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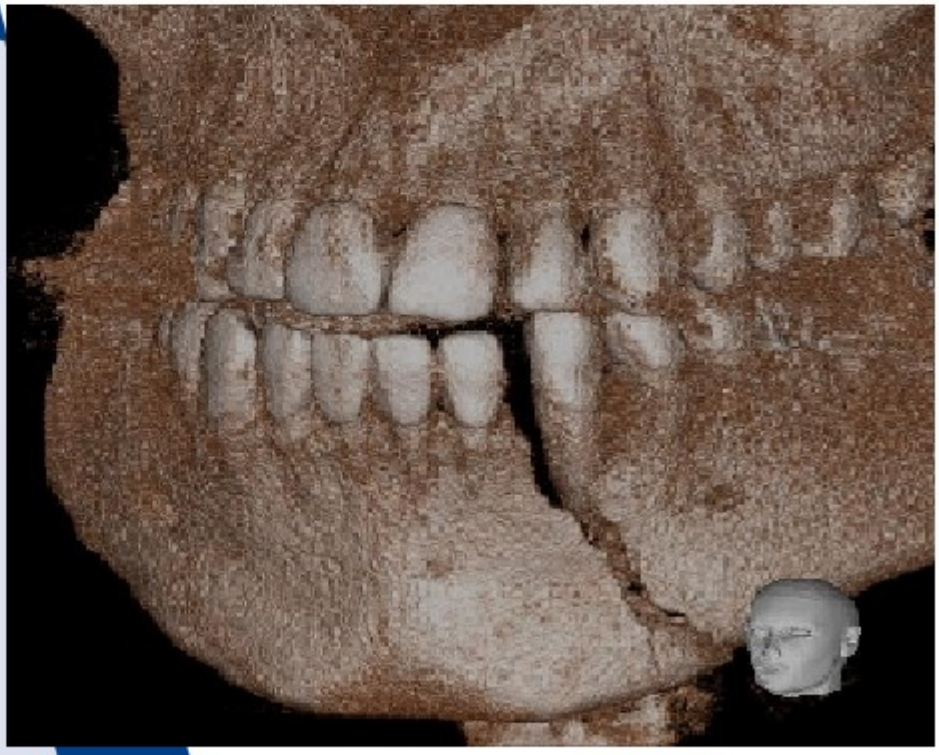

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ORIGINAL RESEARCH

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Comparison of Shear Bond Strength and Adhesive Remnant Index Between Different Adhesive Systems in Bonding and Rebonding of Orthodontic Brackets

Mehmet Semih Velioğlu[1-a*], Hatice Kök[2-b], Nimet Ünlü[3-c]

[1]*Beyhekim Oral and Dental Health Center, Konya, Türkiye*
[2]*Selcuk University, Faculty of Dentistry, Department of Orthodontics, Konya, Türkiye*
[3]*Selcuk University, Faculty of Dentistry, Department of Restorative Dentistry, Konya, Türkiye*
**Corresponding author*

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ABSTRACT

Aim: The purpose of this *in vitro* study was to compare the shear bond strength (SBS) and adhesive remnant index of stainless-steel brackets bonded with different orthodontic adhesive systems.
Materials and Methods: In our study performed on 60 premolar teeth extracted because of orthodontic reasons, MBT prescription 0.022'' stainless-steel brackets (Discovery Smart®, Dentaurum, Germany) were used. Teeth randomly divided into 3 groups, bonding was performed with Group 1: Trulock Light Activated Bonding System (RMO, USA), Group 2: Bisco Ortho Bracket Paste LC (Bisco, USA), Group 3: Transbond XT Light Cure Adhesive (3M, USA). SBS and residual adhesive indexes (ARI) were evaluated by breaking the samples. Adhesive residues were cleaned with tungsten carbide burs from the surfaces of the teeth, rebonding was made after sanding the brackets' surfaces. SBS and ARI values were re-evaluated. One-way ANOVA test were used for statistical analysis of the data, $p<0.05$ was considered statistically significant.
Results: Statistically significant differences were observed between Group 1 and Group 2 in comparison to the first SBS values of three different orthodontic adhesive systems to enamel ($p<0.05$). Among the adhesive systems, only a statistically significant difference was found between the first bonding values and the rebonding values of Group 2 ($p<0.05$). There was no statistically significant difference between the first and rebond strengths of the other two adhesive systems. Rebonding values of three different orthodontic adhesive systems were very close to each other.
Conclusions: The results of this *in vitro* study suggest that the adhesive systems developed for using in orthodontics can show clinically enough bond strength even if the rebonding strengths of the falling stainless-steel brackets to the same enamel surfaces decrease slightly.
Key Words: Orthodontic Adhesives, Orthodontic Brackets, Shear Bond Strength, Adhesive Remnant Index

Farklı Adeziv Sistemlerinin Metal Braketlerde Bonding ve Rebonding Sonrası Makaslama Bağlanma Dayanımları ve Artık Adeziv İndeksleri Açısından Değerlendirilmesi

Süreç

Geliş: 23/08/2021
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ÖZ

Amaç: Farklı ortodontik adeziv sistemlerinin, metal braketlerin mine yüzeyine ilk ve tekrar yapıştırılmaları (rebonding) sonrasında makaslama bağlanma dayanımlarının (MBD) ve artık adeziv indekslerinin karşılaştırılmasıdır.
Yöntem: Ortodontik nedenlerle çekilmiş 60 adet premolar diş üzerinde gerçekleştirilen çalışmamızda, MBT prescription 0.022'' slotlu metal braketler (Discovery smart, Dentaurum, Almanya) kullanılmıştır. Rastgele 3 gruba ayrılan dişlerde bonding işlemi Grup 1: Trulock Light Activated Bonding System (RMO, ABD), Grup 2: Bisco Ortho Bracket Paste LC (Bisco, ABD), Grup 3: Transbond XT Light Cure Adhesive (3M, ABD) ile gerçekleştirilmiştir. Örnekler kırılarak makaslama bağlantı dayanımları ve Artık Adeziv İndekleri (AAİ) değerlendirilmiştir. Dişlerin yüzeylerinden tungsten karbid frezler ile adeziv artıkları temizlenip, braketler kumlanarak, rebonding yapılmıştır. MBD'ları ve AAİ tekrar değerlendirilmiştir. Verilerin istatistiksel analizinde; Tek yönlü ANOVA testi kullanılmış, $p<0.05$ istatistiksel olarak anlamlı kabul edilmiştir
Bulgular: Üç farklı ortodontik adeziv sistemin mineye ilk MBD değerlerinin karşılaştırmasında Grup 1 ile Grup 2 arasında istatistiksel olarak anlamlı farklılıklar gözlenmiştir ($p<0.05$). Adeziv sistemlerden sadece Bisco'nun ilk bağlanma dayanımıyla tekrarlanan bağlanma dayanımları arasında istatistiksel olarak anlamlı bir farklılık tespit edilmiştir. Diğer iki adeziv sisteminin ilk ve tekrarlanan bağlanma dayanımları arasında istatistiksel olarak önemli bir fark gözlenmemiştir. Üç farklı ortodontik adeziv sisteminin tekrarlanan bağlanma değerleri birbirine oldukça yakın değerler göstermiştir.
Sonuçlar: Bu çalışmanın sonuçları, ortodontik braketlerin mineye bağlantısı için geliştirilen adeziv sistemlerinin düşen metal braketlerin aynı mine yüzeylerine tekrar bağlanma dayanımlarını, bir miktar azalmış olsa bile, klinik olarak yeterli bir bağlantı dayanımı gösterebildiklerini ortaya koymaktadır.
Anahtar Kelimeler: Ortodontik Adezivler, Ortodontik Braket, Makaslama Bağlanma Dayanımı, Artık Adeziv İndeksi.

[a] *semiveli@gmail.com* *https://orcid.org/0000-0001-8541-6483*
[b] *dt_kok@hotmail.com* *https://orcid.org/0000-0002-5874-9474*
[c] *nunlu@selcuk.edu.tr* *https://orcid.org/0000-0002-6546-6368*

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Introduction

The number of adult patients seeking orthodontic treatment and aesthetic expectations are increasing day by day.[1] Patients are not only concerned about their smile, but also about the materials used during the treatment. Increasing expectations in the field of aesthetics have also changed the treatment strategies which preferred in orthodontics and have led to the development of many innovations, from the first approaches using stainless-steel brackets and wires to aesthetic brackets produced in a similar color to the tooth, lingual orthodontics and clear aligner treatments.[2] Clinical behavior and bond strength of orthodontic brackets play an important role for successful orthodontic treatment.[3] After Buonocore introduced the enamel etching technique, many studies have been conducted over the years evaluating the attachment of brackets to the enamel surface.[4]

In order to increase the bond strength in orthodontics, many processes such as acid etching, surface roughening, surface conditioning with chemical agents have been applied.[5,6]

As a result of these studies, the factors that determine the success for a successful orthodontic connection are as follows; the orthodontic material used and its mechanical features, tooth surface, enamel surface preparation and morphology, the composition and bond strength of the bonding agent used.[7]

From past to present, many changes have occurred in areas such as mechanism of action, chemical content, application technique, clinical effectiveness in order to increase the success of dental adhesives. The current trend is to provide an effective connection by reducing clinical steps. These products, which are defined as single-bottle adhesive systems, consist of a single product that contains both desensitizer, adhesive and etchant.[8]

The aim of this *in vitro* study was to analyze the SBS and adhesive remnant index of stainless-steel brackets bonded with different orthodontic adhesive systems. The null hypothesis is there is no difference between SBSs and ARI values of different orthodontic adhesive systems after first and rebonding of stainless-steel brackets to enamel surface.

Materials and Methods

This study was conducted at the Selcuk University Faculty of Dentistry Department of Restorative Dentistry in Konya, Turkey. The protocol was approved by the Ethical Committee of Clinical Investigations of Selcuk University Faculty of Dentistry.

In this study, 60 extracted premolar teeth for orthodontic purpose were used. 0.1% thymol solution was used to keep the extracted teeth. Test groups were created by randomly selecting teeth without fractures and /or cracks among the collected teeth to be included in 3 separate bond groups. Group 1; Trulock Light Activated Bonding System (RMO, USA), Group 2: Bisco Ortho Bracket Paste LC (Bisco, USA), Group 3: Transbond XT Light Cure Adhesive (3M, USA). Enamel surfaces were applied 35% acid etch agent, rinsed and dried thoroughly with moisture and oil-free air to obtain an opaque white appearance. After that 0.022'' slot metal premolar brackets (Discovery Smart®, Dentaurum, Germany) were bonded according to the manufacturers' instructions, as shown in Table 1.

The SBS test of samples was carried out in an universal testing device (Instron Corp., Massachusetts, USA). For the flat end of the universal testing machine by means of a tool through the crosshead to build up the load.

The fractured samples were examined after debonding and ARI was decided.

To determine the spots of failing of the adhesive between bracket, resin composite and tooth enamel, ARI scores were used. The ARI scores were assessed by using an optical stereomicroscope (Nicon E400, Nicon Corporation, Warsaw, Poland) with a magnification of x40.

Following the debonding process all teeth surfaces were removed from adhesive remnants by using tungsten carbide burs (No:18, Worlddent, Taiwan), all brackets were cleaned with sandblasting (Al_2O_3 particles). Then rebonding and debonding processes were performed as mentioned above. ARI was reassessed. A power analysis was performed to determine the adequacy of the sample number. It showed that 17 tooth samples per group would provide at least an 80% chance (power) to detect differences of 0.5 standard deviations. Statistical analysis of the data was performed using one-way ANOVA test in SPSS version 22.0 program and $p<0.05$ was considered statistically significant.

Results

In the comparison of the SBS values of three different orthodontic adhesive systems, the highest values were observed in Group 2, Group 3, and Group 1, respectively. When the groups were compared between each other, it was observed that there was a statistically significant difference between the Group 2 and the Group 1. When the bond strengths of all groups were compared after rebonding, it was observed that the bond strength of all groups decreased compared to the initial bonding values, but there was no statistically significant difference between the groups (Figure1, Table2).

When first bonding and rebonding values of the groups were compared, the difference between the first and rebonding values was statistically significant only in the Group 2.

When ARI scores were compared, an increase in ARI 3 score was observed after rebonding in all groups. Compared to the initial bond strengths, there was a decrease in the bond strength values in all groups after rebonding, and in this context, the increase in the ARI 3 score, which defines bracket-cement breakage, was found significant in all groups (Table 2).

Table 1. Application methods of adhesive systems

Materials	Manufacturers	Application Methods of Bonding Systems
Trulock Light Activated Bonding System (Group 1)	RMO. CO. USA	• Dry the etched surfaces thoroughly with moisturefree and oil-free compressed air. The etched surface should appear dull and frosty white • Dispense two drops of Light Activated Bracket Bonding Resin onto a dispensing pad or other suitable surface. With a brush apply one thin uniform layer onto each etched and dried tooth surface to which the bracket is to be bonded. It is not necessary to cure the bonding/sealant resin at this time. n, the bonding/sealant resin may be cured for 10-15 seconds • Apply a thin layer of Trulock™ Light Activated Bracket Adhesive to the underside of the bracket base. Place the bracket onto the tooth and press lightly in the desired position. Excess adhesive can be removed easily from the periphery of the bracket base after bracket is in place. • With a metal bracket, position the curing light to shine from the incisal edge and illuminate for 20 seconds and for 15 seconds from the gingival, mesial or distal bracket edge. Curing may be done directly through a transparent bracket from the labial for 20 seconds. The curing light tip must be placed as close to the bracket base as possible during curing.
Bisco Ortho Bracket Paste LC (Group 2)	Bisco. IL. USA	• Rinse thoroughly with plenty of water. Isolate the teeth and dry with the a syringe. • Dispense LIQUID ETCHANT* into a mixing well. Dab etchant for 20-30 seconds on the surfaces to be bonded. • Rinse etched teeth thoroughly to remove all traces of acid. Re-isolate and dry teeth to be bonded • Brush a thin coat of ORTHO-ONE No Mix Primer on to each etched and dried tooth surface to be bonded. The thin primer coat should be confined to the etched area • Brush a thin coat of ORTHO-ONE No Mix Primer on the underside of the bracket base • Apply a thin layer of ORTHO-ONE No Mix Paste to the underside of the bracket base and immediately place bracket on tooth with a slight rotating motion. Immediately position the bracket to desired angulation and press firmly to insure paste is in a thin uniform layer. All adjustments to brackets must be made within 20 seconds (prior to gelation of paste). Remove excess adhesive from the periphery of the bracket base after the brackets are in place. Keep teeth isolated for approximately 3 minutes.
Transbond XT Light Cure Adhesive (Group 3)	3M Unitek, CA, USA	• Isolate the teeth and dry with the air syringe. • Press the self etching primer capsule, fold and press again. Mix exceeding component for 5 seconds and rub on teeth for 3-5 seconds. Apply air burst gently for 1-2 seconds. • Apply adhesive syringe or capsule to bracket base then place bracket on the teeth. Remove exceeding material carefully.

Table 2. Mean values of tested groups

Groups	N	Mean	Std. Deviation	Minimum	Maximum	p
Group 1	19	192.8275	81.45947	12.45	307.52	0.04*
Rebonded Group 1	19	177.0858	65.76963	19.61	291.23	0.12
Group 2	19	283.0166	143.19018	94.14	721.33	0.24
Rebonded Group 2	19	188.3502	64.50740	98.75	329.68	0.35
Group 3	20	226.6584	119.26257	88.06	628.27	0.19
Rebonded Group 3	20	177.5004	73.78790	50.64	347.72	0.28

* Sign is statistically significant ($p<0.05$)

Table 3. ARI scores of all adhesive system groups

Groups	ARI 0	ARI 1	ARI 2	ARI 3
Group 1	2	7	4	6
Rebonded Group 1	1	3	0	14
Group 2	4	16	0	0
Rebonded Group 2	1	0	4	14
Group 3	11	7	1	1
Rebonded Group 3	1	4	5	10
		p= 0.068		

- Score 0: No adhesive remaining on the tooth
- Score 1: Less than half of the adhesive remaining on the tooth
- Score 2: More than half of the adhesive remaining on the tooth
- Score 3: All adhesive remaining on the tooth, with a distinct impression of the bracket mesh

Figure 1. Comparison of adhesive system groups

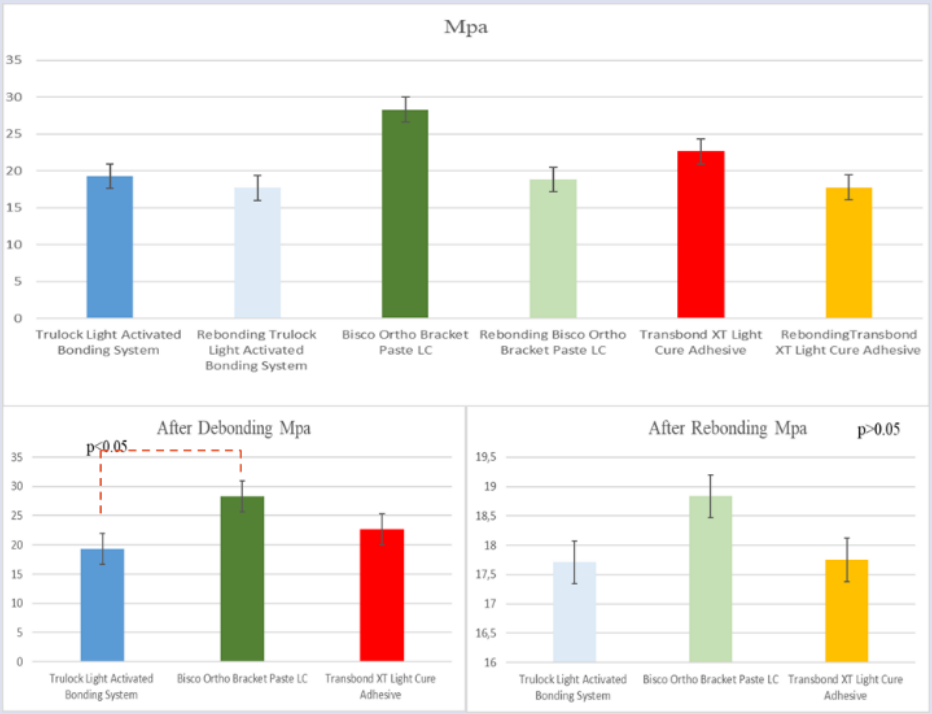

Figure 2. Comparison of adhesive system groups

Discussion

The use of direct bonding systems has opened a new era in orthodontics as in restorative dentistry. Today, acids and primers are used as important components of the adhesion process.[9] With the development of materials and the production of new materials, enamel loss has decreased and the time spent at the patient's side has been shortened. In addition, adhesion procedures have become shorter and more anticipated.[10] The increase in bond strength causes the failure during the removal of the brackets; as desired, it will ensure that it is in the bracket - adhesive interface instead of in the adhesive or in the adhesive - enamel interface.[11]

Many different adhesive systems are used in the literature for bonding orthodontic brackets. However, a study evaluating the bond strength of three different adhesive systems used in our study to orthodontic brackets has not been found in the literature. Therefore, we believe that the data obtained from this study will guide the clinical use of three different adhesives for orthodontic purposes.

According to the results of this study, statistically significant differences were observed between groups in comparison to the first SBS values. Therefore, the null hypothesis was denied.

In the present study Transbond XT showed similar results.[12,13] Hellak *et al.* compared two different adhesive system with Transbond XT and showed similar SBS values with this study (15.49 ± 3.28 Mpa).[14]

There are not many studies on Bisco ortho bracket paste LC in the literature. An *in vitro* study performed by Condo *et al.* compared Bisco Ortho Bracket Paste LC, Transbond XT and Leone LC Orthodontic Paste. According to the obtained results of study all adhesives showed similar SBS values. In the present study Transbond XT and Bisco Ortho Bracket Paste LC showed similar results and this suits with the other studies in literature.[15]

After removing the brackets, removing the resin from the enamel surface may be clinically appropriate to reduce the damage that may occur due to bracket debonding.[16,17] To assess the bracket debonding interface,

one of the frequently used indexes in orthodontics is ARI, which is often calculated.[18]

In this study, ARI scores of 0 and 1 were obtained in most of the samples after the first test. In this study, ARI 0 and 1 scores were obtained in almost all of the samples, except for Group 1, after the first test. When the samples were retested after rebonding, a significant increase was observed in ARI 3 values in all groups. The samples tested in this study were found to have a higher number of bond failures at the adhesive-enamel interface similarly in literature. The low ARI scores are considered positive, therefore there was less remnant on the enamel surface and successively less damage while enamel polishing.[19,20]

Conclusions

Within the limitations of this study, according to the obtained results the adhesive systems developed for using in orthodontics can show clinically enough bond strength even if the re-bonding strengths of the falling stainless-steel brackets to the same enamel surfaces decrease slightly.

It should be noted that these are the results of an *in vitro* study. Clinical results may be differed under the oral environment conditions. Further comparative clinical studies are needed to investigate the bond strength and stress distribution of different adhesives with orthodontic brackets.

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The Differences of Microleakage Smart Dentin Replacement, Glass Ionomer Cement and a Flowable Resin Composite as Orifice Barrier in Root Canal Treated

Erma Sofiani[1,a,*], Emilisa Indah Sari[1,b]

[1]*Conservative Departement,School of Dentistry, Faculty of Medicine and Health Sciences, University Muhammadiyah Yogyakarta, Bantul, Yogyakarta 55184, Indonesia*

**Corresponding author*

Research Article

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ABSTRACT

This study was a laboratory experiment. The sample *was 27 extracted one or two canal mandibular* premolar *teeth* consist of: a smart dentin replacement, glass ionomer cement, and a flowable resin composite. Teeth were prepared using a crown-down method and obturated using gutta percha and AH Plus. After placement of the orifice barrier with a thickness of 4 mm, the teeth were immersed in a 2% methylene blue solution at 37ºC for 24 hours. Teeth sectioned in the buccolingual direction and observation of microleakage using a stereomicroscope (M=10×). The results showed that microleakage differences between a smart dentin replacement, glass ionomer cement, and a flowable resin composite. The smart dentin replacement has the smallest microleakage value of 1.70 but does not differ significantly with the flowable composite resin.

Keywords: Dentin, Flowable Resin Composite, Glass Ionomer Cement, Microleakage, Orifice Barrier, Premolar, Root Canal

[a] *ermasofiani@umy.ac.id* *https://orcid.org/0000-0002-6146-8008* [b] *emilisa.sari009@yahoo.com* *https://orcid.org/0000-0002-2684-1284*

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Introduction

Root canal treatment is aimed at controlling bacterial infections in root canal teeth.[1] It requires adequate restoration to prevent coronal leakage that can lead to recurrent bacterial infection.[2] After root canal treatment, the teeth structure is changed as a result of the preparation procedure, and changes that occur in dentin make it difficult for clinicians to perform restoration.[3]

Microleakage of restoration material can be caused by several factors, such as changes in material dimensions due to polymerization shrinkage, thermal contraction, and water absorption.[4] Inadequate adhesion to the tooth structure due to the formation of smear layers can also be the cause of microleakage.[5] Coronal leakage due to inadequate restoration can expose the root canal to be filled by oral material fluid.[6] Root canal filling materials such as gutta-percha and sealers are unable to block the penetration of saliva and bacteria into the root canals, which can lead to recontamination and treatment failure.[7] The use of an orifice barrier is an efficient method of reducing coronal leakage in post-root canal teeth.[8]

The presence of an intra-orifice barrier will strengthen the teeth after root canal treatment because the post-root canal treatment teeth lose vitality and moisture. The intra-orifice barrier is very useful to protecting post-root canal treatment and preventing coronal leakage.[2] Coronal leakage can lead to ingress of oral fluid and invasion of bacteria into root canals that will affect the prognosis of treatment.[13] According to research by Alikhani *et al.*[9] a glass ionomer cement (GIC, 3 mm thickness) as an orifice barrier has a lower leakage rate compared to a thickness of 1 mm. According to Valadares *et al.*[10], the use of a cervical barrier or orifice with a thickness of 2–3 mm can prevent leakage and *Enterococcus faecalis* bacterial infection.

The dental material used as an orifice barrier is placed on the orifice as a second layer of protection against bacterial contamination when the restoration is disrupted. The dental materials have to be easily placed of the material by the operator, bond with the tooth structure, do not interfere with the attachment of permanent restorations, can be distinguished from tooth structure, and can close the orifice well or have low microleakage. Some dental materials that can be used as an orifice barrier are cavit, amalgam, intermediate restorative material (IRM), Super-EBA, composite resin, GIC, mineral trioxide aggregate (MTA) and calcium-enriched mixture (CEM) cement.[11]

Low microleakage is one of the criteria for a material that can be used as an orifice barrier.[12] There are ongoing studies on microleakage in the dental material used as an orifice barrier aimed at finding dental materials that have

the lowest microleakage rate, to prevent saliva and bacterial contamination from entering the root canals. Composite resin-based materials can also be used as an orifice barrier; the most commonly used material is flowable composite resin, which has low viscosity so that it can penetrate difficult areas such as orifices. The composite resin has a weakness in that its large shrinkage can cause microleakage. Smart dentin replacement is a bulk fill flowable composite resin that has low shrinkage, good cavity adaptation, low modulus of elasticity, and polymerization modulators that can reduce shrinkage so that the marginal gap between the fill and restoration material is minimal.[13]

There are several studies regarding the microleakage rate of bulkfill flow composite resin materials as an orifice barrier material (3 mm thickness).[14] So far, Smart Dentin Replacement (SDR) materials have been used more for tooth restoration to replace dentin structures. Based on this problem, this study aimed to examine differences in microleakage between a SDR, GIC, and a flowable composite resin as an orifice barrier in diganti root canal treated tooth.

Material and Methods

Research design and samples

The study was an experimental laboratory experience. Samples of mandibular premolar teeth were extracted. Twenty-seven post-extraction teeth were divided into three groups to have different treatments: SDR, GIC, and flowable resin composite groups.

Preparation of dental samples

Root canals were prepared using ProTaper Universal (Dentsply Maillefer, Ballaigues, Switzerland) rotary files up to F2 using the crowndown technique. Based on the pre-operative radiographs, file sizes 10 and 15 are measured and pre-curved to match the anticipated full length and curvature of the root canal. The 10 and 15 hand files are utilized within any portion of the canal until they are loose and smooth. The loose depth of the 15 file is measured, and this length is transferred to the ProTaper S1 and S2 files. Then, the coronal two-thirds pre-enlarged was shaped by first utilizing S1 and then S2 prior to initing shaping procedure. The pulp chamber is filled with a full-strength solution of sodium hypochlorit (NaOCl) 2.5%, followed with a shaped file, irrigated and recapitulated with a 10 file to break up debris and move it into the solution. The next step can focus on apical one-third procedures when the coronal two-thirds of the canal is shaped. The apical one-third of the canal is fully negotiated and enlarged to at least a size 15 hand file, and the working length is confirmed and patency established. At this stage of treatment, the preparation can be finished using one or more of the ProTaper Finishing files in a “non-brushing” manner. The F2 is selected and passively allowed to move deeper into the canal in one or more passes until the terminus is reached. When the F2 achieves length, the instrument is removed, its apical flutes are inspected, and if they are loaded with dentin, then visual evidence supports the shape is cut. Then, the root canal is irrigated, recapitulated, confirmed patency, and re-irrigated to liberate debris from the canal. Then, the gutta percha were cut under the free gingival crest to a depth of 4 mm, and a SDR, a GIC, and a flowable resin composite were placed with a thickness of 4 mm (Figure 1). To see the density of the root canal filling material and the orifice barrier, a periapical radiograph was performed (Figure 2).

Microleakage Analysis

Teeth were incubated in artificial saliva at 37ºC for 24 hours and then dried. After drying, the teeth were coated in two layers of nail varnish and wax from apical to CEJ. Then, the teeth were immersed in a 2% methylene blue solution at 37ºC for 24 hours and cleaved from the bucco-lingual direction. Observation of microleaks was carried out under a stereomicroscope (M = 10×). Measurement of the amount of penetration of the dye solution from the coronal to the apical direction on a millimeter scale using the image raster 3.0 program (Figure 3).

Statistical Analysis

The data obtained in this study were quantitative data with a ratio scale. The Shapiro–Wilk test was performed to determine the normality of the data. If the significance value is $p>0.05$, then the data distribution are normal, and vice versa.

The Levene Analysis was performed to determine the data homogeneity. If the significance value is >0.05, then the data obtained are homogeneous, and vice versa. After the data were determined to be normal and homogeneous, they were processed using the parametric statistical test with one-way ANOVA test with a significance value < 0.05. The one-way ANOVA test was conducted to determine the difference in the mean (average) of µ-leakage data from each treatment group. The statistical test was continued by carrying out the post hoc test to find out which groups were different and not significantly different.

Results

The results indicated that the average penetration measurement of dye solutions in the SDR, flowable resin composite and GIC groups were 0.1709 mm, 0.1907 mm, and 0.3770 mm, respectively (Table 2).

Based on Table 3, these results indicate that there are differences in microleakage between the three treatment groups ($\alpha<0.05$). The statistical test was continued by carrying out the post hoc test to find out which group was different and not significantly different from the other two groups (Table 4).

Based on Table 3, the ratio of microleakage between the SDR group and the Flowable Resin Composite group did not differ significantly ($p>0.05$). The comparison of the microleakage of the GIC group with those of the SDR group and the flowable resin composite group indicated a significance value of 0.000 ($p<0.05$), so it can be concluded that the group has a significant difference.

Table 1. Manufacturers and chemical compositions of material used in this study

Material name	Manufacturer	Composition
Smart Dentin Replacement (SDR) 	Dentsply Sirona, Germany	SDR patented urethane dimethacrylate resin, Dimethacrylate resin, Difunctional diluent, Barium and Strontium alumino fluoro-silicate glasses, Photoinitiating System, Colorant
Esthet X Flowable Composite 	Dentsply Sirona, Germany	Resin: BisGMA, a urethane modified BisGMA-adduct, Ethoxylate BisPhenol A dimethacrylate, TEGDMA. Filler System : Barium fluoro alumino-boro silicate glass with an average particle size of 1 µm and Nanofiller silica with a particle size less than 0.02 µm
Dentine Conditioner 	GC Corporation, Japan	Distilled water 90% Polyacrylic acid 10%
Fuji IX GP capsule 	GC Corporation, Japan	Packable glass ionomer restorative with higher fluoride release and extra translucency. It contains a glass filler (Smart Glass).

Table 2. Average measurement results of dye solutions for each group

Treatment groups	N	Average (mm)	Deviation standard	Minimum	Maximum
Smart Dentin Replacement	9	0.1709	0.04320	0.12	0.25
Flowable Composite Resin	9	0.1907	0.05044	0.12	0.26
Ionomer *Cement Glass*	9	0.3770	0.13410	0.13	0.63

Table 3. The result of one-way ANOVA data of orifice barrier microleakage.

Treatment groups	Sig.
Smart Dentin Replacement *Flowable* composite Resin Ionomer cement glass	0.000

Table 4. The post hoc test results of microleakage of orifice barrier material.

