2):97-106.

16. Yilmaz Altin N, Kurt G, Cakarer S, Keskin C. Comparison of conventional and minimally invasive SARME: a clinical study. Turk J Orthod. 2021;34(4):215-222.

17. Berger JL, Pangrazio-Kulbersh V, Thomas BW, Kaczynski R. Stability of orthopedic and surgically assisted rapid palatal expansion over time. Am J Orthod Dentofacial Orthop. 1998;114(6):638-645.

18. Maal TJ, van Loon B, Plooij JM, Rangel FA, Ettema AM, Berge SJ. Registration of 3D facial photographs for clinical use. J Plast Reconstr Aesthet Surg. 2010;63(9):1143-1150.

19. Gurel HG, Memili B, Erkan M, Sukurica Y. Long-term effects of rapid maxillary expansion followed by fixed appliances. Angle Orthod. 2010;80(1):5-10.

20. Verstraaten J, Kuijpers-Jagtman AM, Mommaerts MY, Bergé SJ, Schols JG, Maal TJ. Three-dimensional imaging of facial soft tissue for treatment planning in orthodontics and orthognathic surgery. J Oral Maxillofac Surg. 2010;68(3):720-731.

Volume 5 / Issue 3 / December 2025

Case Report

Rare Hyalinized Variant of Oral Fibroepithelial Lesion: Case Report and Review of the Literature

Safiye Pelin Şahiner[1*], Gözde Serindere[1], Cansel Coşar[2], Figen Öngöz Dede[2], Büşra Erşan Erdem[3]

[1]Ordu University, Faculty of Dentistry, Department of Dentomaxillofacial Radiology, Ordu, Türkiye.
[2]Ordu University, Faculty of Dentistry, Department of Periodontology, Ordu, Türkiye.
[3]Ordu Training and Research Hospital, Department of Pathology, Ordu, Türkiye.

Corresponding author: s.pelinn23@gmail.com

Şahiner, Safiye Pelin., Serindere, Gözde., Coşar, Cansel., Öngöz Dede, Figen., Erşan Erdem, Büşra. "Rare Hyalinized Variant of Oral Fibroepithelial Lesion: Case Report and Review of the Literature". *Acta Stomatologica Cappadocia.* 5;3 (December 2025): 72-82.

DOI: https://doi.org/10.54995/ASC.5.3.5
Received: 04.10.2025; Accepted: 28.12.2025

Rare Hyalinized Variant of Oral Fibroepithelial Lesion: Case Report and Review of the Literature

Safiye Pelin Şahiner, Gözde Serindere, Cansel Coşar,
Figen Öngöz Dede, Büşra Erşan Erdem

Abstract

Benign fibroepithelial lesions of the oral cavity, commonly referred to as irritation fibroma, traumatic fibroma, or focal fibrous hyperplasia, represent reactive proliferations arising in response to chronic tissue injury. While their clinical and histopathological features are well established, hyalinized variants are exceptionally rare and sparsely documented in the literature. Here, we present a case of a hyalinized fibroepithelial lesion of the oral mucosa, initially presenting as a nonspecific pedunculated nodular mass. The lesion was surgically excised, and histopathological examination revealed dense collagen deposition with prominent hyalinization, confirming the diagnosis. A brief review of previously reported cases is also provided to highlight the diagnostic challenges and clinical implications of this unusual histological presentation. This report underscores the importance of considering hyalinized variants in the differential diagnosis of oral soft tissue lesions and reaffirms surgical excision with elimination of irritative factors as the treatment of choice.

Keywords: Hyalinization, Hyperplasia, Irritation fibroma, Traumatic fibroma.

Özet

Ağız boşluğunun iyi huylu fibroepitelyal lezyonları, genellikle irritasyon fibromu, travmatik fibrom veya fokal fibröz hiperplazi olarak adlandırılır ve kronik doku hasarına yanıt olarak ortaya çıkan reaktif proliferasyonları temsil eder. Klinik ve histopatolojik özellikleri iyi bilinmesine rağmen, hiyalinize varyantları son derece nadirdir ve literatürde çok az sayıda vaka bildirilmiştir. Burada, başlangıçta nonspesifik saplı nodüler kitle olarak ortaya çıkan oral mukozanın hiyalinize fibroepitelyal lezyonu olan bir vaka sunuyoruz. Lezyon cerrahi olarak eksize edildi ve histopatolojik inceleme, belirgin hiyalinleşme ile yoğun kollajen birikimi olduğunu ortaya koyarak tanıyı doğruladı. Bu olağandışı histolojik bulgunun tanısal zorluklarını ve klinik sonuçlarını vurgulamak için daha önce bildirilmiş vakaların kısa bir özeti de sunulmuştur. Bu rapor, oral yumuşak doku lezyonlarının ayırıcı tanısında hiyalinize varyantları dikkate almanın önemini vurgulamakta ve tercih edilen tedavi olarak irritan faktörlerin ortadan kaldırılmasıyla birlikte cerrahi eksizyonu yeniden teyit etmektedir.

Anahtar kelimeler: Hiperplazi, Hiyalinizasyon, İrritasyon fibroması, Travmatik fibroma.

Introduction

Benign hyalinized fibroepithelial lesion, also referred to in the literature as focal fibrous hyperplasia, irritation fibroma, or traumatic fibroma, represents a reactive connective tissue hyperplasia (1). Although it may occur at any age, it is most frequently observed in older adults, with a reported prevalence of 1–2%. The lesion develops as a localized response to chronic tissue injury, characterized by fibroblast proliferation and subsequent collagen deposition leading to an increase in tissue volume. Among the most common etiological factors in the oral cavity are chronic irritations such as lip and cheek biting, ill-fitting denture borders, overcontoured restorations, and dental calculus (2).

Clinically, these lesions usually present as sessile nodular masses with a smooth surface, mucosa-colored or yellowish-white in appearance, asymptomatic, and soft in consistency. Repeated trauma may lead to surface changes including hyperkeratosis or ulceration. The most frequent site of occurrence is the occlusal plane of the buccal mucosa exposed to masticatory trauma, although the lower lip, tongue, hard palate, and edentulous alveolar rid-

ges may also be affected. Histologically, they are characterized by dense, collagenous connective tissue covered by variable degrees of stratified squamous epithelium (1,3). The differential diagnosis includes pyogenic granuloma (PG), peripheral giant cell granuloma (PGCG), and peripheral ossifying fibroma (POF) (4).

Although they lack neoplastic potential, such lesions are common in dental practice and may adversely affect patient comfort and oral function. The mainstay of treatment is complete surgical excision in conjunction with elimination of the underlying sources of irritation (5).

The present case report describes a benign fibroepithelial lesion that was initially not considered within this category, but was ultimately identified through histopathological examination by the presence of hyalinization — a rarely reported finding in the literature. The aim is to contribute to the existing knowledge on its diagnosis, management, and prognosis.

Case Report

Case Presentation

A 47-year-old female patient presented to the Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, XXX University, for a routine dental examination. Medical history revealed that the patient had asthma.

Clinical and Radiological Findings

Intraoral examination revealed a pedunculated, erythematous lesion located in the vestibular gingiva of the right mandibular lateral incisor and canine region, extending beyond the mucogingival junction (Figure 1).