(I) Treatments	(J) Treatments	Sig.
Smart Dentin Replacement	*Flowable* composite resin	.836
	Ionomer cement glass	.000
Flowable Composite Resin	*Smart Dentin Replacement*	.836
	Ionomer cement glass	.000
Ionomer Cement Glass	*Smart Dentin Replacement*	.000
	Flowable composite resin	.000

Discussion

In this study, the thickness of the material used was 4 mm, assuming that the thicker the material, the lower the microleakage. According to the research by Olmez *et al.* the coronal leakage of MTA as an orifice barrier with a thickness of 1 mm, 2 mm, 3 mm, and 4 mm. The results of this study explain that MTA with a thickness of 4 mm has the lowest leakage.[15] However, Ghulman and Gomaa reported a different result, that the thickness of the orifice barrier, 4 mm, is too thick, and this causes difficulties in the material retrieval process if the retreatment procedure is required, so that the recommended material thickness is 2–3 mm.[16] Özyürek *et al.* evaluated the microleakage of MTA Angelus, Filtek Ultimate light-cured flowable composite resin, Filtek Z250 light-cured composite resin, and SDR with an orifice barrier thickness of 3 mm. The result is that MTA Angelus and SDR materials show better leakage resistance compared to flowable composite resins and composite resins.[14]

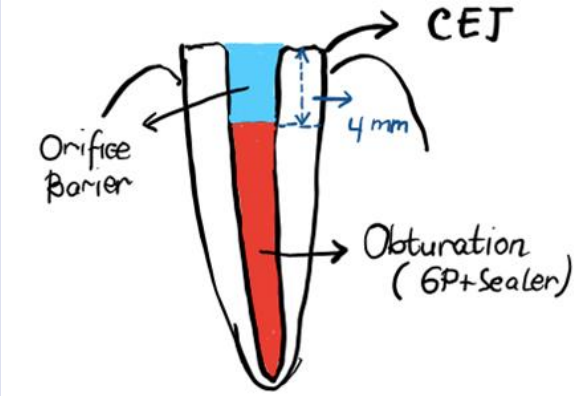

Figure 1. Illustration of orifice barrier placement.

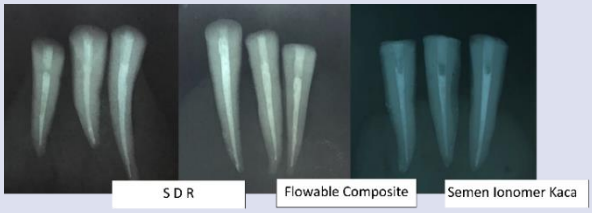

Figure 2. The post-orifice barrier application radiograph.

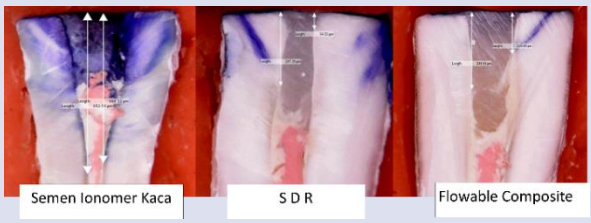

Figure 3. The result of staining dye penetration measurement of the three treatments.

Dental materials that can be used as an orifice barrier are cavit, amalgam, IRM, Super-EBA, composite resin, GIC, MTA, and CEM cement.[11] Wolcott *et al.*[12] reported that the criteria for dental materials that can be used as an orifice barrier are that the placement of the material is easy for the operator to do, binds to the tooth structure, does not interfere with the attachment of permanent restorations, is easily distinguished from the tooth structure, and has a good density to prevent microleakage.

The GIC group had the largest average microleakage value, 3.92 (Table 1), compared to those of the SDR and Flowable Resin Composite groups. The results of the post hoc test also indicated that the GIC was significantly different from the SDR and the Flowable Composite Resin. H. Yavari *et al.*[8] reported that GIC had the greatest microleakage compared to a *MTA* and a composite resin.

The microleakage of GIC in this study could be caused by the researcher not applying polyacrylic acid as a dentin conditioner properly. Polyacrylic acid is used prior to application of GIC to remove the smear layer. The smear layer formed as a result of the preparation procedure can interfere with the bonding of the ionomer cement to the tooth structure.[17] Another factor that can cause µ leakage is the GIC used in this study, which has high viscosity characteristics due to the high ratio of powder to solution and a reduction in the size of glass particles. The high viscosity results in the material not being able to flow through the entire cavity wall properly, which causes microleakage.[18]

In this study, the GIC used was GIC type II (Fuji IX GP capsule, GC Japan). GIC can bind to the tooth structure through chemical bonds between carboxylic groups in polyacrylic acid and calcium ions present in dentin. Fuji IX GP has high strontium content and can form strong bonds with tooth structures. The strontium ion in the GIC and the calcium ion in the teeth diffuse to form an ion exchange layer; this bond structure causes a strong bond between the GIC and the tooth structure.[19]

The high ratio of powder to solution in type II GIC can also improve the physical properties of the GIC.[20] The GIC for capsules can reduce the variability of the properties of GIC and avoid operator error.[21] The advantages of using a capsule preparation are not only a homogeneous ratio of powder to liquid but also good manipulation of powder and liquid using a standardized mixing machine, consistency of the liquid and predictable results.[22] In this study, the researchers experienced difficulties in the application process of GIC because the tip diameter of the capsule tip was too large to wall with the diameter of the orifice.

The SDR group had the smallest microleakage value compared to those of the other groups (Table 1). The results of the post hoc test indicated that the SDR was not significantly different from the flowable composite resin. The microleakage of the SDR was lower than that of Tetric-N-Flow. The SDR contains urethane dimethacrylate, which reduces polymerization shrinkage, so that this material experiences less microleakage than that of flowable composite resin.[23] The amount of the filler material also affects the polymerization shrinkage of the composite resin.[14] The composite flowable resin used in this study had a lower amount of filler than the SDR, so that the composite flowable resin experienced higher polymerization shrinkage and microleakage. SDR also has *self-leveling*, which allows this material to adapt well to the cavity walls.

Flowable resin composites have low viscosity characteristics so that they can flow throughout the cavity walls and can adapt well to tooth structures.[5] The micro flowable resin composite leakage is due to polymerization shrinkage due to its high matrix resin content.[24] In this study, the materials used were flowable resin composites (Esthet X Flow, Dentsply Sirona) that contained nanofiller particles that could improve the mechanical properties of the material. Esthet-X Flow has 61% of filler by weight and 53% by volume and is a type of low viscosity composites.[25] The same thing is also reinforced in the research by Poggio *et al.*[26] who found that the flowable composite resin is a material with low viscosity and stress and can thus be applied to hard-to-reach areas so that it can penetrate well.

SDR and flowable composite resin are recommended as orifice barrier materials. Those materials complete the

checklist of the criteria, which include it can be placed easily, can attach to the tooth structure, and has a high density to prevent microleakage. Kumar *et al.*[13] reported that SDR has less microleakage than that of non-flowable bulk fill (Tetric Evo Ceram Bulk).

SDR is a bulk fill composite that can be applied into cavities with a thickness of 4 mm, reduces porosity, and provides a restoration with better consistency.[27] According to Leprince *et al.* SDR has better marginal adaptation[28] and micro tensile than a conventional hybrid composite resin.[2]

Micro orifice barrier leakage can cause gutta percha and a sealer to be exposed to saliva and bacteria, so it is necessary to choose a sealer that has good adhesion to the tooth structure to prevent bacterial and salivary contamination into the root canal. The use of AH Plus as a sealer provides several advantages such this material's ability to bind to the tooth structure, long working-time, ease of manipulation, and good density.[13]

The use of AH Plus (Dentsply) sealer in this study also influenced the results of the study. Different results were reported by Sauáia *et al.*[29] who conducted a study on µ leakage of a flowable composite resin, cavit, and vitremer as intra-orifice using eugenol content as a sealer. In that study, the flowable resin composite's microleakage was greater than those of cavit and vitremer. This was due to the use of sealers with eugenol content. Eugenol can penetrate into the dentin and reduce the bond strength between the tooth structure and the composite resin and interfere with the polymerization of the composite resin.

Conclusions

There are differences in microleakage of the three dental materials tested, including a SDR, a GIC, and a composite flowable resin as orifice barrier materials in post-root canal treatment teeth. The comparison of microleakage between the SDR group and the Flowable Resin Composite group indicated no significant difference. The GIC had the highest microleakage. SDR had the lowest microleakage. This requires further research on orifice barriers with various thicknesses.

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Rehabilitation of Aramany Classification I Defect on a Completely Edentulous Patient: A Clinical Case Report

Pl Ranganayakidevi S Palaniappan[1,a]

[1]*Department of Restorative Dentistry, Faculty of Dentistry, University Malaya, Malaysia.*

Case Report

History

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ABSTRACT

This clinical case report describes a prosthetic rehabilitation for a patient who had partial maxillectomy surgery following the diagnosis of maxillary squamous cell carcinoma in 1991. She was also previously diagnosed with parotid gland pathology on the right and required complete removal of gland along with facial nerve. Her previous prosthesis is 18 years old and claims it not as retentive as before. Intraorally there was a large oval shaped defect on the right side of the maxilla sparing the left alveolus. Defect extends more than 2/3rd of the palatal area with communication to the nasal floor. Presence of buccal frenal pull on the right side on the upper and lower jaws due to the wound contracture on that side of the face. The extraoral facial asymmetry and weakness of facial muscles in this patient may lead to improper denture border seal of the prosthesis. Patient was provided with maxillary acrylic obturator and mandibular acrylic complete denture as a definitive treatment with careful denture extension planning. She was reviewed multiple times till prosthesis stability intraorally was achieved. This improved the prognosis for this patient. The only option for retaining prosthesis in this case, without implants, is optimum engagement of the available soft-tissue undercuts found within the defect space and the non-affected side.

Keywords: Completely Edentulous, Obturator, Facial Nerve, Prognosis, Case Report.

Tam Dişsiz Bir Hastada Aramany Sınıflandırma I Defektinin Rehabilitasyonu: Klinik Bir Vaka Sunumu

Süreç

Geliş: 05/06/2021
Kabul: 27/09/2022

ÖZ

Bu klinik vaka raporu, 1991 yılında maksiller skuamöz hücreli karsinom tanısı ile parsiyel maksillektomi ameliyatı olan bir hastanın protetik rehabilitasyonunu anlatmaktadır. Daha önce sağda parotis bezi patolojisi teşhisi konmuş ve fasiyal sinir ile birlikte bezin tamamen çıkarılmasını gerektirmiştir. Önceki protezi 18 yaşında ve eskisi kadar kalıcı olmadığını iddia ediyor. Ağız içinde sol alveolü koruyan maksillanın sağ tarafında oval şekilli büyük bir defekt vardı. Defekt, nazal tabanla iletişim ile damak bölgesinin 2/3'ünden fazlasına uzanır. Yüzün o tarafındaki yara kontraktürü nedeniyle üst ve alt çenelerde sağ tarafta bukkal frenal çekme varlığı. Bu hastada ağız dışı yüz asimetrisi ve yüz kaslarının zayıflığı, protezin uygunsuz protez kenar sızdırmazlığına neden olabilir. Hastaya dikkatli protez uzatma planlaması ile kesin tedavi olarak maksiller akrilik obtüratör ve mandibular akrilik tam protez verildi. Ağız içinde protez stabilitesi sağlanana kadar defalarca gözden geçirildi. Bu, bu hasta için prognozu iyileştirdi. Bu durumda implant olmadan protezi sabitlemek için tek seçenek, defekt alanı ve etkilenmeyen taraf içinde bulunan mevcut yumuşak doku alt kesiklerinin optimum şekilde bağlanmasıdır.

Anahtar Kelimeler: Tamamen Dişsiz, Obturator, Yüz Siniri, Prognoz, Olgu Sunumu.

[a] *ranganyaki@msn.com* *https://orcid.org/0000-0002-3031-5287*

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Introduction

Functional rehabilitation for a totally edentulous patient with a maxillary palatal defect may be a clinical challenge. Additionally, to understanding the basics of fabricating a functional complete denture, the dentist also must understand the physiology to modify the extension and design of the prosthesis. Only then, it can fulfil all the specified oral functions and improve the prognosis of the treatment provided.

Surgical consequences of the tumour removal will end in the patient having hypernasal speech, fluid leakage into the nasal cavity, impaired masticatory function, facial asymmetry and cosmetic deformity. Management of the patient becomes slightly harder if the patient also has seventh cranial nerve removal. In such cases, patients may present with striated muscle paralysis, weakness or twitching of the face on the affected side. In this case, the patient had maxillary squamous cell carcinoma and salivary gland pathology. Following this, she had partial maxillectomy and complete removal of the salivary gland together with the cranial nerve. This caused the patient to possess muscle weakness on the concerned side. Since the resection was done in the anterior midline region, this patient is assessed as Aramany Class 1.

Surgical reconstruction in comparison to obturator prosthesis being provided has shown to provide a more robust quality of life and performance to the patient.[1] Patients who undergo surgical management often undergo postoperative complications such as graft rejection, repeated surgeries, and psychological impact.[2] As an alternate, simple prosthetic management is an option. Management of this patient was done conventionally without any auxiliary retentive components like dental implants or surgical procedure. It demonstrates that with a correct extension of the prosthesis, retention are often well achieved. The prosthesis used to rehabilitate the maxillary defects are generally remarked as an 'obturator'.[3]

Case Report

A 78-year-old Chinese female was referred to the Prosthetic Clinic of the University of Malaya. She complains of a loose maxillary denture. The patient was diagnosed with maxillary squamous cell carcinoma in 1991 at Hospital Kuala Lumpur, Malaysia. There was partial maxillectomy surgery performed then and was provided with a maxillary obturator. She does not have a lower prosthesis. Currently, the maxillary obturator is not as retentive as before. Her prosthesis is 18 years old with under extended borders and worn off denture teeth. Since she does not have a lower denture, the patient is unable to eat well. Due to this, she frequently has indigestions and loss of weight. There is a previous history of some parotid gland pathology on the right side for an unknown reason. The entire gland was removed along with the facial nerve. This resulted in the eye on the affected side being unable to blink, thus patient uses, moisturizing eye drops.

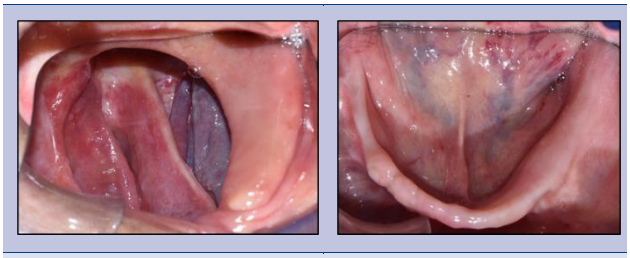
Extraoral (Figure 1), there was severe wound contraction on the right side of the face that caused the facial asymmetry. The patient also presented with depressed and unsupported upper and lower lips. There was overclosure of the lower to the right side at rest when not wearing the prosthesis. Deviation when opening and closing of mouth was noted. The patient had a convex facial profile. She was unable to blink her right eye and also presented with hypoesthesia over the right infra-orbital, nasal and upper lip region.

Intraorally (Figure 2), a large oval-shaped defect on the right side of the maxilla sparing the left alveolus. Defect extends more than 2/3rd of the palatal area with communication to the nasal floor. Presence of buccal frenal pull on the right side due to the extraoral wound contracture on that side of the face. Well defined alveolar ridge and retromolar region on the left side. Completely edentulous maxilla and mandible. Diagnosis for this patient is (i) Maxilla: Aramany Class I defect with completely edentulous arch, (ii) Mandible: Completely edentulous arch.

The aim of the treatment for this patient is (i) Function, (ii) Mastication, (iii) Aesthetic, and (iv) Speech. Thus, maxillary acrylic hollow bulb obturator opposing mandibular removable acrylic complete denture was planned.

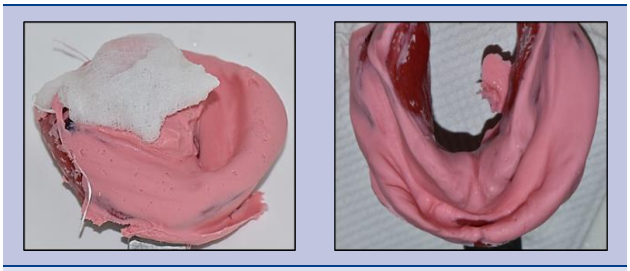
(a) (b) (c)

Figure 1. Extraoral pictures of patient without prosthesis: Right lateral view (a), Frontal view (b), Left lateral view (c).



(a) (b)

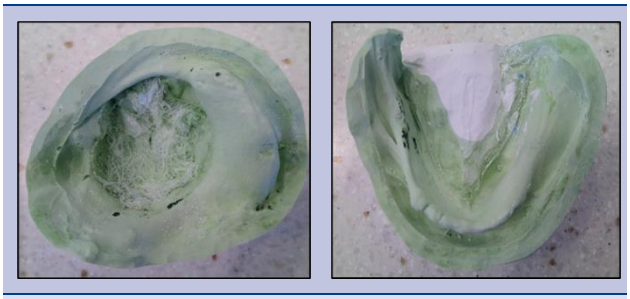
Figure 2. Intraoral view (a) maxilla, (b) mandible.



(a) (b)

Figure 3. Maxillary (a) and mandibular (b) primary impression.

Figure 4. Maxillary (a) and mandibular (b) primary impression.



(a) (b)

Figure 5. Maxillary (a) and mandibular (b) secondary cast.

She preferred simple, treatment with lesser appointments and the most conventional treatment. The patient was fully informed about the treatment and written consent was taken before treatment procedures.

Preliminary model prepared for maxilla and mandible prepared using a stock tray. Before the impression, the maxillary defect was covered with gauze. The impression compound was used and washed with irreversible hydrocolloid (Kromopan, Lascod, Illinois, USA) (Figure 3). The impressions were poured with type III dental stone (Elite Rock, Zhermack SpA, Via Bovazecchino, Badia Polesine, Italy) to produce casts.

Following the clinical trial fitting appointment, the proceeding step for processing the prosthesis was done. The maxillary obturator prosthesis was processed as a closed hollow bulb. The palatal part of the prosthesis cut was cut open (Figure 6). Later the sulcus and teeth portion were waxed-up and secured. At the defect site; the fitting surface was waxed up. The cover lid at the palate was also waxed-up separately following the piece that was cut out previously. Both the separate parts were processed individually and later the bulb and lid portions were joined using the auto-polymerizing resin. The mandibular prosthesis was fabricated with the conventional denture processing method.

In the consecutive appointment, a prosthesis was issued to the patient. The fitting surfaces of the prosthesis were checked with a fit checker and were adjusted accordingly. Occlusion and posterior extension were verified (Figure 7,8). The frenal full on the right mandibular area was causing the prosthesis to be lifted. The extension was checked multiple times till the prosthesis was stable. Before leaving, the patient was given postinsertion instructions for the prosthesis. The patient was reviewed 1-week post-insertion. During the review, the patient was asked to drink with the prosthesis intraorally to access any leakage of fluid. Phonetics and occlusion were also reassessed multiple times. Oral hygiene instructions were reinforced to the patient. The patient's voice was clearer and more understandable. Facial profile of the patient improved to straight.

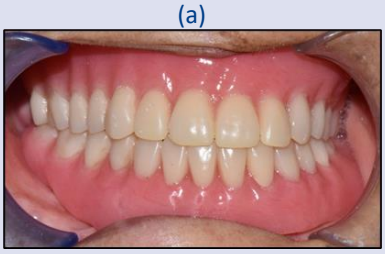
The prognosis of the treatment provided is considered good. The patient was happy with the treatment outcome; oral hygiene was good. Since the maxillary and mandibular prostheses were stable and retentive, the patient could use the prosthesis well.

Discussion

Successful denture therapy for a completely edentulous patient is influenced by the biomechanical phenomena of retention, stability and support.[4] In this case, the stability and support of the maxillary obturator are compromised because of the defect which is at the primary stress-bearing area; the hard palate. Both within the maxilla and also the mandible, there's a buccal frenal pull that disrupts the peripheral seal. Overclosure and wound contraction on the affected side causes the denture to lift easily. This compromises the retention of the prosthesis. Thus, external denture contours were critical.[5] Conversely, poorly designed prostheses that don't accommodate anticipated muscular function may yield compromised denture stability and reduced retention.

Figure 6. The palatal portion of the prosthesis is cut open before wax-up of the bulb portion.

(a)



(b)

(c)

Figure 7: Intraoral view after issue of dentures. Right Lateral view (a), Anterior view(b), Left Lateral view (c).

Figure 8: Posterior palatal extension of obturator intraorally.

Adjustment of the denture flanges that are over-extended is mandatory. The patients' hypesthesia, may lead to ulcers but might not present any pain in the slightest degree. Visualizing the denture extension into the sulcus are often difficult clinically. Pressure indicating paste is used during the review. After drying the denture border within the area being evaluated, the paste was placed and so carefully seated intraorally. Once seated, the denture was held border moulding movements were performed. Overextended borders had the materials removed. These areas were marked and so trimmed with a carbide bur. Finally smoothened and polished before giving it to the patient.

After adjustments to the denture fitting surfaces to be more stable, the patient can manage the prosthesis well despite the lack of any retentive components and also the large defect site. Since this patient is an obturator wearer for over 18 years, she knows well the way to manage the prosthesis. The patient's ability to manage dentures involves a learning process that, initially, could be a conscious endeavour. As a result of repetition, new reflex arcs are founded within the central systema nervosum and also the conscious effort has been replaced by a subconscious behaviour pattern. Constant repetition of impulses lowers the synaptic resistance and facilitates the formation of conditioned reflexes. At the identical time, however, it must be realised that the synaptic resistance are increased within the absence of those repeated stimuli.[6]

This obturator prosthesis incorporates a hollow bulb that's light but bulky. Besides fully engaging the undercuts within the defect with the bulb within the prosthesis, the treatment outcome is restricted because of the path of insertion that becomes complicated. A vital point to notice is that the weight of the prosthesis will cause loss of restraint and also to the propelling forces intraorally.[7] the employment of endosseous dental implants will further improve the prognosis for completely edentulous patients. Individuals wearing implant-assisted prostheses typically report improved oral comfort and function in comparison to conventional, mucosa-supported prostheses.[8] Using Zigomatic Implant in the edentulous maxillary defect was found more advantageous, in terms of compression and tensile stress and retention, when compared with conventional dental Implant.[9]

Except when contraindicated due to financial or surgical considerations, implant-assisted overdentures are usually the treatment of choice. During this case, although the patient understands the advantages of implant-supported prosthesis she isn't interested and only prefers a non-invasive conventional treatment.

Conclusions

With careful planning of denture extensions is executed; along with good impression making and proper fitting of dentures within the anatomical limits, an overall satisfactory treatment outcome can be achieved. A good knowledge understanding of the patients' needs would enable the successful rehabilitation and a comprehensive management.

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Effectiveness of Calibrated Digital Photography Technique in Dental Shade Analysis

Yunus Emre Ozden[1,a], Ayse Erzincanli[2,b], Burcu Bal[1,c*], Zeynep Ozkurt-Kayahan[1,d], Ender Kazazoglu[1,e]

[1]*Department of Prosthodontics, Yeditepe University Faculty of Dentistry, Istanbul, Türkiye*
[2]*Private practice, Istanbul, Türkiye*
**Corresponding author*

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ABSTRACT

Objectives: Although spectrophotometers are commonly used in shade analysis in dentistry; digital cameras, photographic lighting systems, computer programs and photographs have also become the part of this field. The aim of this study was to compare the success of spectrophotometer and calibrated digital photography on shade selection.

Materials and methods: The 3D-Master toothguide (VITA) with 29 tabs was used for the analyses. The ΔE value was determined with L, a, b values from the middle 1/3 of each sample using a spectrophotometer (Minolta CM -2300D, Konica). Colour calibration was performed using a gray card (white balance, Germany) for digital photographic measurements. Each toothguide in the VITA 3D master toothguide was photographed using a digital camera (Canon EOS 600D), a macro lens (Canon EF 100 mm f 1:2.8), two flash units (Canon MT 24 EX), and a tripod at a distance of 40 cm. Photographs were transferred to image analysis software (Adobe Photoshop CC). Digital photographic measurements created ΔE values using L,a,b values taken from 3 different regions of each sample (middle 1/3, cervical 1/3, and incisal 1/3) and ΔE values obtained from the middle 1/3 of the colour scale using a spectrophotometer were compared.

Results: There were significant differences between L* values of the spectrophotometric analyses and digital measurements in 3 different regions of the tab ($p<0.05$). For the evaluation of ΔE values, Post hoc Bonferroni analysis which was performed between the 3 regions of shade tabs revealed significant difference between the middle (21.92 ± 2.31), incisal (13.67 ± 1.69) and cervical (19.57 ± 2.47) region of the tabs ($p<0.05$).

Conclusions: Spectrophotometer was found to be a more accurate shade determination technique compared to calibrated digital photography.

Keywords: Calibrated Photography, Digital Method, Shade Analysis, Spectrophotometer.

Kalibre Edilmiş Dijital Fotoğraf ile Diş Renk Analizinin Etkinliği

Süreç

Geliş: 23/05/2022
Kabul: 05/07/2022

ÖZ

Amaç: Spektrofotometreler diş hekimliğinde renk analizinde yaygın olarak kullanılsa da dijital kameralar, fotoğrafik aydınlatma sistemleri, bilgisayar programları ve fotoğraflar da bu alanın parçası haline geldi. Bu çalışmanın amacı, spektrofotometre ve kalibre edilmiş dijital fotoğrafçılığın renk seçimindeki başarısını karşılaştırmaktır.

Gereç ve Yöntem: Analizler için 29 diş renk örneği bulunan 3D-Master renk skalası (VITA) kullanıldı. Spektrofotometre (Minolta CM-2300D, Konica) ile her bir örneğin orta 1/3 ünden alınan L, a, b değerleri ile ΔE değeri belirlendi. Dijital fotoğrafik ölçümlerde gri kart (White balance, Germany) ile renk kalibrasyonu yapıldı. VITA 3D master renk skalasındaki her bir renk örneği dijital fotoğraf makinesi (Canon EOS 600D), makro lens (Canon EF 100 mm f 1:2.8), twin flaşlar (Canon MT 24 EX) ve 40 cm uzaklığa yerleştirilen bir tripod yardımıyla fotoğraflandı ve fotoğraflar bir görüntü analiz yazılımına (Adobe Photoshop CC) aktarıldı. Dijital fotoğrafik ölçümlerde ΔE değerleri her bir örneğin 3 ayrı bölgesinden (orta 1/3, servikal 1/3 ve insizal 1/3) alınan L,a,b değerleri ile oluşturuldu ve spektrofotometre ile renk skalasının orta 1/3'ünden elde edilen ΔE değerleri ile karşılaştırıldı.

Bulgular: Diş renk örneklerinin 3 farklı bölgesinde spektrofotometrik analizlerin ve dijital ölçümlerin L* değerleri arasında anlamlı farklılıklar saptandı ($p<0.05$). ΔE değerlerinin karşılaştırılması için renk örneklerinin 3 bölgesi arasında yapılan Post hoc Bonferroni analizi, sekmelerin orta (21.92 ± 2.31), insizal (13.67 ± 1.69) ve servikal (19.57 ± 2.47) bölgeleri arasında anlamlı farklılık ortaya koydu. ($p<0.05$)

Sonuçlar: Spektrofotometrenin kalibre edilmiş dijital fotoğrafçılıkla karşılaştırıldığında daha doğru bir gölge belirleme tekniği olduğu tespit edildi.

Anahtar Kelimeler: Kalibre Edilmiş Fotoğrafçılık, Dijital Metod, Renk Analizi, Spectrofotometre.

[a] *emre.ozden@yeditepe.edu.tr* *https://orcid.org/0000-0002-4080-7744*
[b] *ayseyalniz@hotmail.com* *https://orcid.org/0000-0001-2345-6789*
[c] *drburcubal@gmail.com* *https://orcid.org/0000-0002-1849-7006*
[d] *zeynepozkurt@hotmail.com* *https://orcid.org/0000-0002-3320-9244*
[e] *ekazazoglu@hotmail.com* *https://orcid.org/0000-0001-2345-6789*

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Introduction

Esthetic dentistry is usually regarded as the aim of beautiful smile creation.[1] Among all the factors that determine the dental aesthetics, tooth shade matching plays a crucial role in performing the result of the dental therapy.[2-4] Shade matching methods can be divided into two main categories: visual and instrumental. Visual shade matching is a traditional method in dentistry and always be a complicated procedure for dentists during communicating with dental technicians.[5] The specific characterizations of a tooth such as various shades in different portions, translucency or opacities may not be detected by a human eye. In addition, visual shade matching is depending on a wide range factor such as dentist's age, sex, experience, knowledge about tooth shade matching, colour deficiency, eye fatigue and other variables such as different light sources, metamerism and type of the shade guide used.[2,6-12]

The indoor environment of dental office, the type of the light sources, season of the year and almost the time of day are important variables for shade matching. For assisting the visual shade matching, light-correcting devices are used prevalently to reduce metamerism and to permit neutral clearness.[13,14] These instruments correct or decrease the reflected light to approve for a more accurate evaluation of dental translucency and as a result provide more dependable visual shade matching results.[13]

The features in L*a*b* colour space, which is declared in 1976 based on the colour receptors of human eyes,[15] and Hue-Saturation-Value (HSV) colour spaces[16,17] is widely used in dentistry. Most of them measure the differences (ΔE) in L, a*, b* colour features among two tooth shades according to the guide of the American Dental Association for measuring colour differences of dental shades.[15,18,19] Clinical surveillances have declared that a ΔE value greater than 3.7 is graded as an insufficient match in dental shades.[20] There are several limitations of these type of colour measuring instruments such as having a small measuring window which restricting the measurement are of the tooth surface, so the complete tooth surface cannot be detected.[5] Because of the translucency of teeth, these instruments may induce edge loss of the light.[21,22] In addition, they are contemplated for evaluating plain surfaces instead of the geometric distribution of tooth colour .[23]

Unfortunately, the high prices of the colour measurement devices are a handicap for clinicians for daily use. On the other hand, the digital scenes taken with a digital camera and right after determined by using a photo editing software has gathered more attention for evaluation of tooth shades.[24-28] Nowadays, digital cameras have been in a widespread use in dental rehabilitation due to several reasons such as imitation of the patient's nature and transfer the information to the dental technician not with writing but also with an image that tells everything with an objective way. Recent developments in image acquisition and data storage provides a digital, countable, repeatable information. Many studies have indicated the potential of digital cameras for dental shade matching.[24-31]

Although there are some studies evaluating the performance of digital cameras for shade selection,[32-34] effectiveness of calibrated digital photography method is not clear in the literature. The aim of this study was to evaluate the performance of calibrated digital photography method in shade selection and to compare it with the spectrophotometer. The null hypothesis was that no difference would exist between the two shade selection methods.

Materials and Methods

This research protocol was examined and approved by the Institutional Review Board (No:294) and Yeditepe University Non-Interventional Clinical Research Ethics Board (No:5). VITA Toothguide 3D-MASTER (VITA Zahnfabrik) with 29 tabs was used for the analysis. The colour measurements for each tab were performed with a spectrophotometer (Minolta CM-2300D, KONICA) and a digital camera (Canon, EOS 600D).

Spectrophotometric analysis

For spectrophotometric measurements, a white acrylic base holder (Figure 1) was prepared to measure the same point of each tab, as suggested in the literature.[34,35] Before each colour measurement, white calibration of the spectrophotometer was performed according to the manufacturer's recommendation. Each tab was measured 3 times and the mean values were recorded separately for all colour coordinates.

Digital photographic analysis

When measuring with a digital camera, a gray card (White balance, Germany) with a "79" L value was used for calibration. The accuracy of the gray card was checked on the spectrophotometer in which the samples were measured. A phantom maxillary jaw model (G50, KAVO) with a central tooth deficiency was used and a mechanism from a white acrylic material was prepared for fixing both gray card and shade tab to the model (Figure 2).

LED light source (JJC, LED-96) with a 5500 K temperature value was fixed over the model to imitate the daylight and standardize the light comes from the environment. A digital camera (Canon EOS 600D) with a macro lens (Canon EF 100 mm f 1:2.8) and twin flashes (Canon MT 24 EX) were fixed on a tripod. The distance between the shade tab and camera lens was 40 cm. Camera lens was set to be perpendicular to the shade tab as performed in Cal *et al.*'s study.[34] Twin flashes was fixed with a 45° to the tooth surface for cross polarization. To eliminate unwanted reflections on the teeth that are caused by flashes, polar eyes filters were used. Photographs were taken in manual mode and with 1/125 exposure time, F22 aperture, and ISO 100 camera settings (Figure 3).

Figure 1. White acrylic base holder.

Figure 2. Photoshoot Contrivance.

Figure 3. Photoshooting layout.

Images were transferred to a computer (Macbook Air, Apple Inc.) and opened in an image analyzing software (Camera Raw plugin Adobe Photoshop CC). After calibrating the photographs according to the gray card, "L*a*b*" values on the histogram of application were recorded by looking at the colour of the incisal, middle and cervical 1/3 regions of shade tabs.

ΔE calculation

Digital photographic measurements created ΔE values using L,a,b values taken from 3 different regions of each sample (middle 1/3, cervical 1/3, and incisal 1/3) and ΔE values obtained from the middle 1/3 of the colour scale using a spectrophotometer were compared. The ΔE between the values obtained with the spectrophotometer and digital photography was calculated using the following formula:[15,18,19]

$$\Delta Eab = (\Delta L2 + \Delta a2 + \Delta b2)1/2$$

Statistical analysis

While evaluating the data of the study, the IBM SPSS Statistics 22 (IBM SPSS, Turkey) was used for statistical analysis. The data were tested for normality using the Shapiro-Wilks test, and the normal distribution of the parameters was demonstrated. The post- hoc Bonferroni test was used to evaluate the differences in mean ΔE values between the different tab regions. Paired samples t-test was used to evaluate the differences between the measurements of the L*a*b* values of the digital and spectrophotometer. $p < 0.05$ was considered statistically significant.

Results

This study evaluated the colour matching accuracy of a calibrated digital photographic technique compared to a spectrophotometer. The tooth colour measurements (L*a*b* values) were collected by the spectrophotometer and digital photography method (Table 1).

The mean and standard deviations of the L*a*b* values of the two methods are shown in Table 2. Paired-samples t-test showed that there were significant differences between the L* values of spectrophotometric analyses and digital measurements in three different regions of the tabs; (middle, incisal, and cervical 1/3) ($p<0.05$). The same statistical analyses also revealed significant differences with respect to the a* values ($p<0.05$). Similar results were observed when b* values were considered ($p<0.05$).

For the evaluation of ΔE values, Post hoc Bonferroni analysis was performed between the 3 regions (Table 3). Results revealed significant difference between the middle (21.92 ± 2.31), incisal (13.67 ± 1.69) and cervical (19.57 ± 2.47) region of the tabs ($p<0.05$).

Table 1. Colour measurements of shade guide examined by two methods.

Tab no.	Spectrophotometer measurements			Digital Measurements								
				Middle 1/3			Incisal 1/3			Cervical 1/3		
	L*	a*	b*	L*	a*	b*	L*	a*	b*	L*	a*	b*
0M1	67.9	1.49	6.29	84	2	6	77	2	5	80	0	0
0M2	67.6	1.68	6.63	84	2	7	77	2	6	79	7	10
0M3	65.1	1.89	8.85	84	2	8	76	2	7	79	5	10
1M1	57.6	2.76	11.18	81	3	11	72	3	11	77	6	13
1M2	59.1	2.67	14.13	81	3	17	72	3	12	81	4	16
2L1.5	57	2.64	12.61	78	3	17	72	3	11	76	6	17
2L2.5	56	3.36	17.08	79	4	24	71	3	15	75	7	23
2M1	57.8	2.77	10.48	79	3	13	70	3	10	77	5	14
2M2	56.7	3.45	14.05	79	4	19	71	4	12	77	7	19
2M3	56.5	4.18	18.13	79	5	26	70	4	16	75	8	26
2R1.5	57.7	3.36	12.1	79	4	16	72	4	10	77	7	16
2R2.5	55.5	4.58	16.47	78	5	23	70	4	14	75	9	24
3L1.5	51.2	3.83	14.27	73	6	23	67	4	15	68	11	23
3L2.5	52.9	4.28	17.06	73	7	28	67	4	16	68	11	28
3M1	53.9	3.57	11.28	74	5	17	67	4	10	69	9	19
3M2	53.1	4.51	14.98	74	6	23	68	5	15	71	11	23
3M3	52.8	5.11	18.4	74	7	30	68	4	17	71	10	30
3R1.5	53.6	4.37	12.86	74	7	20	68	5	13	70	10	21
3R2.5	54.5	5.07	16.75	72	9	30	68	5	17	69	12	29
4L1.5	49.2	4.41	14.07	69	8	25	66	5	14	65	12	23
4L2.5	50.4	4.71	17.63	68	10	33	65	6	18	65	12	31
4M1	51.7	3.75	11.37	69	8	20	65	4	11	65	11	20
4M2	53.6	4.58	15.08	69	9	27	66	5	16	66	12	27
4M3	53.6	5.5	19.11	70	10	35	67	6	19	65	14	34
4R1.5	51.8	4.91	12.9	69	9	23	65	6	14	67	12	24
4R2.5	54	5.41	16.71	69	11	31	66	7	18	67	14	29
5M1	49.5	4.58	11.83	65	10	23	64	6	12	62	13	22
5M2	50.5	5.58	16.19	66	12	32	64	7	18	64	14	31
5M3	50.1	6.87	20.55	66	15	41	64	8	22	64	17	38

Table 2. Comparison of L, a, b measurements of digital photographs and the spectrophotometer.

	L*	a*	b*
	Mean±SD	Mean±SD	Mean±SD
[1]Spectrophotometer	55.2±4.86	4±1,26	14.1±3.55
[2]Digital Middle	74.45±5.8	6.52±3.38	22.34±8.57
[3]Digital Incisal	68.79±3.75	4.41±1.55	13.59±4
[4]Digital Cervical	71.17±5.77	9.52±3.7	22.07±8.13
1-2 p	0.000*	0.000*	0.000*
1-3 p	0.000*	0.001*	0.033*
1-4 p	0.000*	0.000*	0.000*

Paired Samples t test* p<0.05

Table 3. Comparison of the ΔE values according to the measured surface area of the tooth.

	ΔE
	Mean±SD
Midle 1/3	21.92±2.31
Incisal 1/3	13.67±1.69
Cervical 1/3	19.57±2.47
p	0.000*

Post hoc Bonferroni test * p<0.05

Discussion

Shade selection with calibrated digital photography have begun to find a place among current dental applications.[31,36] The aim in these applications is to provide calibration and standardization in photographs which are used for shade selection in dentistry. However, the semi-transparent structure and surface properties of the tooth can prevent this standardization from being fully adjusted. It is useful to know which factors create differences between two separate photographs taken with the same arrangement to make an optimal calibration to the photographs. The amount of light comes to the digital camera may vary and this difference affects the L* parameter which was called as "Value". A gray card, which is considered to reflect 18% of the light falling on it, is used in photography to match the actual colour of the photograph. Since the gray card has exact values, the computer program is interpreted at the same values and the colour tone of the entire image is calibrated.[31]

Although twin flashes that send high-intensity light is used when taking pictures, the ambient light may also have minimal effects on shade selection. In the literature, shade selection under different light sources has been studied and the importance of ideal temperature of daylight (approximately 5500 K) was reported.[17] In addition, the use of polarizing filters has been suggested to prevent unwanted flashes on tooth surface of the camera flash. In present study, polar eyes filters were used for cross-polarization and elimination of unwanted flashes. For the standardization of light comes from the environment with LED light source which has a 5500 K temperature was used.[16,17]

According to the results of the present study, the null hypothesis, no difference would exist between the two shade selection methods, was rejected. There were significant differences between L* a*b* values of the spectrophotometric analyses and digital measurements. In this study, the photographs were calibrated with gray card whose L* value was previously known (L=79). This value was also confirmed in spectrophotometer. Cal *et al.*[34] measured the L*a*b* values on different shade tabs with digital camera and spectrophotometer. They obtained similar results with the present study. However, they reported higher ΔE and L* values. The use of gray card calibration to ensure standardization may be the reason of this difference.

Auxillary processes helped to reduce the ΔE values in this study but remained well above the acceptable limit in the literature[15] which is shown that the colour difference between two objects (ΔE) of < 2 is not discernible to the human eye. The digital cameras show the light entering the sensor by reflecting from the surface of the photographed object, while the spectrophotometers show the amount of light absorbed on the surface. It would be the reason for the extreme difference in lightness (L) values. The fact supports this interpretation that the L values in the incisal regions of shade tabs where the thinner part of the tabs was closer in the results of spectrophotometer and digital camera. Measurements of incisal 1/3 were closer to the spectrophotometer measurements than mid 1/3 and cervical 1/3 area in the present study. Lasserre *et al*.[38] compared the performances of intraoral camera, traditional visual method and spectrophotometer in canine and incisor teeth. They reported that the performance of intraoral camera was better in canine teeth. This result also supports the present study considering that the translucency value of canine teeth is less than incisal teeth.[38]

Choosing a shade by taking a picture of the shade tab might be misleading, and this is one of the limitations of this study. The reason is that the amount of light reflected from the surface and absorbed on the surface of the natural teeth and the shade tabs are different. The comparison of the shade selection techniques using natural teeth or the evaluation of the effect of shade tabs' thickness on the L values of the photographs may be planned in the future studies.

Conclusions

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

1. The shade determination with calibrated digital photography could be made from the measurements taken from the incisal 1/3 of the tab, which was the thinnest portion.

2. Spectrophotometer was more accurate shade determination technique when compared to the calibrated digital photography method.

Conflicts of Interest Statement

The authors do not have any financial interest in the companies whose materials are included in this article.

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A Cross-Sectional Survey Study on the Use of Communication Methods in the Dentist-Geriatric Patient Relationship

Kübra Güler[1,a*], Emine Pirim Görgün[1,b]

[1]*Department of Periodontology, Faculty of Dentistry, Sivas Cumhuriyet University, 58140, Sivas, Türkiye*
**Corresponding author*

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ABSTRACT

Objectives: The population has been aging more rapidly than in the past, and it has been reported that the number of people over the age of 60 exceeds the number of children under the age of 5. This demographic change has forced countries to plan their health systems with the aging population in mind. In this study, we aimed to see and evaluate the attitudes of dentists and trainee dentists towards communication with their elderly patients during their examination and treatment.

Materials and methods: We applied a 25-item questionnaire on dentist-geriatric patient communication to 241 participants, including the 4th and 5th-year students, residents, and faculty members. Sixteen items, which of the first 7 are "basic", include questions that examine the methods recommended by the American Medical Association in physician-patient communication and whether they find these methods effective. The data we obtained from the survey results were analyzed with appropriate statistical methods.

Results and Discussion: Dentists routinely used an average of 4.6 of the 16 methods and 2.5 of the seven basic methods. While the most frequently used methods were “speaking slowly” and "using a simple language", the least was "using videos". Health literacy awareness and outcome expectancy were associated with the number of methods used.

Conclusions: The number of routine use of the methods is quite low among dentists and trainee dentists. It has been observed that communication methods that would be effective in relationships with geriatric patients with low health literacy skills are not routinely used. It has been concluded that the communication methods that can be used effectively for communication with geriatric patients should be embedded into the dental curriculum.

Keywords: Elderly; communication; delivery of health care; health literacy; dentistry for aged; health services for the aged.

Diş Hekimi-Geriatrik Hasta İlişkisinde İletişim Yöntemlerinin Kullanımı Üzerine Kesitsel Bir Anket Çalışması

Süreç

Geliş: 10/05/2022
Kabul: 10/08/2022

ÖZ

Amaç: Dünya Sağlık Örgütü (DSÖ) verilerine göre günümüzde nüfusun yaşlanması eskiye nazaran çok daha hızlı bir hal almıştır ve 60 yaş üstü insan sayısının 5 yaş altındaki çocuk sayısını geçtiği rapor edilmiştir. Bu demografik değişim, ülkelere, sağlık sistemlerini yaşlanan nüfusu düşünerek planlamaları zorunluluğunu getirmiştir. Yaptığımız bu kesitsel çalışmada diş hekimleri ve stajyer diş hekimlerinin muayene ve tedavileri sırasında, “yaşlı” olarak nitelendirdikleri hastalarla olan iletişime yönelik tutumlarını ve “yaşlılık” ile ilgili tutumlarını görmeyi ve değerlendirmeyi amaçladık.

Materyal ve Metod: Bu çalışmada hekim-geriatrik hasta iletişimi üzerine, fakültemiz 4. sınıf ve 5. sınıf öğrencileri, araştırma görevlileri ve öğretim üyeleri olmak üzere 168 stajyer diş hekimi ve 73 diş hekimine 25 ögelik bir anket uygulaması yapılmıştır. Ankette yer alan 16 ögelik kısım, ilk 7 tanesi “temel” olmak üzere, Amerikan Tıp Derneği’nin hasta-hekim iletişiminde önerdiği yöntemleri ve bu yöntemleri etkili bulup bulmadıklarını irdeleyen soruları içermektedir. Anket sonuçlarından elde ettiğimiz veriler uygun istatistiksel yöntemlerle analiz edilmiştir.

Bulgular ve Tartışma: Temel 7 tekniğin “rutin” kullanım ortalaması 2.57, 16 yöntemin rutin kullanım ortalaması ise 4.63 bulunmuştur. En sık kullanılan “yavaş konuşmak” ve “basit bir dil kullanmak” yöntemleri iken, en az kullanılan “video kullanmak” yöntemi olmuştur. Sağlık okuryazarlığı farkındalığı ve sonuç beklentisi ile tekniklerin rutin kullanım sayısı arasında istatistiksel anlamlı ilişki bulunmuştur.

Sonuçlar: Tekniklerin rutin kullanım sayısı diş hekimleri ve stajyer diş hekimleri arasında oldukça düşüktür. Sağlık okuryazarlığının düşük olduğu geriatrik hastalarla olan ilişkilerde uygulanması etkili olacak iletişim yöntemlerinin rutin kullanımda yer almadığı gözlenmiştir. Diş hekimliği eğitiminde, geriatrik hastalarla iletişimde etkili şekilde kullanılabilecek yöntemler üzerinde daha fazla durulması gerektiği sonucuna varılmıştır.

Anahtar Kelimeler: Yaşlı; İletişim; Sağlık Hizmeti Sunumu; Sağlık Okuryazarlığı; Yaşlılar İçin Diş Hekimliği; Yaşlılar İçin Sağlık Hizmetleri.

[a] *kubraguler.dt@gmail.com* *https://orcid.org/0000-0003-2032-6203* | [b] *eminepirim09@hotmail.com* *https://orcid.org/0000-0002-8867-1663*

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Introduction

Health-related information and dentists' recommendations can often be confusing for patients and cause them to have difficulty in understanding the nature of their conditions and implementing the instructions correctly. Effective physician-patient communication skills are as important to medical care as clinical expertise.[1] At this point, health communication becomes meaningful and can have a significant impact. Health communication is based on two-way information transfer using a common signal and behavioral system through various communication pathways and messages and creates mutual understanding and sympathy among the people communicating.[2] An effective dentist-patient communication can lead to a reduction in anxiety, and increase patients' satisfaction and adherence.[3,4] It becomes more and more important to communicate clearly and simply when communicating about health-related issues, especially considering that the world population is aging steadily and elderly patients may have difficulty in understanding dental issues.

Although it is not based on any medical or biological evidence, old age is generally defined as 65 and over chronological age in the world.[5] According to the data WHO provides[6], the population has been aging more rapidly than in the past, and it has been reported that the number of people over the age of 60 exceeds the number of children under the age of 5. This demographic change necessitates countries to plan their health systems with the aging population in mind. Health is the one area where communication is perhaps the most necessary and can have a significant impact. The aging population means that most patients who approach the hospitals for treatment are elderly people, and the importance given to the communication with patients needs to be increased to reduce hospital visits and ensure that patients understand what is being told and implement it accordingly. The ability of the elderly individual to interpret what he hears can have an impact on the shaping of health behavior, as well as it is effective in the perception that the delivery of health care is seen as adequate. The main purpose of health communication practices is to optimize the individual's health behavior in the desired direction, as well as develop and improve both individual and social health.[7]

In the reliability and validity study of Turkey's health literacy scales (TSOY-32)[8] conducted under the fosterage of the Ministry of Health in 2016, it has been observed that when the literacy level by age groups is examined, the literacy level of approximately four out of five elderly people in the 65-year-old and above group is insufficient. Therefore, more efforts should be made to be comprehensible for the elderly about treatments and post-treatment recommendations.

To the best of our knowledge, this study has not been conducted in Turkey before. In this cross-sectional study, we wanted to see whether dentists and trainee dentists use advanced communication methods by considering their attitudes towards "aging" and their patients' age in communication. We aimed to raise awareness against the aging population of the country, to provide data, and to be beneficial to our faculty in terms of practice.

Materials and Methods

This cross-sectional study was reviewed and approved by the Sivas Cumhuriyet University Non-invasive Clinical Research Ethics Committee in Sivas, Turkey, with the decision date 13.01.2022 and under the decision number 2022-01/26, and the research was conducted in full accordance with the Declaration of Helsinki. Patients were informed about the study and they gave their written consent to participate.

To prevent the risk of bias, a face-to-face survey was applied to the 4th and 5th-year students, residents, and faculty members. Residents and faculty members in the Orthodontics and Pedodontics Departments were excluded due to the nature of their patients.

Questionnaire

In this study, we used an adaptation of a survey Rozier *et al.* conducted[9] on the dentists residing in the USA and supported the questionnaire with our questions, as we reckoned were appropriate for our society. The story of the questionnaire that Rozier *et al.* used is as follows: The National Advisory Committee on Health Literacy in Dentistry (NACHLD) created an 86-question, individual and answer-mandated questionnaire. This questionnaire also included communication methods recommended by the American Medical Association (AMA).[10] The important parts of this questionnaire were piloted to 188 participants at the 2007 meeting of the American Dental Association. The results of this questionnaire were evaluated in the NACHLD study group, and the necessary sections were revised and finalized in the Rozier *et al.* study.[9] After that, these 18 communication methods were also included in other survey studies with various revisions.[11–13] With this aspect and not being subject to scoring or scaling, the survey questions that we received support from are not an index, so there was no need for a "reliability and validity study". Among the 18 communication methods, "Asking other office workers to follow up on the patient for post-treatment instructions" and "Using a translator when necessary" were not included and examined in the questionnaire because of the nature of our working conditions, only one secretary works permanently, and the patients who apply are Turkish speaking people. The translation of the communication methods from the original language into Turkish was performed by KG, who is C1 level in English, and was translated back into English by a professional translator and was compared with the original. The results were similar to the original, except for one or two words with synonyms, and the use of the first translation was deemed appropriate.

Our survey consists of 25 questions; 3 demographic questions, a 6-item section, and a section where we

question 16 communication methods and whether they are considered effective. Demographic questions consist of age, gender, and title. The 6-item section consists of the number of elderly patients communicated weekly, the definition of elderly patients, awareness of health literacy, whether participants received communication training, their thoughts on whether addressing elderly patients in an informal language as uncles and aunts made the patients more comfortable and finally, whether the lack of using communication methods while communicating with elderly was attributed to the 6 barriers presented; lack of time, awkwardness, cannot simplify any further, patient's language not efficient enough, and thinking that the patient will not comply. The frequency of use of communication methods was questioned on the Likert scale: always, usually, sometimes, rarely, never. Accordingly, it was scored from always (5 points) to never (1 point).

16 communication methods were grouped into 5 domains as follows in the above-mentioned study9, and we continued the same grouping: Interpersonal communication, teach-back method, patient-friendly materials and aids, assistance, and patient-friendly practice. The first two categories are "Basic Methods".

To evaluate the appropriateness of the survey content, two people representing each title evaluated the draft version of the survey. In this evaluation, the comprehensibility of the questions and expectations in responses were discussed. Only one-word correction (term into "technical term") was made on communication methods, no other corrections were required on the remaining sections.

Data collection

Sample size was calculated by power analysis and we aimed to reach the entire sample universe. 95 4th-year interns, 73 5th-year interns, 57 residents (excluding the residents in the orthodontics and pedodontics departments), and 16 faculty members (excluding the members in the orthodontics and pedodontics departments) participated in the study. The demographic data of the participants are shown in Table 1.

Analysis variables

To the question, "During a typical work week, how often do you use the following communication methods when communicating with elderly patients?", we expected answers on a five-point Likert scale; always (5), usually (4), sometimes (3), rarely (2), and never (1), and use of "always" or "usually" defined the "routine use" category, as opposed to the use of "sometimes", "rarely" or "never". Responses were scored ranging from 5 = "always" to 1 = "never" and a mean score was determined for each communication method from the sum of these scores. The dependent variable is the number of "routine" uses of 16 communication methods and, separately, 7 basic methods.

We also asked dentists whether they thought each of the 16 communication methods was effective, which they could answer as "yes", "no" or "I do not know". We created a scale, defined as "outcome expectancy" by a summary of "yes" answers and conjured a categorical variable based on its distribution; "low", "moderate", and "high" expectancy. Zero to 10 "yes" answers were categorized as "low" expectancy, 11 to 13 "moderate", and 14 to 16 "high", respectively. Seven of the 16 communication methods are the basic methods, and the remaining 9 methods are divided in such a way that the expectation rises in every three.

Analysis strategy

Data were analyzed using a statistics program (SPSS v23.0, IBM, USA). In addition to distributions (frequencies and percentages) of the participants' characteristics, the number of routinely used methods, and perceived effectiveness of methods, we used analysis of variance (ANOVA) to compare the mean numbers of methods used routinely for all 16 methods and also the seven basic methods. Finally, ordinary least squares regression was used to analyze the association between variables selected as the independent variables, and the number of routine use of methods as the dependent variable. Because of the relatively small sample size, we used a backward stepwise elimination process.

Results

Of the 241 participants included in the study, 59.8% were female and 40.2% were male (Table 1). The participants, in a typical work week, communicate with less than 5, 5 to 10, 10 to 20, and more than 20 elderly patients, with a distribution of 27%, 39.8%, 17.4%, and 15.8% respectively. According to the majority of the dentists and trainee dentists (40.2%), the onset of old age was 60, while the lowest being 40 and the highest being 85. The rate of the participants who were aware of health literacy was 26.1%. Compared to the number of residents and faculty members who were aware of health literacy, the number of trainee dentists who had awareness was significantly lower ($p<0.05$). Only 28.9% of the participants mentioned receiving communication training, and there was statistically no difference between titles in terms of having taken a communication course. When we asked about addressing the elderly patients as "uncle" or "aunt", the majority (72%) thought it would make the patients feel more comfortable. Out of the five barrier items we questioned as an obstacle to the implementation of communication methods, "lack of time" was seen as the most basic obstacle (82%). This was followed by thinking that the patients would not comply (47.3%), could not simplify any further (37.8%), thinking the patient was deficient in the language (37.2%), and awkwardness (22.4%).

In Table 1, the participants' characteristics are compared in terms of routine use of communication methods. While there was no difference in the average number of routine uses according to gender or age, the average number of routine use of 16 communication methods by 4th-year students was significantly higher than other titles ($p<0.05$).

Table 1. Bivariate analysis of predictor variables and mean number of communication methods used routinely

VARIABLES		16 COMMUNICATION METHODS			7 BASIC COMM. METHODS		
		SAMPLE SIZE* (Number and percentage)	MEAN NO. OF METHODS USED	P-VALUE	SAMPLE SIZE* (Number)	MEAN NO. OF METHODS USED	P-VALUE
Participant Characteristics							
Gender							
Female		144 (59.8%)	4,54	0.478	144	2,63	0.700
Male		97 (40.2%)	4,76		97	2,57	
Age (years)							
20-25		159	4,70	0.594	159	2,57	0.602
25-30		62	4,52		62	2,71	
30-40		8	5,25		8	3,00	
>40		12	3,92		12	2,33	
Title							
4th-year student		95	5,08	**0.035#**	95	2,62	0.541
5th-year student		73	4,11		73	2,48	
Dentist**		73	4,56		73	2,71	
No. of Patients Weekly							
<5		65 (27%)	4,89	0.107	65	2,57	0.589
5-10		96 (39.8%)	4,29		96	2,54	
10-20		42 (17.4%)	4,40		42	2,57	
>20		38 (15.8%)	5,29		38	2,87	
Elderly Description (years)							
>50		46	4,93	0.761	46	2,54	0.902
55		45	4,67		45	2,56	
60		100 (40.2%)	4,48		100	2,60	
>65		50	4,62		50	2,72	
Health Literacy							
Yes		63 (26.1%)	5.14	**0.046#**	63	2.95	**0.012#**
No		178 (73.9%)	4.45		178	2.48	
Comm. Course							
Yes		69 (28.9%)	4.59	0.839	69	2.70	0.576
No		155	4.66		155	2.58	
Addressing as Aunt/Uncle							
Yes		172 (72%)	4.72	0.977	172	2.62	0.714
No		37	4.70		37	2.54	
Barriers							
Lack of time	Yes	196 (82%)	4.63	0.396	196	2.61	0.655
	No	29	5.03		29	2.72	
Awkwardness	Yes	54 (22.4%)	4.41	0.183	54	2.35	**0.020#**
	No	143	4.92		143	2.81	
Cannot simplify any further	Yes	91 (37.8%)	4.73	0.950	91	2.57	0.548
	No	115	4.70		115	2.68	
Patient's language	Yes	89 (37.2%)	4.79	0.642	89	2.60	0.943
	No	115	4.63		115	2.58	
Patient will not comply	Yes	114 (47.3%)	4.65	0.766	114	2.61	0.957
	No	74	4.54		74	2.59	
Outcome Expectancy							
Low		112 (48.1%)	4.11	**0.006##**	110	2.44	0.079
Medium		65 (27.9%)	4.91		66	2.67	
High		56 (24.0%)	5.18		61	2.89	

*The sample size for each variable may not be equal to the overall sample size.

**Residents and faculty members in one variable to equal the sample sizes for each group.

P-value<0.05

P-value<0.01

The count of routinely used methods did not change according to the number of patients the participants interacted with weekly or what age they defined the patients as elderly. It was observed that the dentists and trainee dentists with awareness of health literacy used significantly more methods routinely ($p<0.05$). Participants with a background in communication training did not use more methods routinely. Participants who had taken a communication course had significantly lower outcome expectations ($p<0.05$).

Table 1 also summarizes the number of routine use of communication methods according to the dentists' and trainee dentists' outcome expectations and the reasons they see as barriers to using communication methods. 196 participants out of 240 saw the lack of time as a barrier to the implementation of communication methods. Although it was not statistically significant, it was observed that participants who thought they were comfortable in terms of time, used more methods, and those who found the use of various communication methods awkward used significantly less number of basic communication methods ($p<0.05$). We found that the outcome expectancy variable was a strong predictor and associated with the number of methods used. It was observed that the number of routinely used methods and routinely used basic methods strongly and positively correlated with the outcome expectancy ($p<0.001$ and $p<0.01$, respectively) (Table 4). Dentists who we classified as having high outcome expectancy routinely used 30 percent more methods (mean, 5.18) than did those we classified as having low outcome expectancy (mean, 4.11) (Table 1). Responses were distributed mostly between "yes" and "don't know," with a few "no" responses. For seven of the methods, including four of the seven basic methods, one-third or more of the participants reported that they did not know whether it was effective.

The frequency of use of the communication methods was generally low (Table 2). Three out of seven basic communication methods had mean Likert scale scores higher than three and among these, only one had a score higher than four.

Table 3 summarizes the expectation of the effectiveness of the communication methods. The methods that were considered most effective were "using a simple language" (96.1%) and "speaking slowly" (86.8%). This was followed by "using models or radiographs to explain" and "reading instructions out loud". "Referring patients to the internet or other information sources for information", "presenting two to three concepts at a time", and "drawing pictures or using printed illustrations" were found ineffective by the participants at a rate of 15-16%. The expectation of effectiveness was generally low. Only 24.0% of the participants had high outcome expectancy (Table 1).

The routine uses of communication methods are shown in the Figure 1. "Using a simple language" with 89.6% and "presenting 2 to 3 concepts in a conversation" with 69.7% are the communication methods the participants use most routinely. These methods were followed by "speaking slowly", "reading out loud", and "using models or radiographs to explain", respectively. The "Using videos" method was barely used routinely (2.9%).