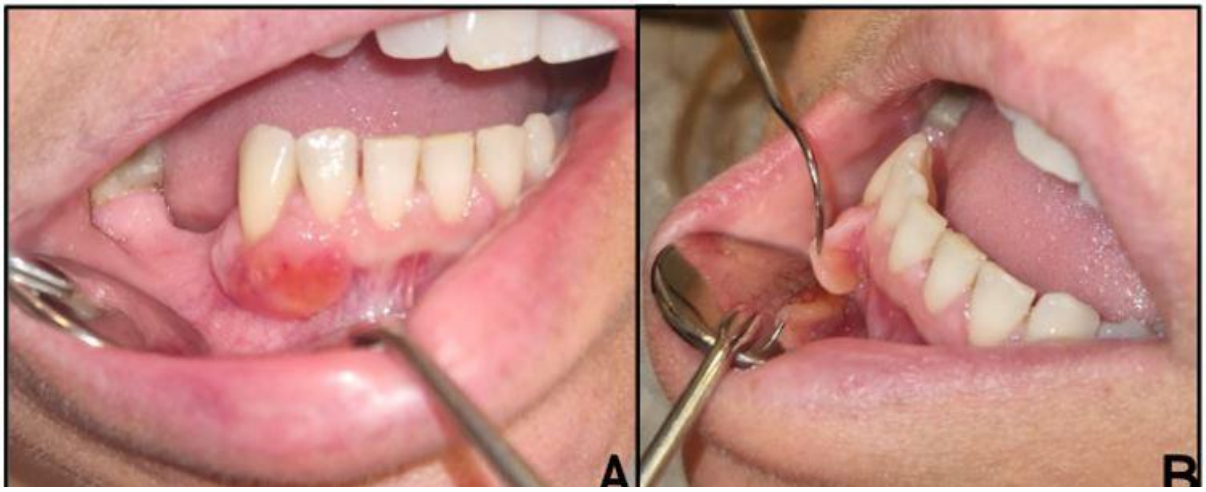


Figure 1. Intraoral image of the lesion during the diagnostic evaluation

A panoramic radiograph taken during the routine examination showed no abnormalities in the related region (Figure 2).

Figure 2. Panoramic radiograph obtained during routine examination

The patient was unaware of the lesion and reported no pain or discomfort, and therefore the exact onset of the lesion could not be determined. Although partial edentulism was observed, the patient did not use any prosthetic appliances. Further history revealed no deleterious oral habits such as nail biting, holding objects like pens or straws in the mouth, or aggressive tooth brushing. Based on the clinical features, a provisional diagnosis of peripheral giant cell granuloma or pyogenic granuloma was made, and the patient was referred to the Department of Periodontology for biopsy.

Surgical Procedures

The patient was informed about the lesion, the proposed treatment, and possible risks, benefits, and alternatives. Written informed consent was obtained for treatment and for the publication of this case report to contribute to the existing literature.

As an initial step, oral hygiene instruction and phase I periodontal therapy were performed to reduce local inflammation and allow the lesion to become more fibrotic in appearance (Figure 3A, B).

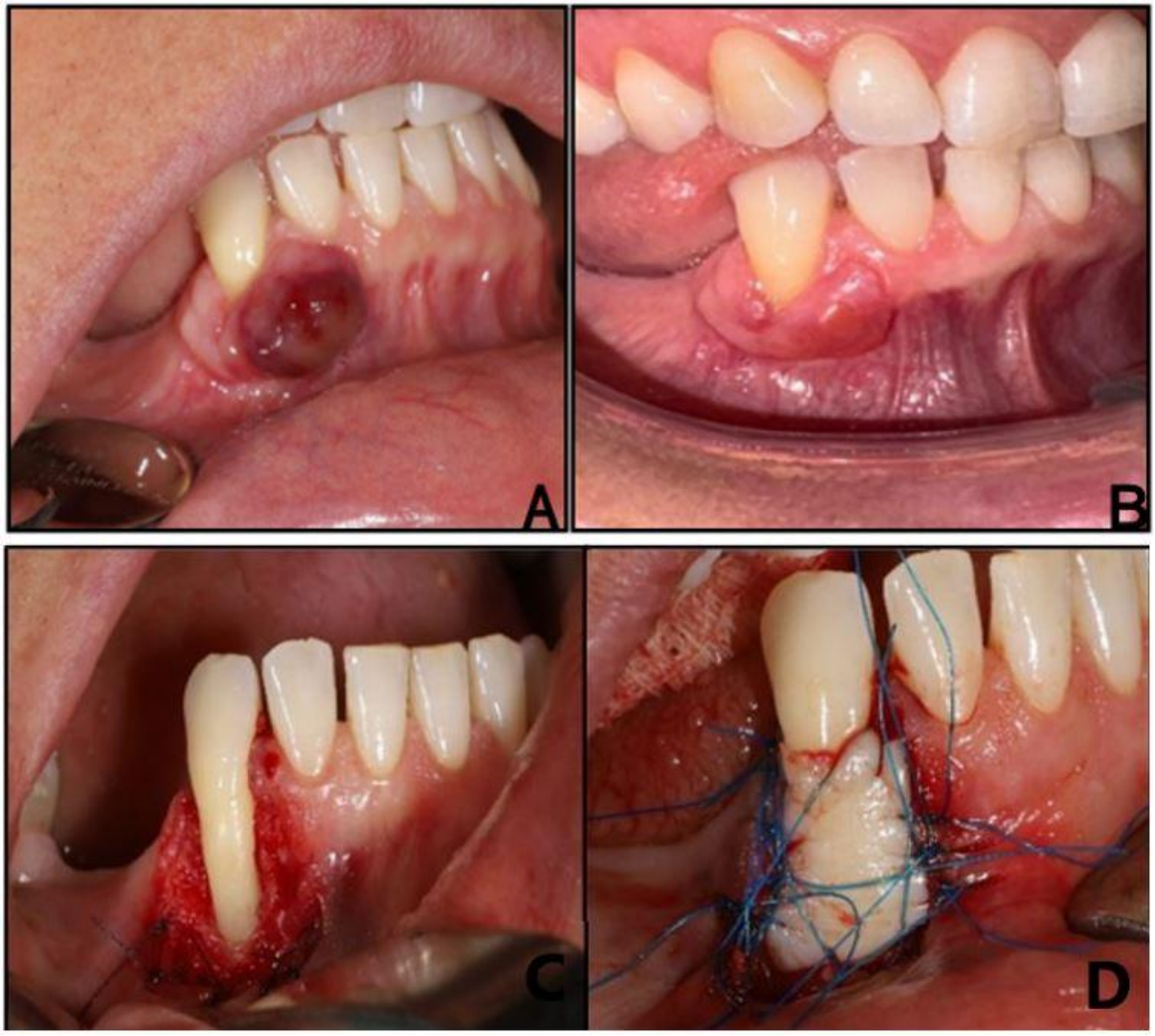


Figure 3 A–D. Images documenting the initial treatment and surgical procedure. **(A)** Before phase I periodontal therapy **(B)** After oral hygiene instruction and completion of phase I periodontal therapy **(C)** Exposed root surface following biopsy (D) Free ging graft secured to the recipient site

Subsequently, excisional biopsy was performed under local anesthesia, and the lesion was completely removed. The excised specimen was placed in a formalin container and sent for histopathological evaluation. Following the excision, a free gingival graft procedure was planned to cover the exposed root surface and to increase the width of keratinized gingiva in the region (Figure 3C). Root planing of tooth #43 was performed using a Gracey 5/6 curette. A free gingival graft measuring approximately 1.5 mm in thickness and 7 × 15 mm in size was harvested from the maxillary right palatal donor site under local anesthesia. The graft was adapted to the recipient site and stabilized with 5/0 monofilament sutures, and a pressure suture was applied to enhance stability. Hemostasis of the donor site was achieved with Spongostan, which was subsequently closed with 3/0 silk sutures (Figure 3D).

Histopathological Characteristics

The excised tissue consisted of two fragments measuring 1.2 × 0.8 × 0.2 cm and 0.7 × 0.5 × 0.3 cm, respectively, with a brownish-cream appearance. Histopathological examination revealed hyperplastic stratified squamous epithelium overlying subepithelial connective tissue exhibiting marked hyalinization, small vascular structures, and mild lymphocytic infiltration. CD34 immunostaining showed endothelial expression, while Ki-67 was within normal limits. No accumulation was detected with PAS-AB or Congo red staining. The morphological features were not specific for pyogenic granuloma and were consistent with a benign hyalinized fibroepithelial lesion (Figure 4).