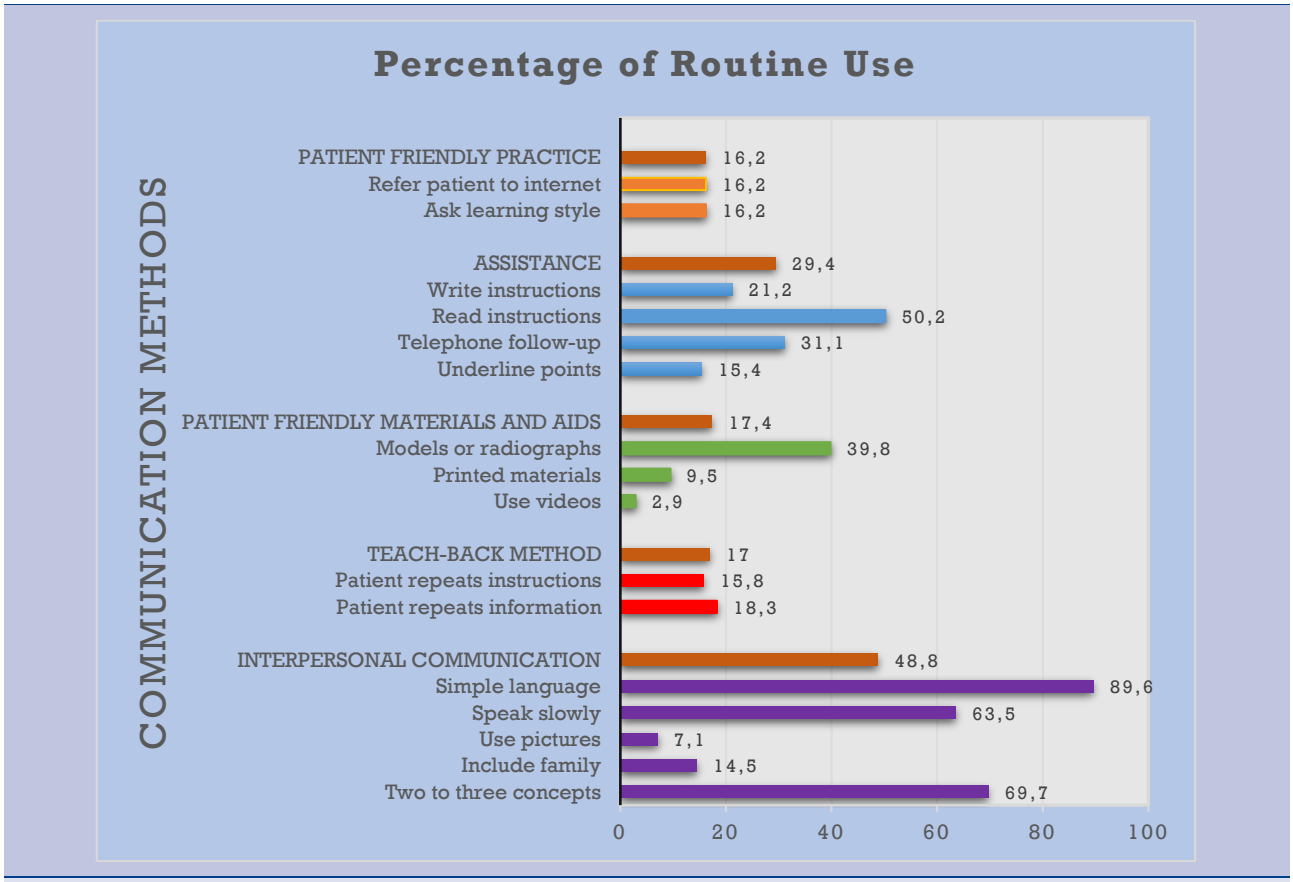

Figure 1. The routine uses of communication methods

Table 2. Percentage distribution of the participants, according to the frequency of use of communication methods and mean Likert scale scores.

DOMAIN Communication Methods	SAMPLE SIZE	DISTRIBUTION (%)					MEAN SCORE*
		Never	Rarely	Sometimes	Usually	Always	
Interpersonal Communication#		4.6	12.4	31.5	38.2	12.0	
Two to three concepts	241	0	1.7	29.0	56.8	12.4	3.80
Include family	241	21.6	34.4	29.5	11.6	2.9	2.40
Use pictures	240	46.5	29.9	16.2	6.6	0.4	1.84
Speak slowly	240	1.7	7.5	27.0	53.1	10.4	3.63
Simple language	241	0	1.7	8.7	62.7	27.0	4.15
Teach-back Method#							
Patient repeats information	241	19.5	29.9	32.4	16.6	1.7	2.51
Patient repeats instruction	241	22.0	30.7	31.5	13.3	2.5	2.44
Patient-Friendly Materials and Aids							
Use videos to explain	241	64.3	26.1	6.6	1.7	1.2	1.49
Printed materials	240	32.4	29.0	28.6	8.7	0.8	2.16
Use models or radiographs to explain	241	9.5	14.5	36.1	32.4	7.5	3.14
Assistance							
Underline points	239	33.2	22.8	28.2	12.4	2.9	2.29
Telephone follow-up	239	19.1	17.4	31.5	23.2	7.9	2.83
Read instructions out loud	239	5.8	13.3	29.9	37.3	13.0	3.38
Write instructions	240	24.9	25.7	27.9	15.0	6.3	2.52
Patient-Friendly Practice							
Ask learning style	240	39.0	25.3	19.1	13.7	2.5	2.15
Refer patient to internet	241	22.0	29.0	32.8	13.7	2.5	2.46

* Mean score on a five-point Likert scale (ranging from 1=never to 5=always).# 7 basic communication methods.

Table 3. Percentage distribution of participants. according to beliefs about the effectiveness of communication methods.

DOMAIN Communication Methods	Sample Size (Number)	Distribution (%)		
		Yes	No	Do not know
Interpersonal Communication#				
Present two to three concepts at a time	237	68.8	15.6	15.6
Ask patients whether they would like a family member or friend involved in the discussion	235	53.2	14.9	31.9
Draw pictures or use printed illustrations	235	54.9	15.3	29.8
Speak slowly	233	87.1	6.5	6.4
Use simple language	235	96.2	1.3	2.5
Teach-back Method				
Ask patient to repeat information back	234	57.3	11.1	31.6
Ask patient to repeat instructions back	236	58.5	10.6	30.9
Patient-Friendly Materials and Aids				
Use videos to explain	236	48.3	13.1	38.6
Hand out printed materials	234	62.8	11.1	26.1
Use models or radiographs to explain	236	81.8	5.5	12.7
Assistance				
Underline key points on print materials	236	66.5	11.0	22.5
Follow up with patients by telephone to check understanding and adherence	236	78.4	5.5	16.1
Read instructions out loud	236	82.2	3.0	14.8
Write or print out instructionstion	235	69.4	10.2	20.4
Patient-Friendly Practice				
Ask patients how they learn best	235	54.9	11.5	33.6
Refer patients to the internet for information	235	53.6	16.2	30.2

Table 4. Ordinary least squares regression results of predictor variables on number of communication methods routinely used.

VARIABLE	16 Communication Methods		7 Basic Communication Methods	
	Coefficient (Standard Error)	P-value	Coefficient (Standard Error)	P-value
Age	0.400 (0.326)	NS	0.333 (0.185)	NS
Gender#	0.309 (0.307)	NS	0.030 (0.174)	NS
Title*	-0.746 (0.273)	**0.007**	-0.129 (0.155)	NS
Health literacy awareness	-0.893 (0.350)	**0.011**	-0.532 (0.199)	**0.008**
Communication course	-0.284 (0.273)	NS	-0.218 (0.155)	NS
Barriers				
Lack of time	-0.133 (0.278)	NS	-0.031 (0.158)	NS
Awkwardness	-0.188 (0.237)	NS	-0.045 (0.135)	NS
Cannot simplify any further	-0.360 (0.231)	NS	-0.097 (0.131)	NS
Patient's language	-0.247 (0.241)	NS	-0.012 (0.137)	NS
Patient will not comply	-0.065 (0.207)	NS	-0.046 (0.118)	NS
Outcome expectancy	0.803 (0.192)	**<0.001**	0.301 (0.109)	**0.006**

#1=female, 2=male. *Title 1=4th-year, 2=5th-year, 3=resident and 4=faculty member. NS not significant.

Discussion

In our cross-sectional study, we created a questionnaire based on the study Rozier et al.9 conducted and also on our observations and we aimed to observe the attitudes of dentists and trainee dentists towards "aging", how often they used the recommended communication methods in communicating with "elderly" patients and whether they thought these methods were effective. When we look at the literature, no study was found on dentists/trainee dentists which the methods recommended in patient-physician communication were specifically evaluated in geriatric patients. In our study, geriatric patients were especially preferred.

The AMA and health literacy experts recommend 16 methods for dentists to use for improving communication with their patients. We observed that many of these communication methods were under-utilized and 241 participants in total, routinely used 4.63 of the 16 methods and only 2.61 of the 7 basic methods. We observed that a small number of methods were used routinely, contrary to the results of previous studies.[9,11,12] In a study9 Rozier et al. conducted on dentists in the USA, in which they did not impose any age restrictions on the patient population they communicated with, it was observed that they routinely used 7.1 of 18 methods and 3.1 of 7 basic methods. In the study12 on family physicians in the USA conducted by Weatherspoon et al., likewise without patient age restriction, it was observed that physicians routinely used 6.6 of 17 communication methods and 3.3 of basic methods. In their study[11] with nurses, Koo et al. concluded that nurses routinely used 8 of 17 methods and 4 of 7 basic methods. The number of communication methods questioned differed, but it was observed that nurses routinely used more of the 7 basic communication methods which were the same in terms of the methods included in all of the abovementioned studies. [9,11,12]

We observed that the dentists and trainee dentists who participated in our study thought that the lingual communication was the most important when communicating with the elderly and tried to keep their sentences simple and understandable. The most used methods were "simple language", "speaking slowly" and "using two to three terms at most". In the study by Rozier *et al.*[9], the most used method was "using a simple language" and it was followed by "explaining on models or radiographs", "speaking slowly" and "giving printed materials", respectively. In the studies conducted by Koo *et al*.[11] with nurses and Weatherspoon *et al.* with family physicians[12], the most frequently used methods were the methods that focused on linguistics, similar to our study. The abovementioned studies[9,11,12] were performed without age restriction in patients. This should be considered when evaluating the results because we think that restricting to only the elderly patients may affect the results of these studies.

Although studies observe that older people think positively about learning from videos and that older people also prefer it[14–16]; similar to the studies of Koo and Weatherspoon conducted, in our study, we found that the least used communication method was "using videos to explain". Stressing that the lack of time was the biggest barrier in the face of using various communication methods, "using videos to explain" can be a good communication method, as we can save time.

According to the social identity theory, outcome expectation affects the emergence of behavior.[17] Consistent with this, in our study, a positive correlation was found between outcome expectancy and the number of communication methods used routinely. In their study, Rozier *et al.* observed that as the outcome expectancy decreased, the number of routinely used methods also decreased. In the study of Koo *et al.* with nurses, the number of nurses believing in the effectiveness of the methods was higher than we dentists.

Contrary to the results of Weatherspoon *et al.*, in our study, having ever taken a communication course in addition to participants' dentistry education did not affect the number of routinely used communication methods, but there are many studies[2,18–20] emphasizing that taking a communication course affects the results positively.

Although teaching communication skills is not a part of the dental curriculum in our faculty, many schools abroad have established communication courses and consider it a central learning objective.[1,21–23] Interestingly, in our study, we observed that participants who had taken a communication course had significantly lower outcome expectations but studies on education and behavior change prove that taking health communication lessons from professionals can have a major impact on outcomes.[24] We think that if we ensure the necessary time to practice communication skills throughout the education, the students' self-confidence in interpersonal communication will increase and they will use these communication methods more frequently.

Health literacy, a term first proposed in the 1970s, generally relates to an individual's competence in the face of the complex demands of promoting and maintaining health in modern society.[25] According to the Health Promotion and Development Dictionary of the Ministry of Health of Turkey, health literacy is the cognitive and social skills that determine the motivation and ability of the individuals to access, understand and use information in ways that promote and maintain good health.[26] In the TSOY-32 study conducted in 2016, in which 400 people participated, it was found that the health literacy level of 69.4% of the study participants was insufficient or problematic.[8] It has been observed that individuals with insufficient or problematic health literacy have fewer check-ups for early diagnosis of diseases, are more careless about precautions, and occupy the emergency response units more.[27] In a study conducted in the USA, it was found that individuals with low health literacy had a higher prevalence of periodontitis.[28] Similar to Rozier *et al.*'s study9, which also questioned health literacy awareness as a criterion, the number of routinely used methods by survey participants with health literacy awareness was statistically significantly higher in our study. While the awareness rates of the dentists participating in the Rozier *et al.* study were close to each other, in our study, most of the participants were not aware of health literacy.

Trust is one of the most basic factors of the patient-physician relationship[29], and even patients with high health literacy have to trust their physicians in terms of giving correct information, keeping their private information confidential, and applying the necessary treatment in a way that is not missing or more. It was found that the OHIP-14 scores of the elderly patients who did not trust their physicians were significantly higher.30 Confidence is important for better perception and implementation of health services, and the effect of communication in creating the necessary trust has been emphasized in the studies.[31–33]

Conclusions

Our study observed that various communication methods that would strengthen communication with elderly patients and facilitate understanding and implementation of healthy behaviors found little practice in routine use. The fact that dentists and trainee dentists with low health literacy awareness use less number of communication methods shows that the health literacy awareness is not necessary only for the patients but also for the dentists. The authors of this article think that communication skills courses should be embedded into the curriculum and if we ensure the necessary time to practice communication skills throughout the education, the students' self-confidence in interpersonal communication will increase and they will use the recommended communication methods more frequently.

This study was carried out only with trainee dentists and dentists in our faculty, and the results should be evaluated in this context. Larger sample size studies are needed with dentists with a diversity of characteristics and different work conditions.

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Conflict of Interest

The authors have no conflicts of interest.

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Assessment of the Community Periodontal Index of Treatment Needs (CPITN) in Pregnant Women Referring to the Health Centers in Arak, Iran

Saeid Bashirian[1-a], Maryam Barati[2-b*], Majid Barati[1-c], Salman Khazaei[3-d], Leila Gholami[4-e], Ensiyeh Jenabi[5-f], Samane Shirahmadi[6-g]

[1]*Social Determinants of Health Research Center, Hamadan University of Medical Sciences, Hamadan, Iran.*
[2]*Department of Public Health, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran.*
[3]*Department of Epidemiology, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran.*
[4]*Department of Periodontics, Dental Research Center, Hamadan University of Medical Sciences, Hamadan, Iran.*
[5]*Autism Spectrum Disorders Research Center, Hamadan University of Medical Sciences, Hamadan, Iran.*
[6]*Department of Community Oral Health, School of Dentistry, Hamadan University of Medical Sciences, Hamadan, Iran*
**Corresponding author*

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ABSTRACT

Objectives: **:** Oral health during pregnancy is very important because of the immediate and long-term impact on women and children's health. The present study aimed at assessing the Community Periodontal Index of Treatment Needs (CPITN) in Pregnant Women Referring to the health centers in Arak, Iran.

Materials and methods: This is a cross-sectional, descriptive-analytical study that was conducted among 275 pregnant women visiting the health centers in Arak, Iran, in 2021. Cluster random sampling method was used to select the samples. The demographic information was gathered and oral examination was performed to determine the Community Periodontal Index of Treatment Needs (CPITN). The data were analysed by SPSS18 software, using multinomial logistic regression analysis.

Results: According to the results, the normal gingival status (code 0), Bleeding on probing (code1), dental calculus (code2), and periodontal pocket depth between 4 and 5 millimeters (code3) were observed of 44.7%, 17.5%, 36.4%, 5.1% of women, respectively. No periodontal pocket deeper than 6 millimeters (code4) was observed. Overall, 17.5% of these women needed oral health education, and 37.9% required scaling as well as oral health education; however, there were no pregnant women who required specialized treatment.

Conclusions: According to the CPITN measurement, pregnant women were not in good health condition in terms of gingival and periodontal disease and more than half of them required oral health education or treatment. The results of the present study provide experimental evidence that can be helpful in planning and identifying the priorities to promote oral health in pregnant women.

Keywords: Pregnancy, CPITN index, Periodontal Diseases, Brushing Frequency, Bleeding on probing.

[a] *s_bashirian@yahoo.com* *https://orcid.org/0000-0003-2133-087X*
[b] *barati85@gmail.com* *https://orcid.org/0000-0002-8174-2190*
[c] *barati@umsha.ac.ir* *https://orcid.org/0000-0002-5152-1928*
[d] *salmankhazaei61@gmail.com* *https://orcid.org/0000-0001-5918-2310*
[e] *l.gholami@hotmail.com* *https://orcid.org/0000-0001-5287-1754*
[f] *en.jenabi@yahoo.com* *https://orcid.org/0000-0001-6111-1538*
[g] *shirahmadi_s@yahoo.com* *https://orcid.org/0000-0002-3008-6613*
https://orcid.org/0000-0001-6386-8892

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Introduction

Oral health during pregnancy is very important because of the immediate and long-term impact on women and children's health.[1] Various conditions during pregnancy, such as vomiting and reflux, dryness in the mouth, and poor washing effect of the saliva can lead to an increase in tooth decay, and nausea, fatigue, and physical weakness may lead to poor oral hygiene during pregnancy.[2] Moreover, the gums undergo some changes during pregnancy due to hormones where the risk of suffering periodontal diseases increases.[2-5] The periodontal disease during pregnancy is considered to be significant because not only does it affect the tissues supporting the teeth, but also it is connected with systemic conditions such as adverse pregnancy outcomes (e.g., preeclampsia, eclampsia, abortion, preterm birth, low birth weight).[6-14] However, it is clear that the pregnant woman oral health is related to her general health.[15] In addition, poor oral hygiene and the quantity of plaque accumulation aggravates gingivitis. Bacterial plaque is a necessary primary etiology for gingivitis. In the absence of bacterial challenge, gingival tissues can remain in a healthy state during pregnancy.[16,17] whereas, some studies have shown that 36-53% of pregnant women receive dental care.[18-21] Therefore, providing data about periodontal status and treatment needs among pregnant women to those planning the oral health programs during pregnancy seems necessary. The prevalence of periodontal diseases in pregnant women has been determined in different populations worldwide, ranging from 3% to 90%. For example, the same rate is about 3.1% in the USA,[22] and it varied in African countries from 14.2% in Tanzania to 89% in Ghana[14,23-25], 73% in Indonesia, and it was 76% and 83.5% in Pakistan and Egypt respectively.[26,27] However, it should be considered that periodontitis includes a wide range of clinical symptoms from mild to severe, which can

eventually lead to gum destruction and tooth loss. Therefore, various methods such as the presence of subgingival calculus to radiographic evidence of alveolar bone loss are used to diagnose periodontal diseases in different stages of development. Thus, the prevalence estimates vary across studies. In Iran, oral and gingival health status was examined in a national survey in 2018[28]; however, there is limited information on periodontal disease in pregnant women in Iran.[29-31] Therefore, the present study aimed at assessing the Community Periodontal Index of Treatment Needs (CPITN) in Pregnant Women Referring to the health centers in Arak, Iran.

Material and Methods

This is a cross-sectional (descriptive-analytical) study that was conducted on 275 pregnant women visiting health centers in Arak, Iran, over July to September 2021. Cluster random sampling method was used to select the samples. As Arak is divided into five municipal districts, its health centers were divided based on the five districts. A number of health centers were randomly selected from among the health centers of each district (18 health centers out of the 50 centers: 4 centers in Region 1, 2 centers in Region 2, 5 centers in Region 3, one center in Region 4, and 6 centers in Region 5) using cluster sampling method and considering the population of that district. The total number of pregnant women covered by the selected health centers were extracted from the sib website (https://sib.iums.ac.ir) and the sample size allocated to each health center was selected using simple sampling method. The sampling chart is presented in Figure 1.

Inclusion and exclusion criteria:

The inclusion criterion was having a pregnancy record in one of the health centers of Arak. The exclusion criteria were wearing fixed or removable braces, having complicated problems during pregnancy, being under 18, or not having enough teeth to determine the index. women should be systemically healthy.

In the present study, the demographic information including age, education, number of children, gestational age, insurance status, and pregnant woman's job, and brushings frequency was collected by the questionnaire. Oral examination was performed to assessing periodontal status. In this study, the Community Periodontal Index of Treatment Needs (CPITN) proposed by WHO was used to determine gingival health.[32]

An oral hygienist performed all the examinations based on WHO recommendations for determining the CPI. He was calibrated by the dental clinic of Arak health center at the Arak University of Medical Sciences. The oral hygienist had worked in the dental clinic of Arak health center for 2 years and performed oral examinations for different groups, including pregnant women. The Kappa agreement between the examiner and dental clinic were 0.91.

The objectives of the study were explained. If pregnant women consented to participate in the study, they were included in the study. Informed consent was completed by all participants. The oral hygienist performed all the examinations at the health centers and in a separate room. Each pregnant woman sat on a chair and a headlamp was used as a light source. Each examination lasted about 10 minutes and the scores determined for each tooth were announced by the oral hygienist while being registered by the oral hygienist's assistance in the table of any given person. After completing the questionnaire and oral examination, they were educated about the importance of oral hygiene during pregnancy.

The CPI index was measured in 10 index teeth (17,16,11,26,27,47,46,31,36,37) and six sextants (17–14, 13–23, 24–27, 37–34, 33–43, 44–47). The probing was carried out around the tooth and in 6 parts, including buccal, mesiobuccal, distobuccal, lingual, mesiolingual, and distolingual, using WHO CPI probe, and a dental mirror. CPI probe has a 0.5-mm ball tip, and a black ring at a distance of 3.5 millimeters and 5.5 millimeters, and also in the 8.5 millimeters to 11.5 millimeters. After 30 seconds of probing each part, the bleeding or non-bleeding in each part was registered.

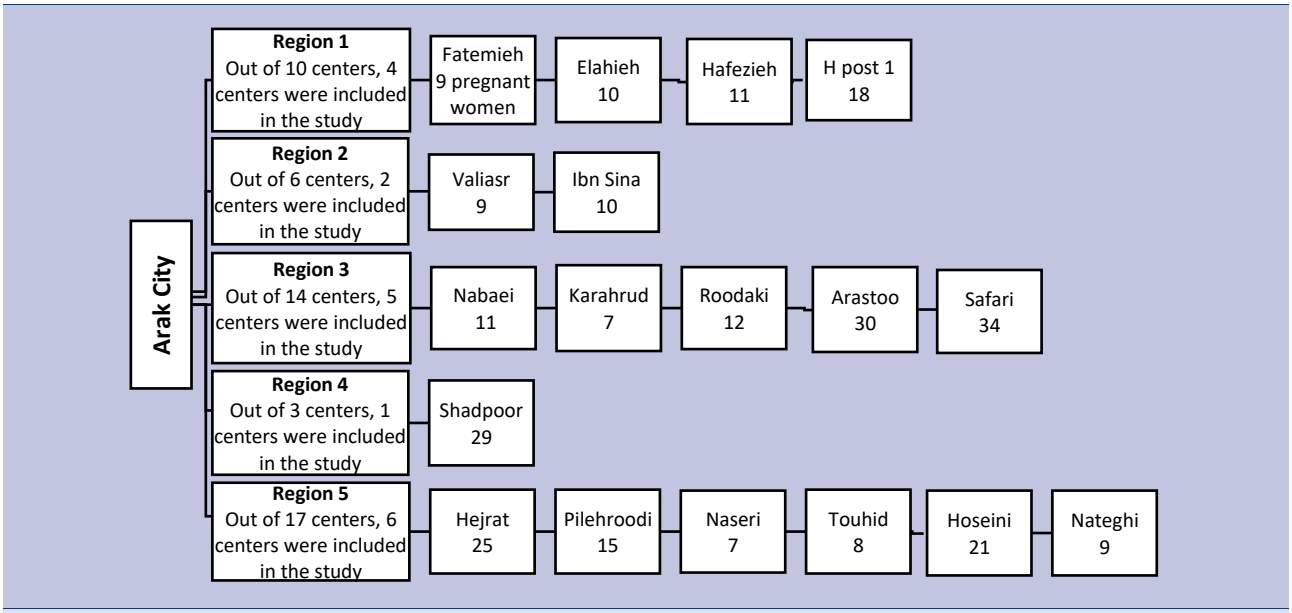

Figure 1. Multistage sampling strategy across five districts in Arak

The scores of each tooth were registered, and the highest score for each sextant was considered. Then, the highest registered code was considered the index for each person. There had to be at least two teeth to determine the index in each sextant. If none of the index teeth were present, all the teeth in the sextant were examined. In this index, code 0 indicates that the gum is healthy and that it required no treatment, code 1 indicate bleeding after probe and the depth less than 3 mm requiring education about oral health, code 2 indicates dental plaque and dental calculus observed or felt by probing requiring education about oral health and scaling, code 3 indicates pathological pocket deeper than 3 millimeters and less than 6 millimeters requiring education about oral health and also scaling. Code 4 indicates the pathological pockets that are 6 millimeters or deeper, requiring education about oral health, scaling and also advanced periodontal treatments.[33]

The Ethics Committee of Hamadan University of Medical Sciences approved this study (approval code: IR.UMSHA.REC.1399.863) (approval date: 2021 January 9). All methods were performed in accordance with the relevant guidelines and regulations. Informed consent was completed by all participants.

Data were analyzed by SPSS software version 18 using the descriptive statistics, cross-tabulation, and multinomial logistic regression. Healthy gum (code0) was considered as the reference group, and groups with different demographic characteristics, and tooth brushing frequency were compared with this group (healthy gum) in terms of the possibility of having bleeding on probing and dental calculus. Participants with code 3 (4 participants) and code 2 (100 participants) were combined to perform the analysis. The confidence interval of 95% was considered for the odds ratio.

Results

The mean age of participants was 29.67±5.54 ranging from 18 to 46. One hundred and forty-six of (53.1%) women were in the third trimester, and 123 (44.7%) of women experienced their first pregnancy where most of them (88%) were housewives. The findings indicated that half of the participants brushed once a day (58.5%), and 24% brushed twice or more. The demographic characteristics of the participants and distribution of CPI according to demographic characteristics and daily brushing frequency are provided entirely in Table 1.

The CPITN assessment of pregnant women showed that 17.5% of pregnant women had bleeding on probing (BOP) (code 1). In addition, 36.4% of women had dental calculus (code 2). Most cases of BOP and dental calculus were observed in lower anterior teeth. 1.5% percent of participants had periodontal pocket depth measuring 4mm to 5mm (code 3); however, no pocket deeper than 6mm (code 4) was observed. Overall, 44.7% of the pregnant women had healthy gums requiring no treatment while 17.5% of these women needed education about oral hygiene, and 37.9% required scaling as well as education about oral health; however, there were no people requiring specialized treatment (Table 2).

Table 1. Distribution of CPITN according to demographic characteristics and daily brushing frequency

Characteristics	Categories	N(%)	CPITN			
			Healthy N (%)	Bleeding on probing N (%)	Calculus with plaque seen or felt by probing N (%)	Pathological pocket (4 – 5 mm) N (%)
Age(year)	Under 25 years	63(22.9)	29(46.03)	17(26.98)	16(25.39)	1(1.58)
	26 to 35 years	168(61.1)	75(44.64)	26(15.47)	64(38.09)	3(1.78)
	More than36 years	44(16)	19(43.18)	5(11.36)	20(45.45)	0(0)
Education	Under diploma	53(19.2)	18(33.96)	12 (22.64)	21(39.62)	2(3.77)
	Diploma	116(42.5)	48(41.37)	17(14.65)	49(42.24)	2(1.8)
	Academic	106(38.5)	57(53.77)	19(17.92)	30(28.03)	0(0)
Number of children	No children	123(44.7)	63(51.21)	24(19.51)	34(27.64)	2(1.62)
	One child	98(35.6)	41(41.83)	17(17.34)	40(40.81)	0(0)
	Two or more children	54(19.6)	19(3.18)	7(12.96)	26(48.14)	2(3.7)
Gestational age	First trimester	26(9.5)	10 (38.46)	1(3.84)	15(57.69)	0(0)
	Second trimester	103(37.5)	50(48.54)	20(19.41)	32(31.06)	1(0.97)
	Third trimester	146(53.1)	63(43.15)	27(18.49)	53(36.30)	3(2.05)
Insurance status	Yes	233(84.7)	106(45.49)	40(17.16)	84(35.5)	3(1.28)
	No	42(15.3)	17(40.47)	8(19.04)	16(38.09)	1(2.38)
Occupation	Housewife	242(88)	104(42.97)	46(19.08)	88(36.36)	4(1.65)
	Employee	33(12)	19(55.57)	2(6.06)	12(36.36)	0(0)
Tooth brushing frequency	Once every two or three days	48(17.45)	10(2.08)	13(27.08)	23(47.91)	2(4.1)
	Once a day	161(58.54)	70(43.47)	26(16.14)	63(39.13)	2(1.24)
	Twice a day or more	66(24)	43(65.15)	9(13.63)	14(21.21)	0(0)

Table 2. CPITN (Community Periodontal Index of Treatment Needs) among studied pregnant women (n=275)

CPITN	Percentage	Number
No periodontal disease (code 0)	4.7	123
Bleeding on probing (code1)	17.5	48
Calculus with plaque seen or felt by probing (code 2)	36.4	100
Pathological pocket 4 – 5 mm (code 3)	1.5	4
Pathological pocket 6 mm or more (code 4)	0	0

Table 3. Relationship between demographic factors and frequency of tooth brushing with CPI using multinomial logistic regression analysis

Predictor variables		Bleeding on probing		Calculus with plaque seen or felt by probing& Pathological pocket (4 – 5 mm)	
		OR (CI 95%)	P-value	OR (CI 95%)	P-value
Age(year)	Under 25 years	Reference		Reference	
	26 to 35 years	0.45 (0.12-1.70)	0.242	1.60 (0.56-4.50)	0.374
	More than36 years	0.52 (0.21-1.26)	0.148	1.20 (0.55-2.63)	0.637
Education level	Under diploma	1.02 (0.36-2.92)	0.962	1.54(0.62-3.85)	0.353
	Diploma	0.66 (0.28-1.56)	0.348	1.65(0.82-3.29)	0.154
	Academic	Reference		Reference	
Number of children	No children	Reference		Reference	
	One child	1.12 (0.34-3.64)	0.844	1.79(0.74-4.25)	0.187
	Two or more children	1.50(0.66-3.42)	0.331	1.53(0.78-2.97)	0.209
Gestational age	First trimester	Reference		Reference	
	Second trimester	4.79(0.56-40.50)	0.150	0.72 (0.28-1.84)	0.497
	Third trimester	4.32(0.50-37.12)	0.182	0.50(0.18-1.33)	0.167
Insurance status	Yes	Reference		Reference	
	No	1.24 (0.45-3.39)	0.674	1.12(0.50-2.50)	0.780
Occupation	Housewife	3.20(0.66-15.49)	0.148	0.84(0.34-2.08)	0.717
	Employee	Reference		Reference	
Tooth brushing frequency	Once every two or three day	**6.27(1.97-19.94)**	**0.002**	**6.57(2.40-18.01)**	**0.000**
	Once a day	1.71(0.71-4.12)	0.228	**2.57 (1.24-5.33)**	**0.011**
	Twice a day or more	Reference		Reference	

The reference category is: healthy. CI, confidence interval; OR, odds ratio. Significance level P<0.05.

The results of the present study showed that there were no significantly relationships between demographics characteristics and CPI scores. Moreover, the results concerning brushing frequency and CPI showed that pregnant women who brushed their teeth every two or three days, were 6.27 times more likely to have bleeding on probing than the ones who brushed their teeth twice a day (OR: 6.27, 95%CI: 1.97-19.94). Moreover, the results show that women who brushed their teeth every two or three days (OR: 6.57, 95%CI: 2.40-18.01) or once a day (OR: 2.57, 95%CI: 1.24-5.33) were more likely to have dental calculus and periodontal pockets (4-5mm) than the ones who brushed their teeth twice a day (Table 3).