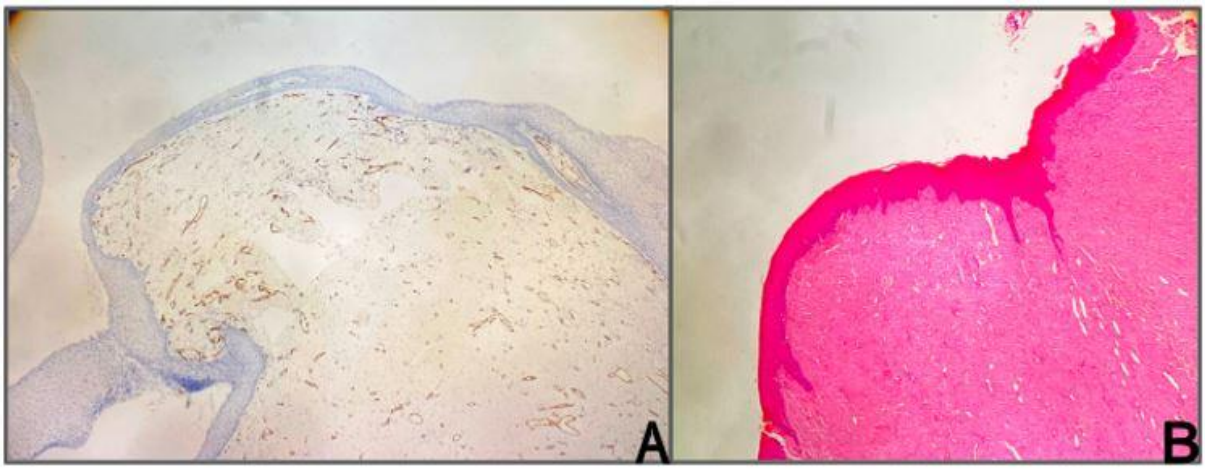


Figure 4 A, B. Histological images. **(A)** A fibroepithelial polyp with benign hyperplastic stratified squamous epithelium overlying a hyalinization-rich fibrovacular stroma is observed (Hematoxylin & Eosin, ×100) **(B)** Immunohistochemical staining shows CD34, ×100).

Differential Diagnosis and Diagnostic Challenges

In this case, the lesion was initially misdiagnosed as a peripheral giant cell granuloma or pyogenic granuloma due to its clinical presentation. The pedunculated, erythematous nodular appearance, along with the absence of pain and the relatively small size, closely resembled these common reactive lesions, making initial misdiagnosis plausible. The rarity of hyalinization in fibroepithelial lesions and the unusual location on the attached gingiva further contributed to the diagnostic challenge.

Histopathological examination ultimately clarified the diagnosis. The presence of marked subepithelial hyalinization, combined with the absence of features specific to pyogenic granuloma (such as lobular capillary proliferation) or peripheral giant cell granuloma (such as multinucleated giant cells), allowed for accurate identification. CD34 expression confirmed

normal endothelial structures, while Ki-67 proliferation index was within normal limits, ruling out neoplastic processes. This underscores the importance of histopathology in differentiating rare variants from more common reactive lesions.

Postoperative Follow-up and Treatment Outcomes

The patient was informed about the postoperative instructions. A chlorhexidine gluconate spray was prescribed to be applied three times a day for two weeks on the surgical site. In addition, ketoprofen 100 mg was prescribed for systemic analgesic effect. The patient was recalled after 14 days for suture removal. During examination, erythema was observed in the surgical area due to insufficient oral hygiene caused by the sutures, and the patient received repeated oral hygiene instructions (Figure 5A,B).

Figure 5 A, B. Fourteenth-day follow-up before and after suture removal.

The patient was followed up at 1, 3, and 6 months postoperatively, with no evidence of recurrence (Figure 6).

Figure 6 A–C. Postoperative follow-up. (A) One-month postoperative follow-up (B) Three-month postoperative follow-up (C) Six-month postoperative follow-up.

Postoperative gingival recession had largely resolved, and adequate keratinized gingival tissue was achieved, demonstrating that the treatment met the desired clinical outcomes.

Discussion

Compared to commonly encountered fibroepithelial lesions in the oral cavity, the hyalinized variant is extremely rare. Therefore, the present case represents a significant contribution to the literature, filling a gap and providing a different perspective on the differential diagnosis. Previous studies have shown that fibroepithelial lesions most frequently occur between the third and fifth decades of life (6). Consistent with these findings, the lesion in the present case appeared in a patient during the fifth decade of life. In the case report published by Samudrawar et al. (7) in 2017, the patient was 42 years old, whereas Asundari and Tavargeri (8) reported a hyalinized fibroepithelial lesion in an 11-year-old patient.

Mortazavi et al. (9), in their study on exophytic oral lesions, reported that traumatic fibromas occur more frequently in women. Although the present case occurred in a female patient, most previously reported cases of hyalinized fibroepithelial lesions involved male patients.

Another remarkable feature of this case is the lesion's location, which does not correspond to the sites most frequently reported in the literature. Whereas these lesions are typically found on the buccal mucosa or lower lip (1), the current lesion was observed on the attached gingiva, making this presentation noteworthy. Additionally, the absence of deleterious oral habits and the lack of significant calculus deposition suggest that typical predisposing factors for fibroepithelial lesion development were not present, complicating the diagnostic process (2). Furthermore, histopathological examination revealed stromal hyalinization, a feature that has been reported only rarely; to the authors' knowledge, only two previously published case reports have explicitly mentioned hyalinization (7,8).