Discussion

The present study aimed at assessing the Community Periodontal Index of Treatment Needs (CPITN) in Pregnant Women Referring to the health centers in Arak, Iran. The measurement of CPITN in the present study showed that 17.5% of pregnant women needed to oral health education for the mild periodontal disease. However, 37.9% of the participants needed professional cleaning and plaque removal in addition to improved personal oral hygiene practices. Many studies have been conducted on this issue in different communities. The results of these studies vary and range from 3.1% to 89%.[5,22-24,34,35] The prevalence of periodontal diseases in Iran varied, from 40% to 70%.[26,30,31,36] The differences could originate from different socio-cultural backgrounds and other indices and definitions for periodontal diseases. In Wandera's study among 713 pregnant women in Uganda using the CPITN index, 67.3% of the participants received a code>0.[24] In Abdal's study, among pregnant women in Ilam, according to the CPTIN index, 70% received code>0 (Healthy gum=30%, bleeding on probing=18%, calculus=36%, and periodontal pocket (4-5mm)=16%).[29] The Gesase's study among 1117 pregnant women in Tanzania showed the 14.2% prevalence of gum disease using CPI (code>0). The low prevalence rate in the Gesase study could have been influenced by the location of the study (in an urban area with good education).[14]

According to the results of the present study, BOP and dental calculus observed in pregnant women were 17%

and 36.4% respectively, that were consistent with the studies in Iran by Meybodi,[37] Dehghanipour[31], Taheri[30], Abdal[29] and also in other countries.[34,38] However, the rates of BOP in the study by Lasisi[23] in Nigeria and by Wandera[24] in Uganda were significantly lower (5.2% and 3.3%, respectively). As opposed to their low BOP rates, the dental calculus in the mentioned studies were much more than those in the present study (87% and 63%, respectively). Considering that BOP is one of the early symptoms of gingival diseases while the accumulation of dental calculus occurs in the long run, thus the high rates of dental calculus in different societies may indicate the oral health habits of women before pregnancy.

Additionally, the results showed that the odds of having BOP were greater in pregnant women who brushed their teeth once every two or three days than pregnant women who brushed their teeth twice a day. However, the probability of having BOP was not higher in women who brushed their teeth once a day than in women who brushed their teeth twice a day. In the Martinez *et al.* 's study[39] among pregnant women living in southeast Spain showed that the increased frequency of tooth-brushing was associated with lower scores for CPI and BOP. While, in Gil *et al.*'s study[38], among pregnant women, no significant relationship was found between BOP and brushing frequency. Also in Dehghanipour's study,[31] which was conducted among 407 pregnant women in Varamin, the probability of BOP in pregnant women who brushed their teeth less than once a day was not higher than those who brushed their teeth more than once a day. In general, it seems necessary to emphasize daily brushing in the prevention of early symptoms of periodontal diseases.

In addition, the results showed that the odds of having dental calculus and periodontal pockets were greater in pregnant women who brushed their teeth once every two or three days, and once a day than pregnant women who brushed their teeth twice a day or more. In general, in other studies, specifically conducted on pregnant women there were relationship between daily brushing and pregnant women's gingival health.[30,38,40,41] The evidence showed that effective control of dental plaque is critical to gingival health, and the prevalence of gingivitis in women without dental plaque was much lower than those with it.[38,42-44] Therefore, providing instructions about frequency, time, and correct method of tooth brushing can be effective. Comparison of the results of the present study with the results of the previous study in Arak,[45] showed that daily brushing frequency in pregnant women has increased overall. However, as the results of this study indicated, only 24% of pregnant women brushed their teeth twice a day, indicating the need for more oral hygiene education in pregnant women.

As mentioned, periodontal diseases are determined by different methods in different stages of development, but in the studies aiming at examining the periodontal disease status in a large population, the use of CPITN is a cost-effective, simple, and quick screening method and considering the mission to promote public health it seems to be an appropriate method applied to answer the two questions, namely the number of people in the community at the risk of periodontal disease progression, and the treatment they need. Although the original CPI index has limitations, such as evaluating the periodontal pocket and not considering loss of attachment.[46-48]

Since sampling was done from all of the health centers in the city, and health centers cover about 85% of the total pregnant women in the city, the sample size can be representative of the target community, although it is recommended to conduct a study in rural areas with different socio-cultural backgrounds. Also, most of the pregnant women visiting health centers were in the second and third trimesters of pregnancy. Because after the diagnosis of pregnancy, the pregnant women visit the private centers to receive prenatal care. Then they go to health centers in the second and third trimesters to file a pregnancy record or were identified by the health center staff.

Conclusions

In the present study, according to the CPITN measurement, pregnant women were not in good health condition in terms of gingival and periodontal disease and more than half of them required oral health education or treatment. The results of the present study provide experimental evidence that can be helpful in planning and identifying the priorities to promote oral health in pregnant women.

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Conflicts of Interest statement

The authors declare no conflict of interest, financial or otherwise.

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Retrospective Evaluation of Maxillofacial Fractures With Cone-Beam Computed Tomography

Emre Haylaz[1,a,*], Gediz Geduk[1,b], Çiğdem Şeker[1,c], Murat İçen[2,d]

[1]*Department of Oral and Maxillofacial Radiology, Zonguldak Bülent Ecevit University Faculty of Dentistry, Zonguldak, Türkiye*
[2]*Department of Oral and Maxillofacial Radiology, Nevşehir Hacı Bektaş Veli University, Nevşehir, Türkiye*
**Corresponding author*

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ABSTRACT

Objectives: The aim of this study is to evaluate the distribution, localization, number, presence of displacement and radiological features of fractures in the maxillofacial region according to age and gender retrospectively by using Cone-Beam Computed Tomography (CBCT).

Methods: CBCT images taken from 84 patients who applied to Zonguldak Bülent Ecevit University Faculty of Dentistry, Oral and Maxillofacial Radiology Department between 2019 and 2021 due to trauma were retrospectively analyzed. Age, gender, fracture localization, and the presence of displacement in fractures were recorded. For statistical analysis, descriptive and frequency analyzes were applied to the entire patient group, while age and gender of the patients; Chi-square test was used when comparing with the fracture line and the fracture site.

Results: CBCT images of a total of 84 patients, 60 male and 24 female (M/F, 2.5/1) due to maxillofacial trauma, were examined. The number of 116 fracture lines occurring in various localizations due to different etiological reasons was detected radiologically. While displacement was observed in 73 of all fractures examined, displacement was not observed in the remaining 43 fracture lines. Fractures that occurred were most frequently detected in the mandibular angulus (22.61%:n=19). The least fractures were seen in the ramus of the mandible (3.57%; n=3) and coronoid process (3.57%; n=3).

Conclusions: Detection of the presence of fracture lines, their localization and displacement of fracture fragments through accurate radiographic techniques is important for the implementation of the necessary treatment procedures. In cases where the use of two-dimensional radiographs is insufficient, three-dimensional imaging methods such as CBCT should be preferred.

Keywords: Cone-Beam Computed Tomography, Fracture, Mandible, Diagnosis.

Maksillofasiyal Kırıkların Konik Işınlı Bilgisayarlı Tomografi ile Retrospektif Değerlendirilmesi

Süreç

Geliş: 17/05/2022
Kabul: 17/07/2022

ÖZ

Amaç: Bu çalışmanın amacı maksillofasiyal bölgede meydana gelen fraktürlerin yaş ve cinsiyete göre dağılımlarını, lokalizasyonlarını, sayısını, deplasman varlığını, radyolojik özelliklerini Konik Işınlı Bilgisayarlı Tomografi (KIBT) ile retrospektif olarak değerlendirmektir.

Gereç ve Yöntem: Zonguldak Bülent Ecevit Üniversitesi Diş Hekimliği Fakültesi, Ağız Diş ve Çene Radyolojisi Anabilim Dalı'na 2019 ve 2021 yılları arasında travma nedeniyle başvuran 84 hastadan alınan KIBT görüntüleri retrospektif olarak incelenmiştir. Yaş, cinsiyet, fraktür lokalizasyonu, fraktürlerde deplasman varlığı kayıt altına alındı. İstatistiksel analiz için tüm hasta grubuna tanımlayıcı ve frekans analizleri uygulanırken, hastaların yaş ve cinsiyetlerini; fraktür hattı ve fraktür bölgesi ile karşılaştırırken ki-kare testi uygulandı.

Bulgular: 60 erkek 24 kadın hasta (E/K, 2,5/1) olmak üzere toplam 84 hastanın maksillofasiyal travma nedeniyle KIBT görüntüsü incelendi. Çalışmada incelenen hasta grubunun yaşları 6 ve 72 arasında değişmekte olup yaş ortalaması 33.17±1.48 olarak belirlendi. Farklı etiyolojik nedenlerden kaynaklı çeşitli lokalizasyonlarda meydana gelen 116 fraktür hattı sayısı radyolojik olarak tespit edildi. İncelenen tüm fraktürlerin 73'ünde deplasman izlenirken kalan 43 fraktür hattında deplasman görülmedi. Meydana gelen fraktürler en sık angulus mandibulada (%22,61:n=19) tespit edildi. En az fraktür mandibula ramus (%3,57; n=3) ve koronoid proseste (%3,57; n=3) görüldü.

Sonuçlar: Fraktür hatlarının varlığının, lokalizasyonlarının ve kırık parçalarının yer değişiminin doğru radyografik teknikler aracılığıyla tespit edilmesi, gerekli tedavi prosedürlerinin uygulanması açısından önem taşımaktadır. İki boyutlu radyografilerin kullanımının yetersiz kaldığı durumlarda KIBT gibi üç boyutlu görüntüleme yöntemleri tercih edilmelidir.

Anahtar Kelimeler: Konik Işınlı Bilgisayarlı Tomografi, Fraktür, Mandibula, Teşhis.

[a] *emrehylz03@gmail.com* *https://orcid.org/0000-0001-7330-9525*
[b] *gedizgeduk@gmail.com* *https://orcid.org/0000-0002-9650-2149*
[c] *cgdmdmrhn@gmail.com* *https://orcid.org/0000-0001-8984-1241*
[d] *drmuraticen@gmail.com* *https://orcid.org/0000-0002-2779-5646*

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Introduction

The maxillofacial region is one of the most traumatized areas in the human body. Its etiology and prevalence may vary in different populations. While traffic accidents are reported as the most common cause, home and work accidents, assault and sports injuries play a role in the etiology.[1,2] In the pediatric group, falls and traffic accidents are the most frequently reported causes.[3] Considering the etiological factors by gender, assault in men and traffic accidents in women have been reported as the most important factors in the literature.[4]

Fractures occurring in the maxillofacial region are most commonly seen in the nasal bones, while mandible fractures taking the second place.[5] Since the mandible has a distinct anatomical structure, it is more likely to be damaged due to trauma.[6] Maxillofacial trauma may cause serious clinical problems due to the characteristics of this anatomical region. As a result of fractures of the mandible, hypoesthesia, malocclusion, joint problems, damage to the teeth, and airway problems occur in the lower jaw.[7,8]

Fractures may occur isolated or may be more complex by affecting adjacent soft and hard tissues. Radiological imaging is essential for initial diagnosis and treatment planning.[9,10] The aim of radiological imaging is to show the fractures presence, localization, prevalence, displacement of fragments and foreign bodies of fractures caused by trauma, and also plays a major role in the recovery and maintenance period after treatment.[11]

In the diagnosis of maxillofacial trauma physical examination should be performed. Crepitation, tenderness, and occlusion disorders should be carefully evaluated on physical examination. Following the physical examination, conventional two-dimensional radiography and, if necessary, advanced three-dimensional imaging should be used.[12] Two-dimensional conventional radiographs are insufficient to determine the exact location and number of the fracture line in the visualization of complex fractures in the maxillofacial region. Computed Tomography (CT) is a commonly used imaging method in trauma patients. On the other hand, the use of CT in dentistry is limited due to the high dose and cost, the need for a larger area and limited accessibility. While Cone Beam Computed Tomography (CBCT) eliminates these problems, it also provides many advantages in the field of dentistry.[13-15]

Patients apply to dentistry clinics with many complaints and radiographic images are often needed to diagnose the problem. In cases where a complete diagnosis cannot be made with conventional rontgen techniques, it becomes necessary to resort to advanced imaging methods such as CBCT.[16]

The aim of this study is to determine the distribution of fractures occurring in the maxillofacial region by age and gender, localization, numbers, presence of displacement, and radiological features retrospectively with CBCT.

Material and Methods

CBCT (Veraviewapocs 3D R100 (J. Morita Corp., Kyoto, Japan)) images taken from 84 patients who applied to Zonguldak Bülent Ecevit University Faculty of Dentistry, Department of Oral and Maxillofacial Radiology between 2019 and 2021 due to trauma were retrospectively analyzed. Prior to the study, the approval of the Non-Interventional Clinical Research Ethics Committee of Zonguldak Bülent Ecevit University (2022/02 decision no.) was obtained.

In our study, factors such as age, gender, fracture localization were recorded from the patients who applied to the clinic. Fractures were classified as displaced and non-displaced. Single or multiple fracture lines were recorded. Fractures diagnosed in the study were modified according to the fracture classification of Harorlı et al. and classified as mandible, condyle and maxillofacial bone fractures.[17] Fractures in the mandible were subdivided according to their localization as coronoid process fractures, mandibular ramus, angulus, corpus, mandibular alveolar process, symphysis and parasymphysis fractures (Figure 1, 2, 3). Condyle fractures; condylar head-condylar neck and subcondylar region fractures were divided into two.[18] Maxillofacial fractures; they were grouped as maxillary alveolar process, pterygoid process, nasal bone fractures, maxillary sinus wall, zygoma and orbital fractures.[17]

Statistical Analysis

For statistical analysis, descriptive and frequency analyzes were applied to the entire patient group, while age and gender of the patients; Chi-square test was used when comparing with the fracture line and the fracture site. SPSS 22.0 Software Package Program (SPSS 22.0 Software Package Program, Inc. Chicago, IL, USA) was used as statistical software in the study. The p value was accepted as 0.05 in all tests.

Results

Between 2019 and 2021, CBCT images were obtained from 60 male and 24 female patients (M/F, 2.5/1) out of 84 patients due to maxillofacial trauma. Accordingly, the number of 116 fracture lines occurring in various localizations due to different etiological reasons were detected radiologically. Considering the gender distribution of the examined patient group, 80 (69%) of the fracture lines were detected in male patients and 36 (31%) in female patients. While displacement was observed in 73 of all fractures examined, displacement was not observed in the remaining 43 fracture lines.

While the mean age of the patient group examined in the study was determined as 33.17±1.48, the minimum age was 6 and the maximum age was 72. In order to compare gender, fracture site, localization, and the presence of displacements, patients were divided into three groups, aged 6-27, 28-50 and 51-72. The age range with the highest number of patients was the 28-50 age group with 38 patients.

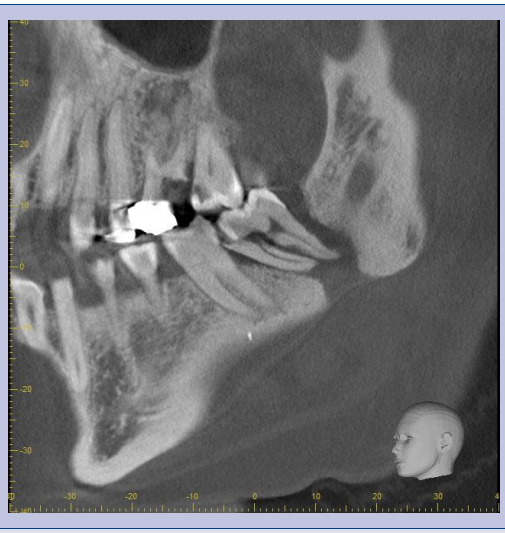

Figure 1. Vertical fracture line in the left mandible angulus region

Figure 2. Oblique fracture line in the left mandible symphysis region

Figure 3. Three-dimensional reconstruction of the symphysis fracture in Figure 2.

Age groups were divided into three groups at equal intervals in order to perform statistical tests. There were only 11 patients in the 51-72 age range, and there were 35 patients in the 6-27 age range. In the CBCT images of the patients examined, the mandible was the bone with the most fractures, with 61 fracture lines in 48 patients. Only mandibular bone fracture line is present in 30 patients. Mandible fractures were accompanied by condyle and maxillofacial region fractures in 18 patients.

Fracture lines in the maxillofacial bones were the second most common site. Fractures were detected in 54 patients in this region. While only maxillofacial bones were broken in 36 patients, fracture lines were seen in both mandibular and maxillofacial regions in 18 patients. Of the total fracture lines, 61 (52.6%) were detected in the mandibular region, 32 (27.6%) in the maxillofacial region, and 23 (19.8%) in the condyle region (Table 1). When the gender-fracture region and gender fracture line localization of the patients were compared with the chi-square test, no statistically significant results were found ($p>0.05$).

A statistically significant difference was found when the age ranges and fracture region were compared in the examined patient group. ($p<0.05$) (Table 1)

The localization of the fracture line are divided into 13 different regions, and their numbers along with the regions are given in Table 2.

The highest number of fracture lines (n=84) was observed in the mandible in all age groups. The most fracture lines were detected in the angulus (22.61%; n=20) region in the mandible. It is followed by the condylar head-condylar neck (21.42%;n=17), symphysis (14.28%; n=12), corpus (13.09%;n=11), parasymphysis (8.33%;n=7) in order of frequency, subcondylar area (7.14%;n=6) and mandibular alveolar process (5.95%;n=5). The regions with the least fractures in the mandible were found in the coronoid process (3.57%;n=3) and ramus (3.57%; n=3) (Table 1,2).

A total of 32 fracture lines were observed in the maxillofacial region. Fracture localizations were highest mostly detected in maxillary alveolar process (%62,5;n=20), maxillary sinus wall (%21,87;n=7) , zygoma (%9,37;n=3) and nasal bone (%6,25;n=2) respectively. No fracture lines were detected in the orbit (Table 1,2).

Discussion

The epidemiology of fractures occurring in the maxillofacial region; It has varied over time depending on the geography, socioeconomic status, cultural structure, lifestyle of the society and the level of development of the societies.19,20 Studies have linked the main causes of maxillofacial fractures to traffic accidents and interpersonal fights.[21]

The age range of 28-50 constitutes the age range with the highest number of fractures, with 38 patients in our study. This result shows the similarity of our study with the literature. As a result of the researchers, it has been reported that fractures are seen mostly between the ages of 20 and 50.

Table 1. Distribution of age group and number of fracture lines by region

Age Groups		Fracture Region			
		Mandible	Condyle	Maxillofacial	Total
Group 1 (6-27)	n	30	4	15	49
	%	61.2%	8.2%	30.6%	100.0%
Group 2 (28-50)	n	22	16	15	53
	%	41.5%	30.2%	28.3%	100.0%
Group 3 (51-72)	n	9	3	2	14
	%	64.3%	21.4%	14.3%	100.0%
Total	n	61	23	32	116
	%	52.6%	19.8%	27.6%	100.0%

Table 2. Distribution of detected fracture line localizations

Fracture Localizations	n	percent
Condyle Head- Condyle Neck	17	15.5%
Subcondylar Region	6	5.2%
Coronoid Process	3	2.6%
Ramus	3	2.6%
Angulus	20	16.4%
Corpus	11	9.5%
Mandible Alveolar Process	5	4.3%
Symphysis	12	10.3%
Parasymphysis	7	6.0%
Maxillary Alveolar Process	20	17.2%
Nasal Region	2	1.7%
Maxillary Sinus Wall	7	6.0%
Zygoma	3	2.6%
Orbit	-	0%
Total	116	100%

Table 3. Results of some studies on mandibular fractures

Authors	Year	Country	M/F	Age Range	Most Frequent	Least
Barde et al.[30]	2022	India	M >F	7-89 years	Parasymphysis (32%) Condylar Region (18%) Angulus (18%)	Coronoid Process (0.8%)
Kumar et al.[31]	2015	India	M >F	1-77 years	Parasymphysis (33%) Condylar Region (31%) Angulus (15%)	Coronoid Process (0.4%)
Devarakonda et al.[32]	2020	India	M >F	9 months to – 72 years	Parasymphysis (34.6%) Condylar Region (24.1%) Angulus (14.4%)	Coronoid Process (1.2%)
Buch et al.[33]	2016	USA	M >F	8 months to – 95 years	Angulus (34%) Condylar Region (27%) Alveolar Proses (12%)	Parasymphysis (3%)
Demirdover et al.[34]	2018	Turkey	M >F	1-86 years	Parasymphysis-symphysis (50.5%) Angulus- Ramus (27.6%) Corpus (19%)	Coronoid Process (1.8%)
AlHammad et al.[35]	2020	Saudi Arabia	M >F	15-34 years	Condylar Region (%25) Angulus (18%) Corpus (18%)	Coronoid Process (2%)
Hoşgör et al.[36]	2019	Turkey	M >F	7- 65 years	Angulus (%34.6) Parasymphysis (17.8%) Simfiz (11.8%)	Ramus (0.9%)
Lee et al[37]	2020	Korea	M >F	18-61 years	Symphysis-Parasymphysis (30.43%) Ramus (18.84%) Condylar Region (18.84%)	Corpus (1.44%)
Clevelan et al.[38]	2021	USA	M >F	0-18 years	Condylar Region (30.8%) Symphysis (27.9%) Angulus (25.6%)	Coronoid Process (1.4%)

M/F: Distribution of Gender Number (Male/Female)

Fractures are more likely to occur because this age group is more outdoors and more socially active.[22-25] Studies have shown that men are exposed to more maxillofacial trauma than women.[21,26,27] In another study conducted in Nigeria, it was stated that maxillofacial fractures are more common in women due to the fact that women have to work more in the external environment.[28] In our study, it was determined that the number of male was higher than female in all age groups, and this ratio was 2.5 / 1 in the total number of patients.

In our study, the bone with the highest number of fractures was found to be the mandible with 84 fractures. This result is consistent with Iida *et al.*'s conclusion that the mandible is one of the most frequently fractured facial bones due to its localization, protruding bone and lack of abutment point, although the etiologic causes are different.[29] In our study, we found the most common angulus fracture in the mandible. This was followed by the condyle head and neck, and then the symphysis region. The least fracture was detected in the coronoid process. The results found were similar the studies in the literature. Some studies in the literature are shown in Table 3.

In the radiographic images, the fracture lines are observed as sharp radiolucent lines within the anatomical borders of the mandibular structures.[39] Although there is a despite suspected fracture according to clinical examination findings, three-dimensional imaging techniques such as CT, CBCT and MRI should be used in the diagnosis of complicated fractures where the fracture line cannot be detected by two-dimensional imaging methods.[40,41] Three-dimensional imaging techniques allow imaging of the traumatized regions in sagittal, coronal, and axial planes, thus eliminating superpositions of adjacent structures. In this way, detailed radiographic examination of trauma regions, especially symphysis and condyle fractures without displacement, can be performed and diagnostic accuracy is increased.[42,43] It is reported that the sensitivity of CT in detecting mandible fractures is close to 100%.[44,45] However, it is argued that CBCT images are superior to CT images in the examination of hard tissues of the dental region.[46] CBCT also stands out with its higher spatial resolution, lower radiation dose, and less exposure to beam hardening artifact caused by metal structures. However, its inability to visualize soft tissues compared to CT poses a significant disadvantage for trauma patients.[42,47] According to these literatures, the use of CBCT in dentistry faculties, as in our study, appears to be a more practical method for the detection of fracture lines.

Conclusions

As a result of our study in accordance with the literature, fracture cases were mostly detected in young-adult individuals. This rate is higher in men than in women. In our study, it was determined that fractures mostly occur in the mandible. Detection of the presence of fracture lines, their localization and displacement of fracture fragments through accurate radiographic techniques is important for the implementation of the necessary treatment procedures. The use of two-dimensional radiographs is mostly limited to isolated fracture cases and minor traumas, so in cases where these radiographs are insufficient, three-dimensional imaging methods such as CBCT should be preferred for detailed information and definitive diagnosis.

Conflicts of Interest Statement

The authors have no conflicts of interests.

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Evaluation of Calcium Hydroxide Removal Efficiency of Different Irrigation Techniques by Microleakage Assessment Using Computerized Liquid Filtration Method

Gülsüm Kutlu-Basmacı[1-a*], Faruk Haznedaroğlu[1-b]

[1]*Department of Endodontics, Faculty of Dentistry, Istanbul University, Istanbul, Türkiye*
**Corresponding author*

Research Article

History

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ABSTRACT

Aim: To compare the efficiency of conventional syringe irrigation (CI), sonic irrigation (SI), and passive ultrasonic irrigation (PUI) in removing pure and injectable calcium hydroxide (CH) from the root canals of mandibular second premolars by measuring the probable microleakage of residual CH particles in root canal obturation using computerized liquid filtration (CLF).

Materials and methods: Eighty instrumented mandibular second premolars were categorized into three experimental groups (n = 20 each) based on the irrigation method used for removing CH and a control group (n = 20) in which CH was not used. Each experimental group was divided into two equal groups (pure and injectable CH). After 1 week, CH was removed from the root canals, and the teeth were obturated. CLF measurements were performed 1 week after obturation. Nonparametric variables between two groups were compared using the Mann-Whitney U test, and the Kruskal-Wallis test was used to compare more than two groups.

Results: All experimental groups showed higher leakage values than the control group. The highest leakage values were evident in the CI group, and the lowest leakage values were found in the SI (EDDY) group. No significant differences were detected among the different forms of CH.

Conclusions: None of the analyzed techniques could completely remove CH from root canals, resulting in higher leakage values. Sonic irrigation with EDDY showed best leakage results in removing CH from root canals.

Keywords: Calcium Hydroxide, Computerized Fluid Filtration, PUI, EDDY, Apical Leakage.

Farklı İrrigasyon Tekniklerinin Kalsiyum Hidroksit Uzaklaştırma Etkinliğinin Bilgisayarlı Sıvı Filtrasyon Methodu Kullanılarak Mikrosızıntılarının Değerlendirilmesi

Süreç

Geliş: 29/05/2022
Kabul: 22/08/2022

ÖZ

Amaç: Alt çene ikinci premolar dişlere yerleştirilen saf kalsiyum hidroksit ile enjektabl kalsiyum hidroksiti kök kanallarından uzaklaştırmak amacıyla kullanılan geleneksel şırınga yıkaması, sonik irrigasyon ve pasif ultrasonik irrigasyonun etkinliğinin kök kanal dolgusunun içerisinde kalma ihtimali olan kalsiyum hidroksit artıklarının yaratabileceği mikrosızıntının Bilgisayarlı sıvı Filtrasyon Cihazı ile ölçülerek kıyaslanmasıdır.

Gereç ve Yöntem: Seksen adet şekillendirilmiş mandibular ikinci premolar dişler, kalsiyum hidroksitin kök kanallarından uzaklaştırılması için kullanılan yıkama yöntemine göre üç deney grubu ve kalsiyum hidroksit medikamenti kullanılmamış olmak üzere bir kontrol grubu olacak şekilde kategorize edilmiştir. Her deney grubu ise kalsiyum hidroksit taşıyıcılarına (distile su ve propilen glikol) göre iki adet alt gruptan oluşmaktadır. Kalsiyum hidroksit kök kanallarından 1 hafta sonra uzaklaştırılmış ve örneklerin kanal dolguları yapılmıştır. Kanal dolgusundan 1 hafta sonra Bilgisayarlı Sıvı Filtrasyon cihazı ile diş köklerinin apikal sızıntı değerleri ölçülmüştür. Normal dağılım göstermeyen (nonparametrik) değişkenler iki grup arasında değerlendirilirken Mann Whitney U Testi, ikiden fazla grup arasında değerlendirilirken Kruskal Wallis Testi kullanılmıştır.

Bulgular: Tüm deney grupları, kontrol grubuna göre daha fazla miktarda sızıntı değeri göstermiştir. En yüksek sızıntı değerleri geleneksel şırınga ile yıkama grubuna ait örneklerde görülürken, en düşük sızıntı değerli gösteren örnekler sonik (EDDY) irrigasyon grubuna ait örneklerdir. Kalsiyum hidroksitin farklı taşıyıcılarla karıştırılmasının sızıntı değerlerine bakıldığında istatiksel olarak anlamlılık göstermediği belirlenmiştir.

Sonuçlar: İncelenen irrigasyon yöntemlerinden hiçbiri kök kanallarından kalsiyum hidroksiti tamamen uzaklaştıramamıştır, bu da deney gruplarında daha yüksek sızıntı değerleri görülmesine neden olmuştur. EDDY ile yapılan sonik aktivasyonun kök kanallarından kalsiyum hidroksiti uzaklaştırmak için en etkili yöntem olduğu görülmüştür.

Anahtar Kelimeler: Kalsiyum Hidroksit, Bilgisayarlı Sıvı Filtrasyon, PUI, EDDY, Apikal Sızıntı.

[a] *gulsumkutlu07@hotmail.com* *https://orcid.org/0000-0001-9394-0699* | [b] *farukhaz@hotmail.com* *https://orcid.org/0000-0003-1658-2976*

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Introduction

Removal of microorganisms and their byproducts from infected root canals is an most important factor determining the success of root canal treatment.[1,2] In case of infected root canals, bacteria invade the entire root canal and irregularities, such as isthmuses, ramifications, and dentinal tubules, which are almost impossible to disinfect chemomechanically.[3,4]

Even with the improvements in the instrumentation procedures, no currently used method can completely disinfect the entire root canal structure.[5] Therefore, an intracanal medicament with high antimicrobial properties can provide better prognosis and treatment outcomes.[6,7] Calcium hydroxide is the most widely used intracanal medication due to its antimicrobial properties. It is used in multi-session endodontic treatments in combination with various techniques and recommended to remain in the root canal system for several days or weeks.[8,9]

Three-dimensional obturation of root canals is crucial for the success of endodontic treatment. Hence, before root canal obturation, the temporary intracanal medicament should be completely removed.[10] As a standard, CH is removed from root canals using CI with different irrigation solutions such as sodium hypochlorite (NaOCl) and ethylenediaminetetraacetic acid (EDTA). However, it is almost impossible to reach the irregularities in the root canal system and completely remove CH, particularly in the apical region, using CI.[11,12] Residues of CH in root canals affect the root canal sealers to infiltrate into dentinal tubules, which may result apical leakage, thereby jeopardizing treatment success.[13,14] Therefore, researchers have proposed several methods to effectively remove calcium hydroxide from root canals.

PUI has proven effective in the efficient removal of CH from the root canal system. It is used with an ultrasonic tip, positioned in the center of the root canal reaching the working length (WL), which is agitated passively. It has been stated that the acoustic irrigation provided by this technique can provide disinfection of infected root canals and its irregularities.[15] In many studies, passive ultrasonic irrigation has been shown to be highly effective in removing calcium hydroxide from root canals.[16,17]

EDDY (VDW, Munich, Germany) is a recently developed irrigation device that uses sonic agitation. It is used with a polymer tip using a conventional air scaler with a frequency of 6000 Hz. EDDY is comparable to PUI in removing smear layer and debris from root canals.[18] Further, EDDY was also found to be as effective as passive ultrasonic irrigation in a study examining the removal of calcium hydroxide from root canals.[16]

There are many different methods for measuring apical leakage of root canal fillings, such as dye penetration[19], bacterial penetration[20], radioisotope penetration[21], electrochemical means[22] and scanning electron microscopy.[23] However, the use of these techniques require that the samples be irreversibly destructed, making long term leakage measurements impossible. Therefore, the use of liquid filtration technique may be considered owing to samples being preserved.[24] The computerized liquid filtration method is based on detecting the movement of air bubble inside micropipette using light refraction. Measurements of fluid movement are controlled with PC-compatible software (Fluid Filtration'03, Konya, Türkiye), allowing to avoid user error.

Although there are many studies comparing the efficacy of different irrigation techniques in removing CH from root canals, no study has compared the efficiency of different irrigation methods in removing different forms of CH from the root canals through the measurement of leakage. Therefore, this study aimed to compare the efficiency of three different CH removal methods (CI, EDDY, and PUI) in removing two different forms of CH (pure and injectable CH) from root canals and compare the microleakage caused by residual CH particles using computerized liquid filtration (CLF). The null hypothesis was that different irrigation techniques and different forms of CH would have no effect on the amount of leakage.

Materials and Methods

Eighty human mandibular second premolars with straight root canals and fully developed apices and devoid of cracks, fractures, and caries, extracted for various reasons, were selected for this study under a protocol reviewed and approved by the Ethics Committee for Clinical Research of İstanbul University Faculty of Dentistry and stored in thymol solution (pH: 7). The coronal parts of the teeth were cut to standardize all specimens to 15 mm. Canal patency was verified using a #10 K-file (Dentsply Sirona, Konstanz, Germany) and working length (WL) was set 1 mm short of the length at which the tip of the file was visible at the apical foramen. Root canals were instrumented using ProTaper Next Ni-Ti (Dentsply Maillefer) rotary files according to the manufacturer's instructions up to X4 (0.06 taper/Size 40). Root canals were copiously irrigated with 2.5% NaOCl (Chloraxid, Cerkamed, Stalowa Wola, Poland). As the final irrigant, each canal was irrigated with 5 mL of 2.5% NaOCl, 5 mL of 17% EDTA (ENDO-SOLution, Cerkamed, Stalowa Wola, Poland), and 5 mL of distilled water. All root canals were dried using ProTaper Next paper points and subjected to subsequent procedures.

The prepared 60 specimens were randomly categorized into three experimental groups based on the irrigation technique used to remove CH (n=20 each). Each experimental group consisted of two subgroups based on the form of CH used (n = 10). For the control group (n = 20), the samples did not receive any form of CH application.

- Pure CH (Sultan HealthCare, Inc., Englewood, NJ, USA) was mixed with distilled water using a spatula to a paste structure for every specimen. A size 30 Lentulo spiral (VDW, Munich, Germany) was used at 5000 rpm to insert the CH paste into the root canals until the paste overextruded through the foramen.

- Injectable CH (UltraCal XS, Ultradent, South Jordan, UT, USA) incorporates a different type of CH carrier (propylene glycol). It is available in syringe form and was directly applied to the root canals until overextrusion of the paste was evident at the apical foramen. Thereafter, backfilling was performed.

Radiographs were obtained for all specimens to ensure all of the root canal space was completely filled with CH (Figure 1).

Root canal orificies were sealed with a cotton pellet and a temporary sealing material (Cavit G, 3M ESPE, St. Paul, MN, USA). The specimens were maintained at 37°C and 100% humidity for 1 week. The interim restoration was then removed for experimentation.

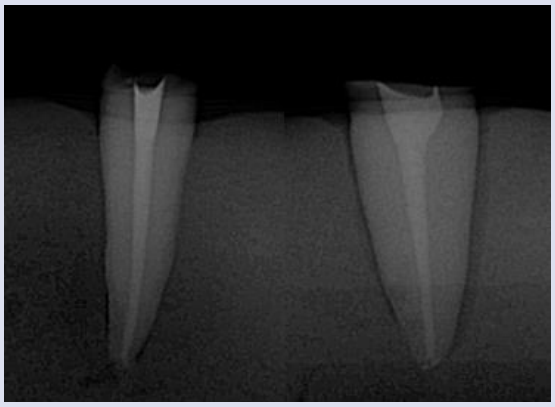

Figure 1. Radiographs of root canal filled with CH

Group A: Sonic activation using EDDY

The irrigant was activated with an air scaler (SONİCflex, KaVo, Biberach, Germany) at a frequency of 6000 Hz. The polymer tip was positioned 1 mm short of the WL and used up-and-down movements with an amplitude of 2–4 mm. First, 2.5 mL of 17% EDTA was injected in the root canal and activated for 30 s. This was repeated twice resulting in 1 min of activation and 5 mL of EDTA solution. Thereafter, 2.5 mL 2.5% NaOCl of was injected in the root canal and activated for 30 s. This procedure was done twice, resulting in 1 min of activation and 5 mL of NaOCl solution. As a result, irrigation with 10 mL irrigation solution and 2 min of activation were performed. 5 mL distilled water was used without activation for final irrigation.

Group B: PUI using Newtron P5XS (Satelec Acteon, France)

The activation of irrigation solution was made at a power setting of 6 according to the manufacturer using a #25 file (Irrisafe, Satelec Acteon, France). The tip of the file was positioned 1 mm short of the WL and verified to be free in the root canal. First, 2.5 mL of 17% EDTA was injected in the root canal and activated for 30 s. This was repeated twice, resulting in 1 min of activation and 5 mL of EDTA solution. Thereafter, 2.5 mL of 2.5% NaOCl was injected in the root canal and activated for 30 s. This procedure was done twice, resulting in 1 min of activation and 5 mL of NaOCl solution. As a result, irrigation with 10 mL irrigation solution and 2 min of activation were performed. 5 mL distilled water was used without activation for final irrigation.

Group C: CI

A side-vented needle (30G, NaviTip, Ultradent, South Jordan, UT, USA) was placed 1 mm short of the WL into the root canal. During irrigation, the syringe was moved using up-and down movements with an amplitude of 5 mm. Thereafter, 2.5 mL of %17 EDTA was injected in the root canal for 30 s. This was repeated twice, resulting in 1 min of irrigation and 5 mL of EDTA. Thereafter, 2.5 mL of 2.5% NaOCl was injected in the root canal for 30 s. This was repeated twice, resulting in 1 min of irrigation and 5 mL of NaOCl. As a result, irrigation with 10 mL of irrigation solution was performed for 2 min. 5 mL distilled water was used for final irrigation.

After experimentation, paper points were used to dry the root canals and obturated using a resin-based sealer (AH Plus sealer, Dentsply-Maillefer) and 40.02 standardized gutta-percha cone (DiaDent, DiaDent Group International Inc., Chongju, Korea) as master cone. The root canals were filled using 25 finger spreader was used for 20.02 accessory gutta-percha cones (DiaDent gutta-percha points, DiaDent Group International Inc., Chongju, Korea) with lateral condensation technique.

Group D: Control group

After instrumentation, root canals of 20 specimens were obturated without using any CH medicament.

After the obturation of the root canals, radiographs were obtained for all specimens to verify the quality of obturation. The access cavities of all specimens were temporarily sealed using a cotton pellet and an interim restorative material. Apart from the experimental and control groups, six teeth were instrumented to form the positive and negative control groups of CLF. To prevent leakage and serve as negative leakage controls, three specimens's external surfaces were covered with two layers of nail polish to prevent leakage. For positive leakage controls, remaining three specimens did not get any nail polish. All specimens were incubated in 100% relative humidity at 37°C for 7 days to mimic physiological conditions. Before performing CLF, the interim restoration was removed.

Computerized liquid filtration technique

To measure the apical leakage, CLF meter method which was previously described by Orucoglu *et al.*[24], was used. Schematic view of computer aided apical microleakage measurement setup of liquid filtration technique is shown in Figure 2. Microleakage measurements are transferred to the computer environment with information such as date, time, amount of movement via an interface (Figure 3). Each specimen was tested eight times during 2 minutes and the mean values were calculated.

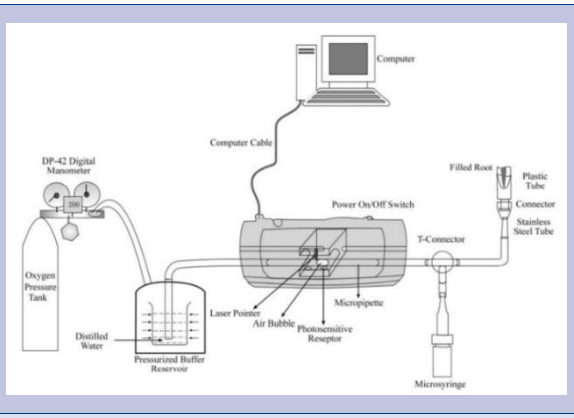

Figure 2. Schematic view of liquid filtration technique with computer aided apical microleakage measurement setup

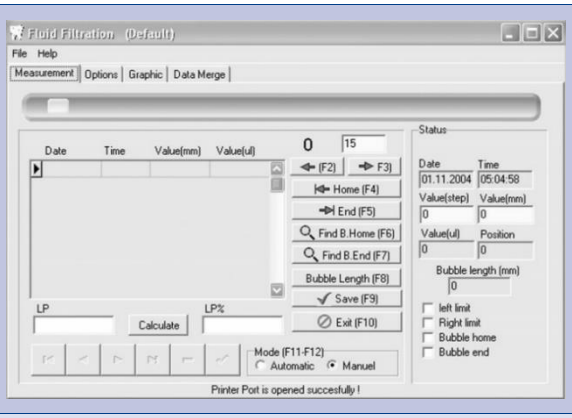

Figure 3. The liquid filtration program interface

Table 1. Apical leakage values for each experimental group

Irrigation method	Forms of calcium hydroxide	Leakage (µL/min × cmH_2O–L)	p
EDDY	Pure	0.001232	0.722
	Injectable	0.001194	
Passive ultrasonic irrigation	Pure	0.002018	0.15
	Injectable	0.00182	
Conventional irrigation	Pure	0.00301	0.298
	Injectable	0.002627	
p			**p > 0.05**

Table 2. Mean, standard deviation, and median leakage values of experimental groups and the control group.

	Mean	Standard deviation	Median
EDDY	0.001211	0.000537	0.001128
Passive ultrasonic irrigation	0.001905	0.000359	0.001889
Conventional irrigation	0.002831	0.000387	0.002796
Control group	0.001109	0.000312	0.001134
p		**< 0.05**	

Statistical analyses

Statistical analyzes were performed with the help of SPSS version 17.0 program. The conformity of the variables to the normal distribution was examined by histogram graphics and the Kolmogorov-Smirnov test. While presenting descriptive analyzes, mean, standard deviation, and median values were used. In cases where the data did not show normal distribution, groups of 2 were evaluated with the Mann Whitney U test and groups of more than 2 were evaluated with the Kruskall Wallis test. Cases with a P-value below 0.05 were considered as statistically significant results.

Results

Each experimental group's apical leakage results are presented in Table 1. The results showed no statistically significant difference between the two forms of CH, regardless of the irrigation method ($p > 0.05$).

Statistically significant difference was shown in mean leakage values among all irrigation method groups, regardless of the different forms of CH ($p < 0.05$). The calculated mean, standard deviation, and median leakage values, regardless of the different forms of CH, are presented in Table 2. The highest leakage was evident in the specimens of Group C (CI), and the lowest leakage was evident in specimens of Group A (EDDY). Complete apical leakage was evident from positive leakage controls, and negative leakage controls showed no leakage.

Discussion

This study evaluated the probable leakage of CH residues from root canal obturations performed using three different irrigation techniques for removing two forms of CH from root canals using the CLF technique. There was no significant difference in leakage between the two forms of CH. However, the three different irrigation techniques for removing CH differed statistically in apical leakage. As a result, the null hypothesis was partially rejected. Although the CI technique for removing CH from root canals showed the highest leakage values, EDDY sonic irrigation showed the lowest.

In recent years, injectable CH formulas have been developed for ease of use and saving time for clinicians. These premixed formulas contain ingredients, such as propylene glycol, different from those in pure CH. Both these forms of CH have antimicrobial properties and high pH values; however, to date, no study has assessed the difference in the removal of different forms of CH from root canals and the probable microleakage caused by the residues of different forms of CH.

In general, copious irrigation combined with instrumentation using a master apical file is the most commonly used technique for removing CH from root canals[11,20] However, it has been proven ineffective in many studies.[11,12,25] CI procedures cannot clean root canal irregularities, such as isthmuses, lateral canals, and apical deltas, and CH may persist in these areas.[26,27] These persistent CH residues may lead to increased leakage, resulting in failure of endodontic treatment.[13,14] Belvedi *et al.*[27] showed that after using different irrigation techniques for removing CH from the cervical, middle, and apical thirds of the root canals, the apical thirds contained the maximum CH residues. In another study, different laser irrigation activation techniques were used to evaluate the effectiveness of calcium hydroxide removal in the artificial apical and coronal grooves prepared in the roots, and according to the result of the study, it was stated that there was more calcium hydroxide residue in the grooves in the apical region.[28] Therefore, it was inferred that removing CH from the apical region would be more difficult, and microleakage should be measured in the apical thirds of the roots.

Owing to the increasing concern regarding these potential problems, more effective irrigation methods, such as PUI, sonic irrigation, and laser irrigation, have been proposed. In our study, the efficacy of CI, EDDY, and PUI in removing pure (powder-liquid) and premixed injectable CH from root canals was analyzed using CLF.

There are several methods to detect leakage in root canals: bacterial penetration[20], dye penetration[19], radioisotope penetration[21], scanning electron microscopy.[23] Owing to the limitations associated with each method, a completely digital CLF technique was developed.[24] Therefore, we used this technique, in which small air bubbles caused by leakage are observed using laser diodes with computer control, allowing more objective results and preservation of the specimens.[24,29]

The results of this study show that none of the irrigation methods used could completely remove CH from root canals, regardless of the type of CH. This was inferred by comparing the amount of leakage from specimens of the control group, in which CH was not used, with that from specimens of the experimental groups. The findings of this study were consistent with the findings of previous studies.[30,31] There was no statistically significant difference between the types of CH in terms of leakage. In line with our findings, Donnermeyer previously reported that none of the tested methods, including PUI, Endoactivator, XP-endo Finisher, and CI, could completely remove the two types of CH from internal resorption cavities, and different forms of CH were comparable in terms of removal.[16] Belvedi *et al.* also reported that remnants of CH were found with both PUI and CI, regardless of the CH type.[27]

In this study, although specimens of Group A (EDDY) showed higher leakage than specimens of Group D (control), the difference was not statistically significant. However, there was a statistically significant difference among the experimental groups. Specimens of Group A (EDDY) showed the least leakage (0.001211), whereas the specimens from Group C (CI) showed the highest leakage (0.002831).

The efficiency of EDDY in CH removal has not yet been assessed using CLF. However, considerable potential of this sonic irrigation activation method at higher frequencies of 6000 Hz has been indicated in recent studies that assessed canal cleanliness.[32] In line with the results of these studies, the least leakage was evident in samples of Group A (EDDY) in our study. Donnermeyer explained the reason for favorable results with EDDY as the small, intense, and circular fluid movements created around the tip of the device with a more apically transmission of irrigation.[16]

The lowest leakage was evident in samples of Group B (PUI) after Group A (EDDY). These results showed that in terms of removing CH from root canals, PUI was more effective than CI. This result is consistent with those of other studies.[33,34] Keskin *et al.*[35] showed that PUI was superior to CI in removing CH from internal root resorption cavities. Additionally, Jiang *et al.*[36] proposed that PUI induced higher volume and velocity of irrigant and that might be the reason for its effectiveness.

Looking at the results of this study, all irrigation activation methods were significantly more effective than CI in terms of removing CH from root canals through leakage measurements. Therefore, these methods are recommended to increase the success rate of treatment. In addition, there was no significant difference between the different forms of CH in removal regardless of the irrigation method. However, the use of CH decreased the sealing ability after obturation.

Conclusions

None of the analyzed techniques could completely remove CH from root canals, and all specimens treated with CH showed higher leakage than the control group specimens, which were not treated with CH. EDDY was the most effective method for the removal of the two different forms of CH. Different forms of CH were comparable regardless of the irrigation technique used.

Within the limitations of this study, the effects that may occur due incomplete removal of CH from the root canals should be considered, and for this purpose, more effective irrigation activation methods may be recommended to be added in routine use. In future studies, the efficacy of other types of irrigation activation methods and different forms of CH in CH removal should be compared.

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Evaluation of Prevalence and Dimension of Pineal Gland Calcification by Cone-Beam Computed Tomography (CBCT)

Muazzez Süzen[1,a*], Emrah Dilaver[1,b], Sina Uçkan[1,c]

[1]*Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Istanbul Medipol University, Istanbul, Türkiye*
**Corresponding author*

Research Article

History

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ABSTRACT

Objectives: This study aimed to investigate the prevalence and dimensions of pineal gland calcification on cone-beam computed tomography (CBCT) in patients undergoing dental treatment.
Materials and Methods: We retrospectively examined CBCT scans in which the pineal gland appeared in the field of view and noted the presence of pineal gland calcification (PGC). Anteroposterior, lateral, and area measurements of the PGCs were made by the same observer. Variables such as age and gender were recorded for each patient from previous clinical examination data.
Results: Among 220 patients (135 females, 85 males), the prevalence of pineal gland calcification was 33.6%. There was no significant difference between males and females ($p>0.05$). PGC was strongly associated with older age ($p<0.001$). The PGCs had mean anteroposterior and lateral dimensions of 2.56±0.98 mm and 3.39±1.29 mm, respectively, and the mean total calcified area was 5.45±3.75 mm^2.
Conclusions: This study showed no correlation between age, gender, and PGC size. However, the average calcified area was found to be significantly larger in men than women.

Keywords: Pineal Gland Calcification, CBCT, Dental Treatment.

Konik Işınlı Bilgisayarlı Tomografi ile Pineal Bez Kalsifikasyonunun boyutu ve prevalansının İncelenmesi (KIBT)

Süreç

Geliş: 30/04/2022
Kabul: 07/09/2022

ÖZ

Amaç: Bu çalışmada diş tedavisi yapılan hastalarda konik ışınlı bilgisayarlı tomografi (KIBT) ile Pineal bez kalsifikasyonunun prevalansı ve boyutlarının değerlendirilmesi amaçlandı.
Materyal ve Metot: Bu retrospektif çalışmada pineal bezin fov aralığında olduğu konik ışınlı bilgisayarlı tomografiler seçilmiştir. Pineal bez kalsifikasyonu görünürlüğü not edilmiştir. Anteroposterior, lateral ve alan ölçümleri tek bir gözlemci tarafından yapılmıştır. Her hastanın yaş, cinsiyet gibi değişkenleri, klinik muayene verileri kullanılarak kaydedilmiştir.
Bulgular: 220 hastada (135 kadın, 85 erkek) pineal bez kalsifikasyonu prevalansı %33.6 dır. Erkekler ve kadınlar arasındaki fark anlamlı değildir. Pineal bez kalsifikasyonu, genç hastalarla karşılaştırıldığında yaşlı hastalarda yüksek oranda görüldü. PGC'nin ortalama anteroposterior, lateral uzunluğu sırasıyla 2,56±0,98 mm ve 3,39±1,29 mm idi. Ortalama toplam kalsifiye alan 5,45±3,75 mm2 idi.
Sonuçlar: Bu çalışmada yaş, cinsiyet ve lineer ölçümler arasında herhangi bir ilişki bulunmadı. Ancak erkeklerde ortalama kalsifiye alan kadınlara göre anlamlı derecede yüksek bulunmuştur.

Anahtar Kelimeler: Pineal Bez Kalsifikasyonu, Konik Işınlı Bilgisayarlı Tomografi, Diş Tedavisi.

[a] *muazzez.suzen@gmail.com* *https://orcid.org/0000-0001-5121-9158*
[b] *emrahdilaver@gmail.com* *https://orcid.org/0000-0003-4522-1424*
[c] *suckan@yahoo.com* *https://orcid.org/0000-0003-1077-7342*

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Introduction

The pineal (epiphysis) gland is a neuroendocrine organ that is embryologically developed from the posterior upper part of the third ventricle. It weighs 100-180 mg, is 5-9 mm in length, 3-6 mm in width, and 3-5 mm in depth, and is surrounded by connective tissue of the pia mater.[1-3] This gland is responsible for regulating physiological cycles by sending time signals to other parts of the body in circadian rhythm by secreting melatonin during darkness.[4,5]

Pineal gland calcification (PGC) was first described in the cranial X-rays of autopsy specimens in 1918.[6,7] Age is reported to be the most critical factor in the incidence of PGC in humans.[8] In previous studies, the frequency of PGC was reported to range from 1.3% to 16.7% and was shown to increase with age.[8-10] Although uncommon, PGC can also be seen in children under 5 years of age.[11,12]

Pineal calcification also depends on environmental factors, such as altitude and sunlight exposure. However, the reasons for differences in calcification between different populations is not fully understood.[8,13] Factors such as age, gender, race, geographical region, lifestyle, nutrition, and social behavior may also affect the calcification process.[10]

Melatonin secretion decreases with PGC and age. A decrease may also be related to cancer or various neurodegenerative diseases such as migraine, schizophrenia, Alzheimer's, Parkinson's, epilepsy, depression, and stroke.[14-16] Therefore, identifying physiological and pathological calcifications is essential for early diagnosis.

Intracranial calcifications can be detected by cranial X-ray, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasonography. However, CT is the most sensitive method. In recent years, the use of cone-beam CT (CBCT) has been widely adopted in dentistry practice for various reasons, including implant therapy, wisdom teeth, and jaw cysts. Thus, it may be clinically helpful to detect calcifications.[13,17]

This retrospective study investigated the prevalence and dimensions of PGC according to age and gender patients who underwent CBCT of the upper face.

Materials and Method

This retrospective study was approved by the Ethics Committee of Istanbul Medipol University (ethics approval number 10840098-604.01.01-E.15729).

A total of 1176 CBCT images obtained between 2014 and 2019 were screened, and those that included the pineal gland in the field of view were analyzed. Patients with bone disease, drug use, congenital disorders, trauma history, history of tumor or malignancy, and previous surgery were excluded from the study.

All images were obtained using the i-CAT 17–19 Imaging System (Imaging Sciences International, Inc., Hatfield, PA, USA) at 120 kVp and 5 mA. CBCT images were evaluated in Invivo5 software (Anatomage Inc., San Jose, CA, USA). PGC was identified within the cranium at the midline in the posterior cranial fossa in the axial, coronal, and sagittal planes (Figure 1). Linear measurements (anteroposterior and lateral dimensions) and area of calcification were calculated in the axial plane (Figure 2). Measurements were repeated three times for reliability by the same observer. The patients' age and gender at time of CBCT examination were noted from their medical records. For age group analysis, the prevalence of PGC was determined in patients aged ≤10, 11–20, 21–30, 31–40, 41–50, 51–60, 61–70, and ≥71 years of age.

Statistical Analysis

Study data were analyzed using IBM SPSS Statistics version 22 (IBM Corp, Armonk, NY) software. Data distributions were evaluated with the Kolmogorov-Smirnov and Shapiro Wilks tests, and it was determined that the parameters did not show normal distribution. Data were summarized using descriptive statistical methods (mean, standard deviation, frequency). Quantitative data were analyzed using Kruskal-Wallis test with post-hoc Dunn's test for comparisons among multiple groups and using Mann-Whitney U test for comparisons between two groups. Chi-square tests were used to compare qualitative data. Spearman's rho correlation analysis was used to examine the relationships between parameters. Significance was evaluated at the level of $p<0.05$.

Results

Out of 1176 records, 220 CBCT scans were evaluated in this retrospective study. There were 135 females (61.4%) and 85 males (38.6%) with a mean age of 28.79 ± 17.76 years. PGC was seen in 29 (34.1%) of the male patients and 45 (33.3%) of the female patients, with no significant difference between genders ($p>0.05$) (Table 1). The mean age of patients with PGC was 39.34±18.49 years, compared to 23.45±14.79 years in those without PGC ($p<0.001$). There was a statistically significant positive relationship between age and PGC, with a steady increase in the rate of PGC detection between age groups ($p<0.001$) (Table 1).

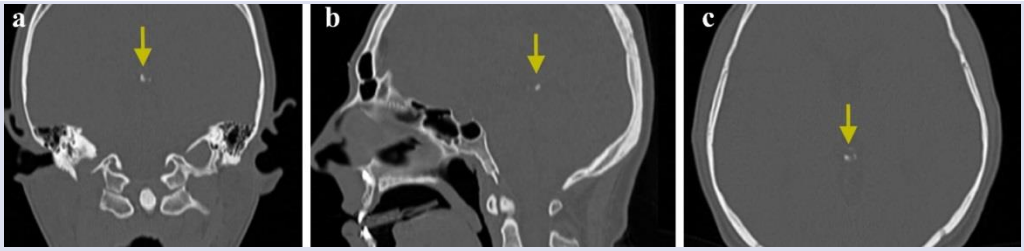

Figure 1. Coronal (a), sagittal (b), and axial (c) cone-beam computed tomography sections showing pineal gland calcification.

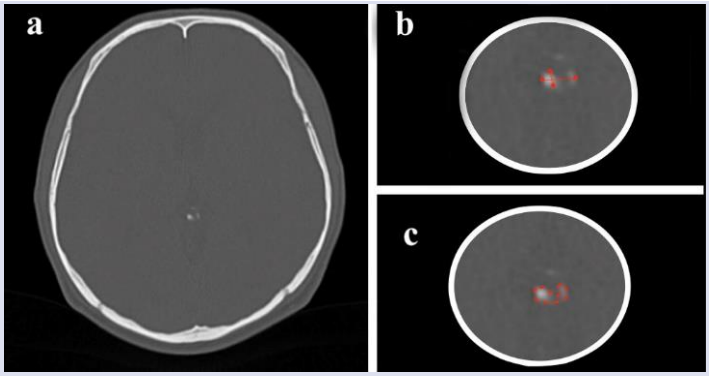

Figure 2. Axial cone-beam computed tomography (CBCT) section (a) and measurements of the anteroposterior and lateral dimensions (b) and area (c) of pineal gland calcification.

Table 1. Evaluation of pineal gland calcification (PGC) according to age and gender

		PGC		p
		No n (%)	Yes n (%)	
Gender	Female	90 (66.7%)	45 (33.3%)	1.000
	Male	56 (65.9%)	29 (34.1%)	
Age	<10	5 (100%)	0 (0%)	<0.001*
	10-19	79 (83.2%)	16 (16.8%)	
	20-29	31 (73.8%)	11 (26.2%)	
	30-39	13 (54.2%)	11 (45.8%)	
	40-49	7 (38.9%)	11 (61.1%)	
	50-59	5 (25%)	15 (75%)	
	60-69	2 (20%)	8 (80%)	
	>70	4 (66.7%)	2 (33.3%)	

Chi-square test* p<0.05

Table 2 Mean values of linear measurements of pineal gland calcification

	n	Min	Max	Mean±SD
Horizontal (mm)	74	1.72	7.31	3.39±1.29
Vertical (mm)	74	1.22	6.79	2.56±0.98
Area (mm^2)	74	1.18	20.19	5.45±3.75

Abbreviations: SD: Standard Deviation

Table 3. Correlation of age and pineal gland calcification dimensions

	Age	
	r	p
Horizontal	0.073	0.537
Vertical	0.139	0.239
Area	0.119	0.313

Spearman's rho correlation test

Based on linear measurements, the PGCs had a mean anteroposterior dimension of 3.39±1.29 mm, mean lateral dimension of 2.56±0.98 mm, and mean calcified area of 5.45±3.75 mm^2 (Table 2). There was no statistically significant correlation between age and PCG anteroposterior, lateral, or area measurements (p>0.05) (Table 3).

Discussion

Melatonin is an essential mediator of bone formation that inhibits bone resorption by interfering with osteoclasts. Melatonin may also play a physiological role in tooth development/growth by regulating the cellular function of odontogenic cells in tooth germs.[29] It has been shown that melatonin has high antioxidant and anti-inflammatory properties because it suppresses interleukin-6 and nitric oxide production.[18] Theoretically, increased melatonin concentrations in the plasma and saliva may decrease rates of periodontal disease and caries due to its protective effect. Additionally, more caries lesions develop in the spring and summer, when melatonin levels are lowest, and fewer caries occur in the autumn and winter, when melatonin levels are highest.[19] Several studies have investigated PGC, melatonin secretion, and their relationship with other diseases.[20,21] However, most studies on PGC in the dental literature have been based on prevalence. Few studies have investigated correlations between age, gender, and the extent of PGC.[2,8,22]

Sedghizadeh et al. reported intracranial calcification rates as high as 80%.[22] However, Abbassian et al. reported the prevalence of PCG as 18.3% in individuals over the age of 20 years,[23] while the prevalence of PGC in other studies ranged between 11.8% and 26.2%.[24-27] The prevalence rate in the present study (33.6%) was higher than in previous studies.

Some studies in the literature have indicated that PGC is more common in males than females.[8,24] However, another study showed that the occurrence rate was higher in females.[13] In the present study, the prevalence of calcification was similar in females (33.3%) and males (34.1%).

According to Whitehead et al., PGCs were punctate and single in all patients younger than 7 years old and were generally more extensive and numerous in patients older than 7 years.[11] In addition, Deepak et al. stated that PGC is rare in children younger than 6 years old, and a pineal gland tumor should be considered when calcification is detected before the age of 9 years and is larger than 1 cm in diameter.[28,29] Therefore, a careful examination is necessary in patients younger than 7 years of age with extensive PGC. In the present study, the youngest patient with PGC was a 14-year-old girl.

Similar to our results, in another study the average PGC dimensions were reported as 3.73 mm in the anteroposterior direction and 3.47 mm in the medio-lateral direction with a total area of 9.79 mm^2, and no correlation was observed between calcification size and age.[13]

This study suggests that the prevalence of PGC as an incidental finding is high among patients undergoing dental therapy. Numerous studies show that melatonin can be an important factor in the development of caries and periodontal diseases.[19,30-33] However, as this was a retrospective study, we were unable to evaluate melatonin levels in these patients. Further studies including larger samples with more standardized and specific groups are needed to determine the relationships between PGC, melatonin production, and caries and periodontal diseases.

Conclusions

In conclusion, detection of PGC was associated with older age, but age was not associated with the linear dimensions of the calcified area. In addition, the average calcified area was significantly larger in men than women.

Conflicts of Interest

The authors declare no conflict of interest.

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None

Author Contributions

Concept: M.S.; Supervision: M.S., S.U.; Materials: M.S., E.D.; Data Collection and Processing: M.S., E.D.; Analysis and Interpretation: M.S., E.D., S.U.; Writing: M.S., E.D

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Evaluation of the Effect of Non-Surgical Periodontal Treatment on Oral Health-Related Quality of Life in Patients with Periodontitis at Different Stages

M. Ayşe Tayman[1-a*]

[1] *Department of Periodontology, Faculty of Dentistry, Ankara Yıldırım Beyazıt University, Ankara, Turkiye*

Research Article

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ABSTRACT

Objectives: To determine the effect of non-surgical periodontal treatment (NSPT) on oral health-related-quality-of-life (OHRQoL) in individuals with periodontitis at different stages.