Hyaline is a pale, glassy, acellular material, generally rich in protein, and stains eosinophilic in histological preparations. Hyaline degeneration is characterized by the accumulation of eosinophilic plaques, bands, or rounded masses in the extracellular tissue. Hyalinization is defined as the deposition of a homogeneous material that can be intensely stained with acidic dyes and is considered a product of interactions between cellular and extracellular matrix components (10-12). In pathological lesions, the hyalinized stroma undergoes biochemical alterations, which may influence the biological behavior of neoplastic lesions. It often appears

as a manifestation of degenerative changes in lesions of prolonged duration. In many odontogenic lesions, it develops as a result of interactions between epithelial and mesenchymal tissues. It has been suggested that abnormal accumulation of basal membrane material synthesized by tumor cells may contribute to hyalinization. Furthermore, the hyalinized stroma contains glycosaminoglycans, hyaluronic acid, and proteoglycans, and the excessive presence of these components may play a role in more aggressive biological behavior observed in certain lesions (13-15).

In conclusion, the initial misdiagnosis was understandable due to the clinical similarity to more common reactive lesions, the absence of typical predisposing factors, and the lesion's unusual anatomical location. This case emphasizes that careful histopathological evaluation, with particular attention to rare features such as stromal hyalinization, is crucial for accurate diagnosis and appropriate management of fibroepithelial lesions in the oral cavity. Furthermore, it underscores the broad clinical and histopathological spectrum of these lesions, highlighting the educational value for clinicians by raising awareness of atypical presentations. Reporting such rare variants can improve clinical decision-making, guide treatment planning, enhance patient outcomes, and contribute meaningfully to the existing literature.

References

1. Gonsalves WC, Chi AC, Neville BW. Common oral lesions: Part II. Masses and neoplasia. Am Fam Physician. 2007;75:509-12.
2. Axéll T. A prevalence study of oral mucosal lesions in an adult Swedish population. Odontol Revy Suppl. 1976;36:1-103.
3. Lapitskaya A, Cahuana-Bartra P, Brunet-Llobet L, Miranda-Rius J. Oral irritation fibroma associated with the pathological migration of a primary tooth. BMJ Case Rep. 2022;15:e249369.
4. Kolte AP, Kolte RA, Shrirao TS. Focal fibrous overgrowths: a case series and review of literature. Contemp Clin Dent. 2010;1:271-4.
5. Jané-Salas E, Albuquerque R, Font-Muñoz A, González-Navarro B, Estrugo Devesa A, López-López J. Pyogenic granuloma/peripheral giant-cell granuloma associated with implants. Int J Dent. 2015;2015:839032.

6. Bouquot JE, Gundlach KK. Oral exophytic lesions in 23,616 white Americans over 35 years of age. Oral Surg Oral Med Oral Pathol. 1986;62:284-91.

7. Samudrawar S. Fibro-epithelial polyp: case report with literature review. Int J Appl Dent Sci. 2019;5:240-2.

8. Asundaria RR, Tavargeri A. Excision of traumatic fibroma of the tongue in a pediatric patient: a case report. Int J Clin Pediatr Dent. 2023;16:166-9.

9. Mortazavi H, Safi Y, Baharvand M, Rahmani S, Jafari S. Peripheral exophytic oral lesions: a clinical decision tree. Int J Dent. 2017;2017:9193831.

10. Hamamura M, Oshikata T, Katoku K, Tsuchitani M, Yamaguchi R. Two types of deposits, hyaline droplets and eosinophilic bodies, associated with α2u-globulin accumulation in the rat kidney. J Toxicol Pathol. 2017;30:275-82.

11. Miller MA, Zachary JF. Mechanisms and morphology of cellular injury, adaptation, and death. Pathol Basis Vet Dis. 2017;2-43.

12. Saluja T, Iyer J. Unmasking the grey zone of hyalinization with a proposed classification of oral hyalinizing lesions. J Interdiscipl Histopathol. 2017;5:18-21.

13. Siwach P, Joy T, Tupkari J, Thakur A. Controversies in odontogenic tumours: review. Sultan Qaboos Univ Med J. 2017;17:e268-72.

14. Puthiyaveetil JS, Kota K, Chakkarayan R, Chakkarayan J, Thodiyil AK. Epithelial-mesenchymal interactions in tooth development and the significant role of growth factors and genes with emphasis on mesenchyme – a review. J Clin Diagn Res. 2016;10:ZE05-9.

15. Elgundi Z, Papanicolaou M, Major G, Cox TR, Melrose J, Whitelock JM, Farrugia BL. Cancer metastasis: the role of the extracellular matrix and the heparan sulfate proteoglycan perlecan. Front Oncol. 2020;9:1482.