Materials and Methods: Full-mouth clinical periodontal parameters [plaque-index (PI), gingival-index (GI), probing-pocket-depth (PD), bleeding-on-probing (BOP), clinical-attachment-loss (CAL)] of 119 healthy individuals aged 24 to 64 years just before and six-weeks after NSPT were obtained and the mean was calculated. Oral hygiene instructions were given. The Oral-Health-Related-Quality-of-Life-United-Kingdom (OHRQoL-UK) scale was used to measure the positive and negative effects of NSPT on OHRQoL. Sociodemographic data (age, gender, education and income status, reason for admission to the hospital, use of toothbrush, other cleaning tools, removable prosthesis and smoking) of the participants were recorded using a multiple choice questionnaire.

Results: The use of toothbrushes and cleaning device increased in all phases after the treatment. Ages of individuals in stage-IV were higher than other stages. Individuals in stage-III and IV had fewer teeth than other stages, while the use of removable prosthesis was higher. Clinical periodontal parameters decreased significantly in all stages after treatment and showed improvement. When all stages before and after treatment were compared within themselves, there were significant differences in the total score of OHRQoL between stages I-III, I-IV, II-III and II-IV. It was observed that all OHRQoL scores increased when compared before and after treatment in terms of symptoms, physical, psychological and social status.

Conclusions: NSPT provides a significant improvement in the OHRQoL of individuals in all stages of periodontitis.

Keywords: Periodontitis, Staging, Quality of Life, Turkiye.

Farklı Evrelerdeki Periodontitis Hastalarında Cerrahi Olmayan Periodontal Tedavinin Ağız Sağlığı ile İlişkili Yaşam Kalitesi Üzerine Etkisinin Değerlendirilmesi

Süreç

Geliş: 28/06/2022
Kabul: 24/09/2022

ÖZ

Amaç: Cerrahi olmayan periodontal tedavinin farklı evrelerdeki periodontitis hastalığına sahip bireylerde ağız sağlığı ile ilişkili yaşam kalitesi üzerine olan etkisini belirlemektir.

Gereç ve Yöntemler: Evre I,II,III, ve IV' deki yaş aralığı 24-64 olan toplam 119 sağlıklı bireyin periodontal tedaviden önce ve tedaviden 6 hafta sonra sonra kapsamlı periodontal muayeneleri gerçekleştirildi, oral hjyen eğitimi verildi ve tüm ağız klinik periodontal parametrelerinin [plak indeksi (PI), gingival indeks (GI), cep derinliği (CD), sondlamada kanama (SK), klinik ataçman kaybı (KAK)] ortalaması hesaplandı. Periodontal tedavinin yaşam kalitesi üzerine pozitif ve negatif etkisini ölçmek için, Birleşik Krallık- Ağız Sağlığına İlişkin Yaşam Kalitesi (Oral Health Related Quality of Life-United Kingdom=OHRQoL-UK) ölçeği kullanıldı. Çoktan seçmeli anket formu kullanılarak katılımcıların sosyodemografik verileri (yaş, cinsiyet, eğitim durumu, gelir durumu, hastaneye başvurma nedeni, diş fırçası-yardımcı temizlik aracı- hareketli protez ve sigara kullanımı) kaydedildi.

Bulgular: Diş fırçası ve yardımcı temizlik aracı kullanımı tedavi sonrası tüm evrelerde arttı. Evre IV hastalarının yaşları diğer evrelere göre yüksekti. Evre III ve evre IV'deki hastaların diş sayısı diğer evrelerden daha azdı, hareketli protez kullanımı daha fazlaydı. Klinik periodontal parametreler tedavi sonrasındaki tüm evrelerde anlamlı düzeyde azalarak iyileşme gösterdi. Yaşam kalitesinin toplam skoru tedavi öncesindeki ve tedavi sonrasındaki evreler kendi aralarında kıyaslandığında evre I-III, I-IV, II-III ve II-IV arasında anlamlı farklıydı. Tedavi öncesi ve sonrası kıyaslandığında semptom, fiziksel durum, psikolojik durum ve sosyal durum açısından tüm yaşam kalitesi değerlerinin arttığı gözlenmiştir.

Sonuç: Periodontal tedavi periodontitisin tüm evrelerindeki bireylerin yaşam kalitesinde önemli bir iyileşme sağlamaktadır

Anahtar Kelimeler: Periodontitis, Evreleme, Yaşam Kalitesi, Türkiye.

[a] *ayseatay06@hotmail.com* *https://orcid.org/0000-0001-8924-6725*

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Introduction

Periodontitis is a common, chronic, immuno-inflammatory disease that can lead to loss of tooth supporting tissues, slow progressive destruction of alveolar bone, pocket formation or gingival recession.[1] Symptoms of periodontitis include gingival redness, bleeding on brushing, mobility and shifting of the teeth, chewing difficulties, bad breath, unaesthetic appearance, pain, and eventually tooth loss. From the individual's point of view, all of these can be a major oral health problem.[2] Besides its clinical importance, poor oral health causes personal insecurity, leads individuals to social isolation, feelings of guilt and inferiority, and exacerbates or facilitates the emergence of psychiatric and psychosomatic conditions such as depression.[3]

The desired outcome of periodontal treatment is to prevent disease progression by inhibiting inflammatory disease processes and to improve the patient's individual oral health. Non-surgical periodontal therapy (NSPT) reports contradictory results of healing, either significant[4,5] or insignificant.[6,7] The duration of treatment is usually long and its procedures may cause some discomfort. Besides the improvement of traditional-objective clinical parameters such as reduction of inflammation and attachment gains[8], subjective patient-reported findings should be considered as an important endpoint to fully evaluate the efficacy of periodontal therapy.[9] Possible side effects of non-surgical root instrumentation include gingival recession, soft tissue trauma, root hypersensitivity, and pain.[10,11]

Subjectively perceived oral health and its physiological, psychological and social effects on daily life have been named by Locker and Allen as "Oral Health Related Quality of Life" (OH-QoL).[12] OHRQoL defines oral health satisfaction and self-confidence as a multidimensional construct that reflects people's comfort while eating, sleeping and engaging in social relationships. Over the years to evaluate the impact of oral diseases such as periodontitis on OH-QoL; various methods and tools have been developed, including the General (formerly Geriatric) Oral Health Assessment Index (GOHAI)[13], the Oral Health Impact Profile (OHIP)[14], the Oral Health Quality of Life Scale-United Kingdom (OHRQoL-UK)[15] and the Oral Effects on Daily Performance (OIDP)[16]. Some scales focus on the frequency of oral health problems and only record negative aspects of the disease state; that is, the more symptoms there are, the worse the OHRQoL. Among the tools used to measure quality of life, one of the most widely used is the OHRQoL-UK proposed by McGrath and Bedi.[15,17] OHRQoL-UK has a broader approach beyond the absence of disease. It focuses on the impact of oral health on a person's daily life and well-being.[15] Thus, it is a salutogenic approach that focuses on health rather than disease, aiming to report not only the frequency of problems but also the positive effects of oral conditions. The OHRQoL-UK was used to examine the relationship between OHRQoL and periodontal disease with respect to both disease and health status.[10,18,19]

The effect of periodontitis on OHRQoL is well known.[4,18] However, relatively little is known about the impact of mechanical instrumentation at different stages of periodontitis on patient perception and OHRQoL. This study aimed to evaluate OHRQoL before and after NSPT at different stages of periodontitis using OH-QoL-UK.

Materials and Methods

Study Design

This cross-sectional study was conducted in accordance with the 2002 Helsinki Declaration and the "Guidelines for Good Clinical Practice". The purpose and procedure of the study were explained to all volunteers and an informed consent form was signed. The participants of the study were selected among the individuals who applied to the Periodontology Clinic of Tepebaşı Oral and Dental Health Training and Research Hospital between November 2020 and March 2021, taking into account the participation criteria detailed below. The study protocol was approved by the Ethics Committee No.1 of Ankara City Hospital. (Date:11.11.2020 / Decision no:E1/1259/2020).

Selection Criteria

Participation criteria: Inclusion criteria were determined by radiographic examination and full-mouth clinical periodontal evaluation. Systemically healthy individuals with periodontitis who applied to the periodontology clinic were included in the study. The clinical diagnosis and staging of periodontitis was determined according to the “2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions”.[20] Accordingly, patients with interdental radiographic bone loss of ≥2 mm in non-adjacent teeth or with a pocket depth of >3 mm on probing for ≥2 teeth and with 15% buccal or oral radiographic bone loss were diagnosed as periodontitis. Periodontitis is divided into four stages: Stage I (Initial periodontitis), Stage II (Moderate periodontitis), Stage III (Severe periodontitis with the potential for additional tooth loss) and Stage IV (Severe periodontitis with excessive tooth loss and potential for dentition loss) categorized. The staging process was evaluated in terms of severity and complexity. The severity was determined by the worst tooth in the dentition, primarily based on the level of interdental clinical attachment loss. Attachment loss due to periodontitis was scored as 1-2 mm for Stage I, 3-4 mm for Stage II, and ≥5 mm for Stage III and IV. The determining factor for the differentiation of Stage III and IV was the number of teeth lost due to periodontitis; Stage III: ≤4 teeth and Stage IV: ≥5. The presence of even one complexity factor (The presence of vertical defects, furcation involvement, excessive tooth mobility, tooth displacement or loss, loss of alveolar crest and chewing function) pushed the diagnosis to a higher stage. All periodontitis patients were generalized periodontitis patients with more than 30% teeth affected in terms of generality.

Exclusion criteria: Patients with systemic disease that may affect periodontal tissues (diabetes, rheumatoid arthritis, cardiovascular), patients who have used drugs (antibiotics, anti-inflammatory, calcium channel blockers) or received periodontal treatment that may affect the gingiva in the last six months, patients with active infectious diseases (AIDS, HBV, tuberculosis), pregnant and lactating women were not included in the study.

Clinical Measurements and Data Collection

Periodontal examination of a total of 119 participants was performed by a periodontologist (M.A.T.) with a periodontal probe (Williams' probe, Hu-Friedy, Chicago, IL). All clinical periodontal parameters of patients, such as number of teeth, whole mouth plaque index (PI), gingival index (GI), bleeding on probing (BOP), pocket depth on probing (PD), and clinical attachment loss (CAL) were measured before and after NSPT and recorded.

A total of five volunteers were evaluated twice, with a one-hour break, to ensure the investigator's intra-observer calibration. Blinding was provided between the first and second measurements. A repeatability of at least 85% with a mean difference of 1 mm was obtained. Six regions of each tooth (mesiobuccal, buccal, distobuccal, mesiolingual, lingual and distolingual) were evaluated by accepting the cementoenamel junction as the reference point. When calculating the whole mouth PI, GI, PD and CAL, the sum of the values was divided by the total number of regions. BOP was calculated as the % number of regions with (+). Values in mm were rounded to the nearest mm.

Information about the sociodemographic data and socioeconomic status of the participants was collected using a questionnaire containing 9 multiple-choice questions. This questionnaire included questions about age, gender, educational status, income, reason for admission to the hospital, frequency of brushing, use of supportive cleaning tools (floss and interdental brush), use of removable prosthesis, and smoking.

To measure the positive and negative effects of periodontal disease and NSPT on OHRQoL, the OHRQoL-UK scale which includes 16 questions in 4 different categories (symptom, physical condition, psychological state, social status) and was first developed in England in 2000 was used. According to this scale, “How do your teeth, gums, mouth or prosthesis affect your symptom, physical condition, psychological state and social status?” the question was asked. The categories of the scale are respectively; 2 questions about symptoms (comfort, breath), 5 questions about physical condition (nutrition, appearance, general health, speech, smile), 5 questions about psychological status (relaxation/sleeping, confidence, mood, carefree/calmness, personality), 4 questions about social status (social life, private life with partner and friend, work/daily life, economic situation). The scored questions were rated on a scale of 1 to 5 (very bad:1, bad: 2, no effect: 3, good: 4, very good: 5). The sum of the scores of the 16 questions is the lowest 16 and the highest 80. A low score indicates a low OHRQoL.

Non-Surgical Periodontal Treatment

Full-mouth scaling and root planning (SCRP) was applied to the participants. The treatment protocol was performed in two sessions in a 24-hour period using ultrasonic instruments (Cavitron DENTSPLY, York, PA.) and hand tools to complete the entire SCRP. No time limit was set for the procedure sessions. The process was terminated when the root surfaces were satisfactorily cleaned and smoothed. Patients were given standard dental hygiene training (brushing, interdental brushing, flossing, tongue brushing) immediately after the first SCRP procedure and warned not to use any medication or mouthwash. During six weeks after the treatment, the patients were called two or three times and checked for compliance with the hygiene instructions given.

Statistical Analysis

Statistical analyzes were performed using software called Statistical Package for Social Sciences (SPSS) version 20 for Windows (SPSS Inc., St. Louis, MO). Shapiro-Wilk or Kolmogrov Smirnov test was used for normality analysis of the data. To compare groups, t-test and/or Mann-Whitney U-test for non-parametric continuous variables in independent samples and chi-square or Fisher's exact tests were used in accordance with categorical variables. Chi-square test was used for frequency data and Kruskal Wallis test was used for ordinal data in comparison of more than two groups. Results were expressed as the median (IQR) (minimum-maximum) for continuous variables in addition to percentage and frequency distribution for categorical variables. The t-test was used to compare two groups with parametric continuous variables in independent samples, and the ANOVA test was used to compare more than two groups. Parametric tests for comparison of dependent groups; paired t-test for comparison of two groups; ANOVA test was used for repeated measures in the comparison of more than two groups. Results were expressed as mean± standard deviation (SD). $p<0.05$ was determined as statistically significant. Before beginning the study a power calculation was performed to detect a significant difference in effect sizes between groups using the GPower 3.1.9.4 program. At least 27 patients per group were calculated to have 80% power at an effect size of 0.8 and a = 0.05 for the bilateral test.

Results

The age range of 119 individuals participating in the study was 24-64, and the mean age was 44.24 (±10.68). There was no statistically significant difference in age between stages I,II and III ($p>0.05$), but the patients in stage IV were older than the other stages ($p<0.05$). There was no statistically significant difference between the stages in terms of gender and income status ($p>0.05$), but there was a significant difference in terms of the reason for admission to the hospital ($p<0.05$). There was no difference between stage I and II in terms of the number of existing teeth ($p= 0.828$), and there were statistically

significantly fewer teeth in stage III and IV (p=0.00) compared to other stages (Table 1).

There was no significant difference between the stages in terms of smoking (p>0.05). The use of removable prosthesis was significantly higher in stages III and IV compared to other stages (p<0.05). There was no significant difference between the stages before and after the treatment in terms of the use of toothbrush and supportive cleaning device (p>0.05), but it increased significantly in all stages after treatment compared to pre-treatment (p<0.01) (Table 2).

The measurements of clinical periodontal parameters before and after treatment are shown in Table 3. Accordingly, there was a significant difference between the stages (p<0.01) before and after the treatment in terms of PD and CAL, except for stage III and IV (p>0.05). It was observed that PD and CAL values before and after treatment increased as the severity of the stage increased and reached the highest value in stages III and IV. In terms of GI values, before treatment; stage I was significantly higher than stage IV (p<0.05), there was no significant difference between other stages. (p>0.05). After the treatment, there was no significant difference between the stages in terms of GI values (p>0.05). In terms of PI, there was no significant difference between the stages before and after the treatment (p>0.05). In terms of BOP, there was a significant difference between stages I-II, I-III and I-IV before treatment (p<0.05). There was a significant difference between stage I-III, I-IV, II-III and II-IV after treatment (p<0.05). It was observed that the BOP value in stages III and IV was higher than in stages I and II (p<0.01). All clinical periodontal parameters (PD, CAL, GI, PI, BOP) showed significant improvement after treatment compared to before treatment in all stages (p<0.01) (Table 3).

Table 1. Sociodemographic data of periodontitis patients at different stages

		Evre 1 (n:31)	Evre 2 (n:30)	Evre 3 (n:29)	Evre 4 (n:29)	p
% Gender	Female	%28.1	%24.6	%22.8	%24.6	0.896 $^{X^2}$
	Male	%24.4	%25.8	%25.8	%24.2	
% Age	Median	43 (16)	40.5 (20)	48 (15.5)	54 (12.5)	0.00 ^{K}
	(Min-Max)	(25-56)	(24-59)	(25-56)	(34-64)	
% Education level	Primary education	%32.3	%23.3	%51.7	%69	0.00 $^{X^2}$
	High school	%45.2	%60	%37.9	%31	
	University	%22.6	%16.7	%10.3	%0	
% Income status	Below minimum-wage	%35.5	%46.7	%51.7	%41.4	0.253 $^{X^2}$
	Above minimum-wage	%32.3	%33.3	%31	%34.5	
	Twice the minimum-wage	%22.6	%16.7	%13.8	%24.1	
	More than twice	%9.7	%3.3	%3.4	%0	
% Reason for admission to hospital	Gum problem	%45.2	%56.7	%58	%27.6	0.042 $^{X^2}$
	Dental problem	%29	%23.3	%20.7	%31	
	Prosthetic problem	%12.9	%13.3	%10.3	%27.6	
	Routine control	%12.9	%6.7	%10.3	%13.8	
Number of teeth	Median	26(3)	26(2)	22(3.3)	17(3)	0.00 ^{K}
	(Min-Max)	(23-30)	(23-28)	(18-27)	13-19)	

^{K} Kruskal-wallis / $^{X^2}$ chi-squared test. P<0.05 is statistically significant.

Table 2. Smoking and use of removable prosthesis in periodontitis patients at different stages. Oral hygiene habits before and after treatment

		Stage I (n:31)	Stage II (n:30)	Stage III (n:29)	Stage IV (n:29)	p
% Smoking	None	%51.6	%50	%41.4	%37.9	0.496 $^{X^2}$
	Less than 10 pieces per day	%29	%33.3	%37.9	%34.5	
	1 pack per day	%19.4	%3.3	%20.7	%24.1	
	More than 1 pack per day	%0	%3.3	%0	%3.4	
% Use of removable prosthesis		%6.5	%3.3	%17.2	%65.5	0.00 $^{X^2}$
% Use of toothbrush (pre-treatment / post-treatment)	None	%19.4/ 0	%13.3/ 0	%13.8/0	%17.2/0	0.957/0.909 $^{X^2}$
	Irregular brushing	%35.5/ 0	%33.3/ 0	%37.9/0	%24.1/0	
	Once a day	%19.4/29	%26.7/33.3	%20.7/37.9	%34.5/34.5	*0.00 $^{X^2}$
	Twice a day	%25.8/71	%26.7/66.7	%27.6/62.1	%24.1/65.5	
% Use of supportive cleaning tools (floss and interdental brush) (pre-treatment / post-treatment)	None	%80.6/35.5	%73.3/36.7	%86.2/34.5	%75.9/31	0.935/ 0.986 $^{X^2}$
	Once a day	%9.7/35.5	%13.3/33.3	%6.9/41.4	%10.3/34.5	
	Several times a week	%9.7/29	%13.3/30	%6.9/24.1	%13.8/34.5	*0.00 $^{X^2}$

$^{X^2}$ chi-squared test. *p value before/after treatment. P<0.05 is statistically significant.

Table 3. Clinical periodontal parameters of periodontitis patients at different stages before and after treatment

	Stage I (n:31)	Stage II (n:30)	Stage III (n:29)	Stage IV (n:29)	p	p (Pre.T/Post.T)
PD (mm)						
Pre-Treatment	3.2(0.4)	3.8(0.33)	4.8(0.5)	4.9(0.35)	0.00[K]. (0.00[a]/0.068[b])*	0.00**
Post-Treatment	2(0.3)	2.6(0.5)	3.5(0.5)	3.5(0.4)	0.00[K]. (0.00[a]/0.590[b])*	
CAL (mm)						
Pre-Treatment	3.2(0.4)	3.85(0.4)	4.9(0.5)	5(0.35)	0.00[K]. (0.00[a]/0.120[b])*	0.00**
Post-Treatment	3(0.4)	3.55(0.43)	4.5(0.65)	4.7(0.35)	0.00[K]. (0.00[a]/0.479[b])*	
GI						
Pre-Treatment	1.8(0.4)	1.65(0.43)	1.7(0.4)	1.6(0.3)	0.04[K]. (0.004[c])*	0.00**
Post-Treatment	0.8(0.3)	0.9(0.4)	0.8(0.4)	0.8(0.4)	0.697[K]	
PI						
Pre-Treatment	1.3(0.5)	1.5(0.43)	1.5(0.55)	1.4(0.2)	0.467[K]	0.00**
Post-Treatment	0.6(0.2)	0.75(0.33)	0.6(0.4)	0.6(0.35)	0.281[K]	
BOP (%)	77.19±7.04	81.66±8.14	81.86±7.14	83.83±7.39	0.007[λ]	
Pre-Treatment	(65-92)	(68-97)	(69-94)	(68-97)	(0.025[d]. 0.014[e]. 0.001[f])[t]	0.00[t]
Post-Treatment	7.64±3.03	9.17±3.14	26.41±5.02	29.10±5.31	0.030[λ]	
	(6-15)	(7-17)	(18-36)	(20-38)	(0.00[g])[t]	

[K] Kruskal-wallis/ *Mann-whitney u test/ [λ]Anova/ [t]T-test/ **Wilcoxon Signed Test. BOP: Bleeding on probing. PI: Plaque index. GI: Gingival index. PD: Probing Pocket depth, CAL: Clinical attachment loss. p<0.05 is statistically significant.
[a]There is a significant difference between Stage I-II, Stage I-III, Stage I-IV, Stage II-III, Stage II-IV. [b]There is no difference between Stage III-IV. [c]There is a significant difference between Stages I-IV. There is a significant difference between [d]Stage I-II, [e]Stage I-III, [f]Stage I-IV. [g] There is a significant difference between Stage I-III, Stage I-IV, Stage II-III, Stage II-IV.

The parameters evaluated in the pre- and post-treatment questionnaire to evaluate OHRQoL are summarized in Table 4. Accordingly, when the total scores of the patients in all stages were evaluated before the treatment, there was a significant difference between stages I-III, I-IV, II-III and II-IV (p<0.05). After the treatment, when the total scores of all stages were evaluated, there was a significant difference between stages I-III, I-IV, II-III and II-IV (p<0.05). When compared before and after treatment, it was observed that OHRQoL values increased in terms of symptoms, physical condition, psychological status and social status (p<0.01) (Table 4).

Table 4. Evaluation of oral health-related quality of life before and after treatment in periodontitis patients at different stages

	Stage I (n:31)	Stage II (n:30)	Stage III (n:29)	Stage IV (n:29)	p	p (Pre.T/Post.T)
Symptom (2 questions)						
Pre-Treatment	4(1)	4(1)	3(1)	3(1)	0.000[K]. (0.010[a]. 0.000[b]. 0.005[d])*	0.00**
Post-Treatment	7(1)	7(1.25)	7(2)	6(2)	0.001[K]. (0.006[a]. 0.005[d])*	
Physical Condition (5 questions)						
Pre-Treatment	10(2)	10(2)	10(1)	9(1)	0.008[K]. (0.011[a]. 0.009[b]. 0.029[c].0.022[d])*	0.00**
Post-Treatment	17(2)	17(2)	16(1.5)	16(1)	0.010[K]. (0.004[a]. 0.008[b])*	
Psychological Status (5 questions)						
Pre-Treatment	11(1)	11(1)	10(1)	10(1)	0.029[K]. (0.032[b]. 0.048[c]. 0.012[d])*	0.00**
Post-Treatment	18(1)	17(1.25)	17(1)	17(1)	0.001[K]. (0.001[a]. 0.002[b]. 0.021[c]. 0.033[d])*	
Social Status (4 questions)						
Pre-Treatment	10(1)	10(1.25)	10(1)	10(1)	0.08[K]. (0.042[a]. 0.047[c])*	0.00**
Post-Treatment	13(1)	14(2)	13(1)	13(1)	0.092[K]. (0.05[b]. 0.019[d])*	
Total (16 questions)						
Pre-Treatment	34(3)	35(3)	33(1.5)	32(3)	0.000[K]. (0.000[a.b.d]. 0.001[c])*	0.00**
Post-Treatment	55(3)	54(4.25)	53(3.5)	53(3.5)	0.000[K]. (0.014[a]. 0.000[b]. 0.003[d])*	

[K] Kruskal-wallis/*Mann-whitney u test/** Wilcoxon Signed Ranks Test.
There is a significant difference between [a]Stage I-III, [b]Stage I-IV, [c]Stage II-III, [d]Stage II-IV. p<0.05 is statistically significant.

Discussion

In this study, the change in OHRQoL was examined using the OHRQoL-UK questionnaire before and after NSPT in periodontitis patients and it was shown that periodontitis has a significant effect on OHRQoL. The results of this study were in agreement with the studies showing worse OHRQoL in periodontal disease.[4,19,21-24] Unlike other OHRQoL scales, the OHQoL-UK questionnaire used in this study measures the positive and negative effects of oral health based on the revised model of The World Health Organization.[25,26] It has good psychometric

property, validity and reliability.[27] It has been shown to be sensitive to short- and long-term clinical changes, observed clinical periodontal health, and self-reported oral health after treatment.[18] Negative effects of OHRQoL are expressed as values <48.0, positive effects as values >48.0, and 48 shows no effect. Mumcu *et al.*[28] also found a significant relationship between OHIP-14 and OHRQoL-UK scores.

In this study, mean OHRQoL scores in periodontitis patients at different stages were in the range of 32-35 before treatment and increased to 53-55 after treatment, which was similar to other studies that showed significant improvement.[4,21,22,29] The pretreatment scores of our study were lower than those of Aslund *et al.*[10], who had an average pre-treatment score of 46, and Needleman *et al.*[18], who had a mean pre-treatment score of 47, performed on individuals with mild to moderate periodontitis. Some researchers also found weak correlations between gingival status and OHRQoL.[30,31] These differences may be related to the methodology of the studies, population size, socio-economic status and lifestyle of the participants.

Al Habashnneh *et al.*[23] reported that severe and moderate periodontal diseases have a negative effect on OHRQoL. In our study, when the total OHRQoL was evaluated, there was a significant difference in recovery both before and after treatment in patients with more severe stages (stage III-IV) compared to patients with less severe stages (stage I-II). This result is consistent with previous studies showing that the severity of periodontitis affects the improvement in OHRQoL. [2,18] Eltaş and Uslu[32] found a similarly significant relationship between OHRQoL and disease severity. These results are comparable to studies showing greater improvement in more severe patients.[4,5]

In this study, it was stated that before the treatment, individuals with severe periodontitis (stage III-IV) were significantly negatively affected in terms of physiological status (smile, appearance, speech and nutritional performance) compared to individuals with low severity disease (stage I-II), and they also reported that their general health was badly affected. It was observed that the OHRQoL increased significantly in all stages in terms of physiological status after NSPT, but the stage I periodontitis group reported significantly higher OHRQoL compared to the severe groups (stage III-IV). And they noted that individuals with severe periodontitis (stage III-IV) had a significantly worse OHRQoL in terms of psychological status (mood, confidence, carefree-comfort, sleep patterns and personality) after NSPT than individuals with low-severity periodontitis (stage I-II). When all stages after treatment were compared within themselves, the OHRQoL increased significantly compared to before treatment. It is seen that OHRQoL is scored less in severe stages in terms of social life, family, friends and work relations both before and after treatment. In this study, the changes in the perception of OHRQoL between the stages were small but statistically significant. This can be explained by the fact that severe periodontitis groups are more severe in terms of pain, tooth mobility, loss of interdental papillae, probing depth and gingival bleeding[21], and sometimes NSPT may be insufficient in severe stages. In addition, the number of existing teeth in severe periodontitis groups was significantly less, and stage IV patients showed high prosthesis problems as the reason for admission to the hospital. For these patients, NSPT may not be expected to affect all aspects of OHRQoL because good prosthetic treatment may be required for chewing and biting. However, NSPT positively affected the OHRQoL of the participants. Improvement in both clinical parameters and OHRQoL was observed at all stages after NSPT, and this result is also supported by the long-term study performed previously.[33]

Chewing, swallowing and smile aesthetics of the individual are adversely affected due to clinical findings of periodontitis such as redness, bleeding on brushing, gingival recession, mobility of teeth and tooth loss. As a result, the self-confidence and OHRQoL of the individual decreases.[34] However, periodontitis is a complex disease and it may be wrong to evaluate the results from a single perspective. Because the condition after the treatment can be accepted as improved in one respect and worsened in the other. Although improvement is expected in the clinical findings of periodontitis after NSPT; it has other inevitable findings such as cervical tooth sensitivity, gingival recession, pathologically displaced teeth and loss of interdental papillae. These results can have a psychosocial impact as well as affect appearance and comfort. In addition, in this study, it can be said that surgical periodontal treatment is needed in some regions, since BOP levels could not be reduced to levels considered healthy (<10%) after treatment in severe stages.

In this study, the changes observed in clinical parameters after NSPT were statistically significant and consistent with previously reported clinical studies.[10,35] Clinical improvements were observed by evaluating the objective signs of changes in periodontal status following NSPT. After the treatment, BOP values decreased to 10% levels in stages I and II, as it should be in healthy individuals, while it remained at the level of 20-35% in stages III and IV. Similarly, PD scores were found to be significantly higher due to the increase in disease severity both before and after treatment. According to this result, the need for surgical treatment in severe periodontitis in areas where the expected reduction in BOP and PD does not occur with NSPT is also supported by previous studies.[35] The recovery after treatment found in this study, which is also consistent with previous findings[22], is both clinically significant and can be considered significant for patients.[22] However, if the functionality of the tooth is not maintained for life, improvement of clinical parameters alone may not be sufficient. A trend has emerged that demands a shift towards patient-satisfied approaches in evaluating treatment outcomes. The ultimate goal of physicians is to improve the well-being and OHRQoL of patients.

Conclusions

In conclusion, according to this short-term cross-sectional study, the OHRQoL of individuals with periodontitis at different stages was adversely affected in many ways. Although the post-treatment evaluation period of this study was short; It has been clearly demonstrated that NSPT has a constructive role in improving the impact on OHRQoL. Because the ranges of changes are small, there may be minor undetectable differences between stages. These data may be valuable in determining sample size in future studies. It should be emphasized that there is a significant difference between stages I-II which represents initial and moderate periodontitis, and stages III-IV which represents severe periodontitis with tooth loss and the potential for additional tooth loss. Further long-term studies are needed to evaluate the effect of different dental treatments on OHRQoL and to evaluate these changes clinically.

Conflicts of Interest

No financial support was received for the current study. The authors declare no conflict of interest.

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Effect of Self-cured Universal Adhesive System on Shear Bond Strengths of Conventional and Bulk-fill Composites

Ihsan Hubbezoglu[1-a], Serra Kutlu[2-b*], Ayşegül Karaarslan[3-c]

[1] *Sivas Cumhuriyet University, Faculty of Dentistry, Department of Restorative Dentistry, Sivas, Türkiye*
[2] *Niğde Oral and Dental Center, Niğde, Türkiye*
[3] *Sivas Oral and Dental Center, Sivas, Türkiye*
**Corresponding author*

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ABSTRACT

Aim: The aim of this study was to investigate the effect of self-cured universal adhesive system on shear bond strengths of two conventional and two bulk-fill composites to dentin.

Materials and Methods: In this study, four groups were formed: two conventional condensable composites[G-aenial posterior(GC), Palfique Estelite Paste(Tokuyama)], and two bulk-fill composites[Estelite Bulk Fill Flow(Tokuyama), Beautifil Bulk Restorative(Shofu)]. Each group was divided into two subgroups; G-premio bond (control group) ve self-cured Universal Bond (Tokuyama). 32 human third molar human teeth were prepared to expose dentin surfaces. After the preparation, the teeth were randomly divided into 4 main groups and 2 subgroups (n = 8), composites were applied to the surfaces with the help of cylindrical silicone transparent mold with a diameter of 4 mm and a height of 4 mm.

Results: In this study, when both adhesive systems are evaluated; the highest shear bond strength value was Palfique Estelite Paste, while the lowest shear bond strength value was Beautifil Bulk Restorative. While the difference between Palfique Estelite Paste and Estelite bulk-fill flow, Beautifil Bulk Restorative was found to be statistically significant, the difference with G-aenial posterior was not significant in both adhesive groups. The difference between G-aenial posterior and Beautifil Bulk Restorative was found to be statistically significant in both adhesive groups. When adhesive systems are compared; G-premio bond was found to be higher in all composite groups compared to self-cured Universal Bond, but the difference between them was statistically insignificant.

Conclusions: While conventional composites exhibited high shear bond strengths, bulk-fill composites showed values close to these values. The self-cured adhesive system we used showed near values of shear bond strength to the light-polymerized adhesive system. It is advisable to use self-cured adhesive systems for use in areas where light can be difficult to access in clinical applications.

Keywords: Shear Bond Strength, Bulk-Fill Composites, Self-Cured Adhesive Systems.

Geleneksel ve Bulk-fill Kompozitlerin Makaslama Bağlanma Dayanımlarına Işıksız Adeziv Sistemin Etkisi

Süreç

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ÖZ

Amaç: Çalışmamızın amacı, iki geleneksel ve iki bulk-fill kompozitlerin dentine makaslama bağlanma dayanımlarına ışıksız adeziv sistemin etkisinin incelenmesidir.

Materyal-metod: Çalışmamızda iki geleneksel kondanse edilebilen kompozit [G-aenial posterior(GC), Palfique Estelite Paste(Tokuyama)], kütlesel yerleştirilebilen iki bulk-fill kompozit [Estelite Bulk Fill Flow(Tokuyama), Beautifil Bulk Restorative(Shofu)] olarak 4 grup oluşturuldu. Her grup iki alt gruba ayrıldı; G-premio bond (Kontrol grubu) ve ışıksız Universal Bond (Tokuyama). 32 adet insan üçüncü molar insan dişi dentin yüzeyleri açığa çıkacak şekilde prepare edildi. Preparasyonun ardından dişler rastgele 4 ana, 2 alt gruba ayrıldı(n=8), yüzeylere 4 mm çapında ve 4 mm yüksekliğindeki silindirik silikon şeffaf kalıp yardımıyla kompozitler uygulandı. Tüm grupların makaslama bağlanma değerleri universal test cihazında ölçüldü, kuvvet birimi ise "newton" (=N) olarak kalibre edildi.

Bulgular: Çalışmamızda her iki adeziv sistem kullanıldığında da, en yüksek makaslama bağlanma dayanım değerini Estelite Paste gösterirken, en düşük makaslama bağlanma dayanım değerini Beautifil Bulk Restorative göstermiştir. Her iki adeziv sisteminde de Estelite paste ile Bulk-fill flow ve Beautifil Bulk Restorative arasındaki fark istatistiksel olarak anlamlı bulunurken, G-aenial posterior ile arasındaki fark anlamsız bulunmuştur. Adezin gruplarının her ikisinde de G-aenial posterior ile Beautifil Bulk Restorative arasındaki fark istatistiksel olarak önemli bulunmuştur. Adeziv sistemler kıyaslandığında; tüm kompozit gruplarında G-premio bond, Işıksız Universal Bonda göre daha yüksek bağlanma sağlarken, aralarındaki fark istatistiksel olarak anlamsız bulunmuştur.

Sonuçlar: Geleneksel kompozitler, yüksek makaslama bağlanma dayanımları sergilerken, bulkfill kompozitler bu değerlere yakın değerler göstermiştir. Kullandığımız ışıksız adeziv sistem, ışıkla polimerize edilen adeziv sisteme yakın bağlanma değerleri sergilemiştir. Işıksız adeziv sistemler, klinik kullanımlarda ışığın zor olabileceği bölgelerde bağlanma dayanımı açısından kullanılması önerilebilir.

Anahtar Kelimeler: Makaslama Bağlanma Dayanımı, Bulkfill Kompozitler, Işıksız Adezivler.

[a] *hubbezoglu@gmail.com* *https://orcid.org/0000-0001-8984-9286*
[b] *kutluserra@gmail.com* *https://orcid.org/0000-0001-5127-0885*
[c] *uzm.dt.aysegulkaraarslan@gmail.com* *https://orcid.org/0000-0002-3265-1823*

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Introduction

Newly developed dental materials should be evaluated by in vitro studies before they are put into clinical use. Laboratory tests are similar to clinical trials and are important for gaining insight about mechanical properties. The most commonly used tests to investigate the effectiveness of adhesive systems are bond strength tests.Test methods such as tensile, microtensile, shear are used in vitro to measure the bond strength of materials to dental tissues.[1,2]Shear bond strength test is one of the most widely used test methods defined by ISO 11405 standard.[3]The standard method of shear strength tests is routinely used to determine the adhesion of dental materials to the tooth structure due to its advantages such as ease of sample preparation, reliability, and simple and feasible test protocol.[4,5]

Universal adhesives have been advanced to rule out complications in etch and rinse and self-etch adhesive practices and to use an adhesive with all types of adhesive application.[6-9] Universal adhesives contain acidic functional monomers such as MDP (methacryloxidecyl dihydrogen phosphate).[10] MDP has polymerizable methacrylate groups, phosphate groups capable of chemical bonding with calcium in hydroxyapatite. It is an acidifying monomer due to the dihydrogen phosphate groups it contains. It is highly hydrophobic due to its long carbonyl chain. Forms a stable nano layer on the adhesive interface with hydroxyapatite. The resulting MDP-Ca (calcium) salts precipitate along this layer. This ensures a high and stable bond strength.[11,12] The hydrophilic monomer HEMA (2-Hydroxyethyl methacrylate) contained in Universal adhesives improves the bonding strength of the adhesive resin by providing better resin infiltration.[13-15]

Giomers are described as resin based restorative material that releases fluoride, contains S-PRG (surface pre-reacted glass ionomer particles) fillers.[16] In the presence of water, an acid-base reaction occurs between fluoride-containing glass and polyacrylic acid, a wet silica hydrogel is formed, and S-PRG fillers are obtained after these events.After freezedrying the dehydrated xerogel is ground and processed with silane to create S-PRG fillers of a certain size range.S-PRG fillers perform the release of aluminum, boron, fluorine, sodium, silicon and strontium ions. Composite resins containing S-PRG fillers show antibacterial properties thanks to the metal ions released from the composite. Strontium and fluoride transform hydroxyapatite into strontiapatite and fluoroapatite, making the tooth more acid-resistant. At the same time, S-PRG fillers have the ability to regulate the pH of the environment when they come into contact with water or acidic solutions.[18]

In recent years, bulk-fill composite materials have been developed to apply composites to the cavity in larger masses and to reduce application time. Due to the ease of application by reducing the time spent in the clinic, the placement of bulk-fill composites in deep and wide cavities as 4-5 mm thick single layer, bulk-fill composites have been introduced and used with interest by clinicians.[19]

The purpose of this work is to analyze the effect of universal self cured adhesive system on shear bond strength of dentin to 2 conventional and 2 bulk-fill composites.

Materials and Methods

Selection of Teeth

Ethics Committee approval dated 04.07.2019 and numbered 2019-07/05 was obtained by Sivas Cumhuriyet University Non-Interventional Clinical Research Ethics Committee to start the study. In the study, 64 permanent human molars were used and these teeth were procured from the teeth extracted for orthodontic or periodontal reasons in the last 6 months in Sivas Cumhuriyet University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery. No tooth extraction was performed for the study. Organic residues on the tooth surface were cleaned by keeping the teeth in 2.5% sodium hypochlorite (NaOCl) solution for 1 hour immediately after extraction. During the supply of teeth, the teeth were kept in distilled water at room temperature and the storage fluid was renewed every week. When all the teeth were collected, the work began.

Preparation of Specimens

Before starting the test, 64 human molars were molded using silicone self curing acrylic to be subjected to shear bond strength testing. The occlusal enamel of the teeth was removed using a low-speed diamond saw until the dentinal surfaces were exposed.Then a 600 grit silicon carbide paper was applied to the surfaces to obtain a standard smear layer.2 adhesive systems [G-premio bond (Control group, GC, Japan), chemical cured Universal Bond (Tokuyama, Japan)] and 2 conventional composites[G-aenial posterior (GC, Japan), Palfique Estelite Paste (Tokuyama, Japan)]2 bulk-fill composites [Estelite Bulk Fill Flow (Tokuyama, Japan), Beautifil Bulk Restorative (Shofu, Japan)] were used for the preparation of samples. Materials tested and their compositions are showed in Table 1. In the control group G-premio bond was applied to the surface using applicator, After waiting for 10 s, it was air dried and polymerized using a 10 s LED light device.After the self-cured Universal Bond A and B were mixed, the application was completed within 1 minute and no light application was performed.After adhesive applications, composites were placed using 4 mm diameter, 4 mm high transparent cylindrical mold.In traditional composite groups, 2 layers of 2 mm were inserted by incremental technique.The layers were polymerized (G-aenial posterior 20 sec, Pal fi que Estelite Paste 30 sec) with LED light device (Valo Cordless, Ultradent, USA). In Bulk-fill composite groups, both bulk fill composite resins were applied without layering and cured for 10 seconds.

Table 1. Materials tested and their composition

Material	Composition
G-premio bond (GC, Japan) (One-stage universal adhesive)	10-MDP, 4-META, 10-methacryloxyloxidesyl dihydrogen thiophosphate (MDTP), methacrylate adic ester, distilled water, acetone, photoinitiators, silica
Universal Bond (Tokuyama, Japan) (One-stage two-component universal adhesive)	Primer A: Acetone, 3D-SR monomer, MTU-6 (tiourasil monomer), Bis-GMA, TEGDMA, HEMA Primer B: Acetone, isopropanol, purified water, borate catalyst, peroxide, silane coupling agent
G-aenial posterior (GC, Japan) (microhybrid composite)	UDMA, dimethacrylate co-monomers, strontium and lanthanoid, fluoroaluminosilicate glass, silica (Bis-GMA-free)
Palfique Estelite paste(Tokuyama, Japan) (microfill composite)	Bis-GMA, TEGDMA,
Estelite Bulk Fill flow (Tokuyama, Japan) (flowable bulk-fill composite)	Bis-GMA, TEGDMA, Bis-MPEPP, mequinol, dibutyl hydroxyl toluene, uv adsorber, silicon oxide, zirconium oxide
Beautifil Bulk Restorative (Shofu, Japan) (packablegiomer bulk-fill)	Bis-GMA, UDMA, Bis-MPEPP, TEGDMA, fluoro-silicate glass (S-PRG filler based on fluoroboroaluminosilicate glass) polymerization initiator, pigments and others

Shear Bond Strength Test

After the samples were stored in distilled water at 37 ºC for 24 hours, they were subjected to shear bond strength test using the universal test machine. The crushing apparatus was placed at an angle of 90 ° with the dentin-composite interface of the samples and shear bond strength test was applied to the samples at a head speed of 0.5 mm/min. The forces applied during the crushing process were measured in Newtons (N) and then converted to Megapascals.After shear bond strength test, fracture surfaces of all samples were enquired under a stereomicroscope with X25 magnification.

SEM Analysis

After all samples were examined by stereomicroscope, SEM analyzes were performed to evaluate the fracture surfaces in detail. The samples were analyzed with SEM device.

Statistical analysis

Variation data of were analyzed using the SPSS statistical software program (22.0 version, SPSS Inc., Chicago, USA). The data were subjected to statistical analysis with using one-way analysis of variance and Tukey's post hoc test to examine pairwise differences at a significance level of 0.05.

Results

In Table 2, we presented the minimum, maximum values, mean and standard deviations of the composite groups tested, and the differences between the groups. In this study, when both adhesive systems were used, Palfique Estelite Paste showed the highest shear bond strength value, while Beautifil Bulk Restorative showed the lowest value. Palfique Estelite Paste, which showed the highest bond strength, was followed by G-aenial posterior and Estelite Bulk-fill flow, respectively. The difference between Palfique Estelite paste and bulk-fillcomposites and the difference between G-aenial posterior and Beautifil Bulk Restorative were also statistically significant ($p<0.05$). If we look at the comparison of adhesives; In all composite groups, G-premio bond showed higher values than self cured Universal Bond, while the differences between them were insignificant ($p>0.05$). SEM images of the groups are given in figure 1-8.

Table 2. The maximum, minimum, mean and standard deviation values of the shear bond strength tests of the composite resins used in the study

Composites	G-premio bond	Universal bond
Palfique Estelite paste	18.02 (1.49) ^{a,b}	15.97 (1.14) ^{d,e}
G-aenial posterior	17.14 (1.53) ^{c}	15.07 (1.49) ^{f}
Bulk-fill flow	15.10 (1.19) ^{a}	13.23 (0.76) ^{d}
Beautiful Bulk Restorative	14.68 (1.64) ^{b,c}	12.69 (1.37) ^{e,f}

* F=14.231 p=0.000, p<0.05

a,b,c,d,e,f,g there is a statistical difference between the groups shown with the same lower case letters($p<0.05$).

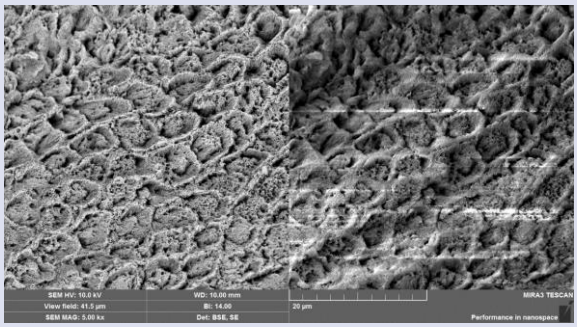

Figure 1. SEM image of G-premio bond + G-aenial posterior

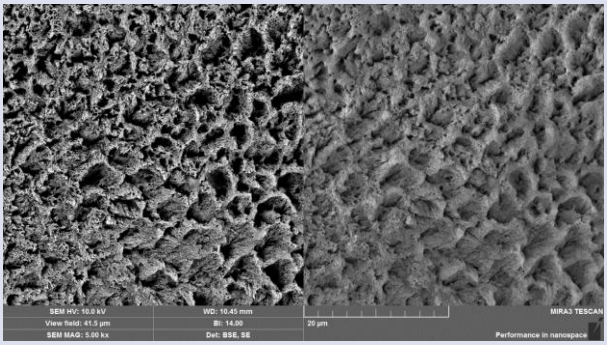

Figure 2. SEM image of Universal bond + G-aenial posterior

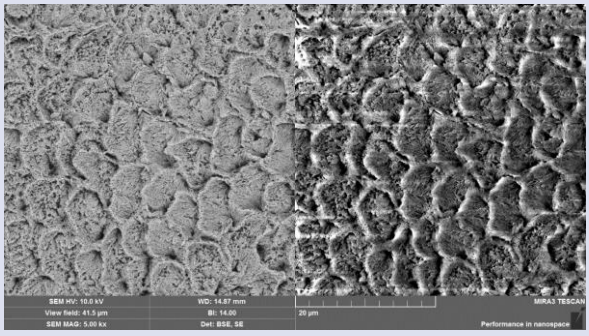

Figure 3. SEM image of G-premio bond + Palfique Estelite Paste

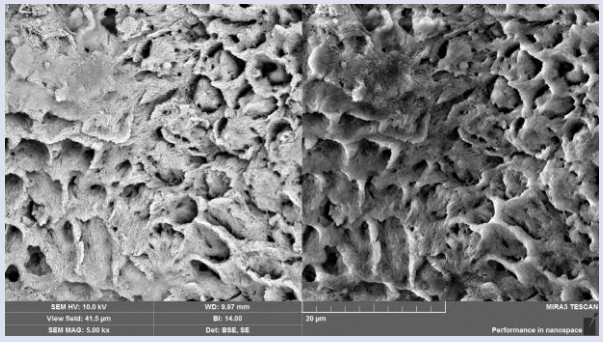

Figure 4. SEM image of Universal bond + Palfique Estelite Paste

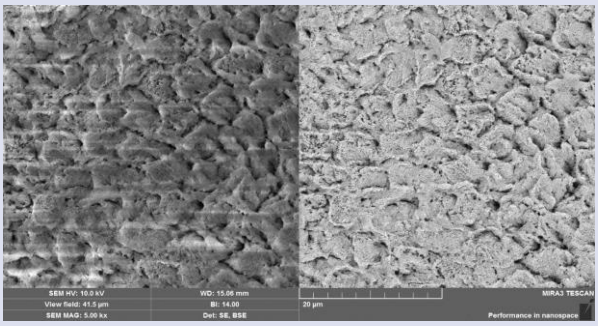

Figure 5. SEM image ofG-premio bond + Estelite Bulk-fill flow

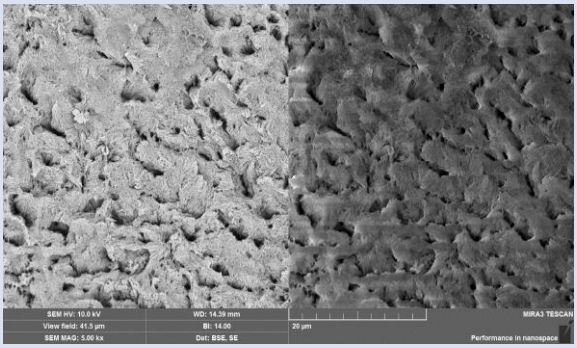

Figure 6. SEM image ofUniversal bond + Estelite Bulk-fill flow

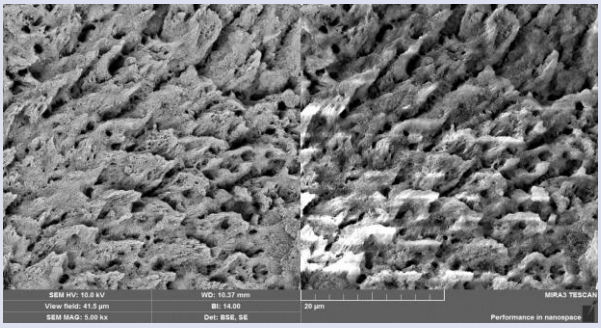

Figure 7. SEM image of G-premio bond + Beautifil Bulk Restorative

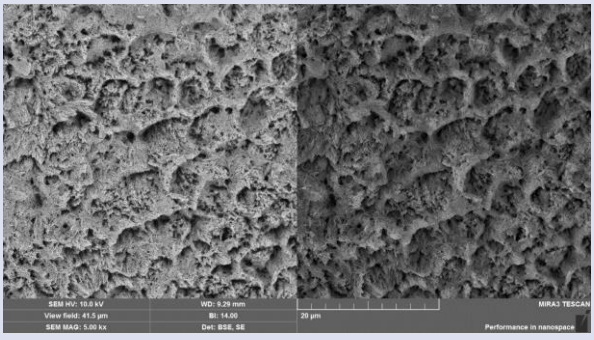

Figure 8. SEM image of Universal bond + Beautifil Bulk Restorative

Discussion

In the field of dentistry, minimally invasive dentistry has greatly increased the use of resin-based materials. The bonding of these materials with the teeth has shown more successful results with the development of adhesive systems. Effective bonding is necessary to reduce microleakage, prevent susceptibility, increase retention and increase caries resistance.[20]

There are many factors that negatively affect the bonding to dentine tissue. Some of these factors; increasing dentin tubule diameters and numbers from enamel dentin border to pulp, reduction of remaining dentin thickness, dentin sclerosis, dentin fluid causing humidification in the cavity, smear layer, smear plug formation, in deep dentin decreasing of intertubular dentin area and increasing the water content.[21,22]As the depth of dentin increases, changes in the chemical structure of dentin, increase in diameter and number of dentin tubules, increase in dentin moisture and change in dentin permeability are observed. These factors affect bonding to dentin.[23]In this study, enamel was removed from the occlusal parts of the teeth 2 mm below the dentin border, in order to ensure standardization. In laboratory tests, 600 grit silicon carbide paper is one of the most preferred abrasives in order to standardize the degree of roughness of the dentin surface and the resulting smear layer.[24]In this study, 600 grit silicon carbide sander was used to prepare tooth surfaces.

It is important to appraise the bonding performance of newly developed adhesives before they are placed on the market.The most preferred bond strength test method is shear bond strength test.[25]Shear bond strength test is a reliable test method used in the assessment of bond strength of materials to different dental tissues.It is frequently preferred especially because it mimics the load distribution in the clinical setting better and achieves significant results in the evaluation of bonding to homogeneous surfaces.[26]

In order for the use of bulk-fill composite resins to become widespread, it is necessary to be aware of their physical mechanical features and to research their bonding to dental tissue. In this study, we aimed to assess the shear bond strength of 1 condensable, 1 flowable bulk-fill composite resin and 2 conventional composites with using 2 different adhesives.

Melkumyan *et al.*[27] compared two in vitro performance of two self etch adhesives (Contax, Bond Force) and two total etch adhesives (Te-Econom Bond, Swisstec SL Bond). Contax and Bond Force composite resin were used with Palfique Estelite Paste, while Te-Econom Bond and Swisstec SL Bond and were used with Swisstec composite resin. According to the their shear bond strength test results, although the bonding of Contax to enamel was not as strong as Te-Econom Bond and Swisstec SL Bond, the difference between them was found to be statistically insignificant. However, the bonding of Contax with dentin was found better than Swisstec SL Bond.

Çolak *et al.*[28]scored the shear bond strength of 2 bulk-fill and 2 nanohybrid composites to dentin in premolar teeth. They performed their work in the middle coronal part of the dentin. If we look at the results of the study, it has been reported that 2 nanohybrid composites show higher values than bulk-fill composites bond strength. Almeida *et al.*[29] evaluated the microtensile bond strength of 2 bulk-fill and 1 nanocomposite. They also performed their work by preparing Class I cavities. As the bondig technique, they preferred the etch and rinse method in all cavities. SonicFill exhibits the highest bond strength, followed by traditional nanocomposite and Tetric Bulk Fill has lowest value. This result can be associated with sonic activation technology. Fronza *et al.*[30] studied the microtensile bond strengths of a microhybrid composite (Herculite Classic), 2 flowable (SureFill SDR Flow, Filtek Bulk Fill Flowable Restorative) and a packable bulk-fill (Tetric EvoCeram Bulk Fill) resin in Class I cavities. While the highest microtensile bond strength was shown by conventional microhybrid composite, the highest bond strength was acquired by packable bulk-fill and the lowest bond strength by the flowable bulk-fill composite Filtek Bulk Fill Flowable Restorative.

Tavarez *et al.*[31] examined the effect of bulk-fill, microhybrid and nanoparticulate composite resins on shear bond strength. Following the application of 37% phosphoric acid to 4 mm diameter, 2 mm thick cylindrical Filtek Z350 composite blocks, the composites were repaired and shear tested. Of these, microhybrid composite showed higher bonding strength than bulk-fill composite, but didn't find a significant difference between them. The lowest value was obtained by nanoparticulate composite. Tavarez *et al.*'s study supports our study by obtaining high bonding values in the microhybrid composite and differs from this study due to the repair of the composite surface. Although G-aenial posterior, which has a microhybrid structure, follows Palfique Estelite Paste which shows the highest bond strength; the differences between them were not statistically significant.

In our literature research, we could not find a research on the bond strength of Estelite Bulk Fill flow composite. According to the results of our study, Beautifil Bulk Restorative exhibited the lowest shear bond strength. Beautifil Bulk Restorative is different from bulk-fill composites thanks to its giomer structure. Singla *et al.*[32] aimed to evaluate the polymerization depths and sub-surface microhardness of 3 bulk fill and 1 conventional composite in cylindrical blocks. SonicFill exhibited the highest surface hardness. When we evaluated the bulk-fills used in the study, it was reported that only giomer bulk-fill exhibited values below the acceptable limit. They suggest that the lower values of the Beautifil Bulk Restorative are associated with a softer PRG filler. Tsujimoto *et al.*[33] studied the cured depth of giomer bulk-fillsand nongiomer bulk-fills. As the curing time was raised in all the materials they used, the curing depth raised. When we look at low viscosity materials, Beautifil Bulk

Flow exhibited the lowest curing depth; when we look at high viscosity materials, Beautifil Bulk Restorative exhibited the lowest curing depth. As a result, they indicated that giomers did not exhibit as much curing depth as other bulk-fills.

In the literature, there are not enough studies on the bond strength of self cured Tokuyama Universal Bond. This newly developed universal adhesive system is related to the bond strength; Katsumata *et al.*[34] in the study of two different universal adhesive system (Tokuyama Universal, Single Bond Universal) using different restorative materials in the dentin microtensile bond strengths were evaluated, although there isn't any statistically significant difference in terms of microtensile bond strength. It was resulted that self cured Universal Bond exhibited lower values than Single Bond Universal.

Conclusions

Conventional composites showed higher values, while bulk composites exhibited shear bond strength values close to these values. The self cured adhesive system exhibitedvalues close to the light polymerized adhesive system. In clinical applications, the use of self-curing adhesive systems may be recommended for use in hard to light areas. As the bond strengths of the two universal adhesive systems used in the self-etch mode were similar, it is concluded that these systems should be tested in vitro using different modes.

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Management of Multiple Adjacent Mandibular Recession Defects using Multiple Lateral Pedicle Flap Autografts-A Case Report

Antarleena Sengupta[1,a], Neetha J Shetty[2,b,*]

[1]*Department of Periodontics, Manipal College of Dental Sciences, Mangalore, Manipal Academy of Higher Education, Karnataka, India.*
**Corresponding author*

Case Report

History

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ABSTRACT

Background: Gingival recession in the aesthetic zone hampers the appearance of the patient's smile and is cause for hypersensitivity in the teeth affected. Usually, the more the number of teeth affected, the more surgical procedures may be required to provide root coverage adequately.
Methods: Five anterior teeth in the mandibular aesthetic zone were treated using multiple separate Laterally Displaced Pedicle Autografts (LPAs).
Results: 90 days' follow-up reveals adequate increase of keratinized tissue and root coverage.
Conclusions: The surgical technique employed here may be a possible approach for single-sitting root coverage procedures of multiple adjacent anterior recessions, provided adequate thickness of biotype exists. This also limits discomfort due to elimination of grafting and provides aesthetic results.

Keywords: Gingival Recessions, Dentin Sensitivities, Periodontal Atrophies, Surgery, Pedicled Flaps.

[a] *antarleenasengupta@gmail.com* *https://orcid.org/0000-0001-7224-546X* [b] *neetha.rajesh@manipal.edu* *https://orcid.org/0000-0001-8841-6235*

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Introduction

Recession of the gingival margin in a localized area, especially in the anterior aesthetic zone, remains an issue of concern in the current scenario of surgical approaches. Exposure of root by receding gingiva is both a cosmetic as well as functional issue. Craniofacial aesthetics are supplanted by restoring normal anatomic structures, which include the oral mucosa. One of the ways to achieve this is by augmentation of soft tissues of the periodontium by different techniques of root coverage. Besides extreme sensitivity to the hard tissues of the teeth, limited maintenance of plaque control and diminished oral hygiene maintenance often lead to carious destruction of the roots. The primary objective of reconstructive surgery of the mucogingival tissues is to achieve coverage of root recessions to a predictable degree. In recent years, the desire for smile designing among patients, along with an increased acceptance of cosmetic oral surgical procedures are key factors to an increased demand for such surgical techniques which can achieve optimum coverage. However, the rates of success for each of the existing techniques are so far contradictory and are therefore subjected to application and review regularly. Traditionally, the use of pedicle flaps has been done along with supplementary use of subepithelial connective tissue grafts (SCTG) as the most dependable method for coverage of recessed areas. The following case report was done root coverage in five teeth in the mandibular aesthetic zone that was managed using five separate laterally displaced pedicle autografts to ensure and evaluate its aesthetic results along with gain in keratinized tissue.[1]

Case Report

A 22-years-old male patient reported to the Department of Periodontics, Manipal College of Dental Sciences, Mangalore, MAHE, with a chief complaint of tooth sensitivity in his lower anterior region with concerns about the appearance of the concerned teeth (Figure 1). The patient did not report with any relevant medical or drug history that could hamper the healing of his oral soft tissues, post-surgery. The patient had

- Miller's Class II recession[2] defects of 2 mm bilaterally on 33 and 43, and of 3 mm on 42.
- Miller's Class I recession defects of 3 mm on the 31 and 32, and of 2 mm bilaterally on 13 and 23, respectively. (Figure 3)

All the recession defects were Recession Type 1 (RT1) according to the classification system given by Cairo.[3] The probing depths seen clinically were ranging from 2-3 millimetres, and the patient experienced sensitivity on the affected teeth on tactile and air blast stimuli. All measurements included in this case report were recorded on cast models using caliper. The patient provided signed informed consent prior to undergoing the procedure as planned.

Figure 1. Presentation of the gingival recessions at first visit.

Figure 2. Outline of incisions to achieve root coverage using multiple LPAs in mandibular anterior aesthetic zone.

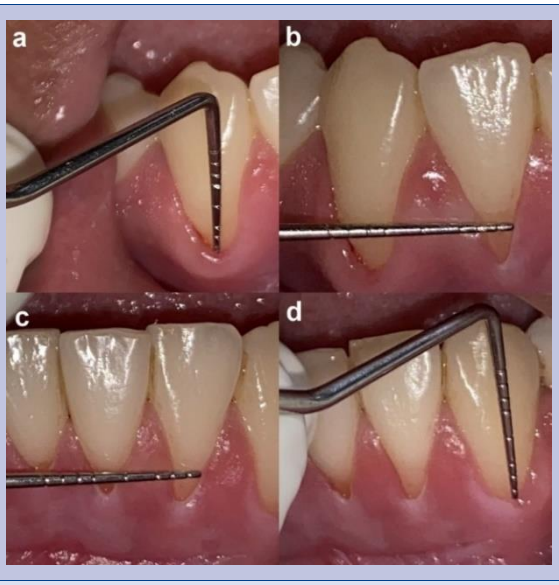

Figure 3. Recession depth (RD) and Recession width (RW) in the affected region.

Table 1. Resolution of recession at 15-day follow-up

	AT **15 DAYS** POST-OP		
TOOTH	**PERCENTAGE OF Gingival recession defect (GRD) COVERAGE**		
	PRE-OP	**POST-OP**	**EQ**
31	3 mm	0.5 mm	**83.3%**
32	3 mm	2.5 mm	**16.67%**
33	2 mm	1 mm	**50%**
42	3 mm	0 mm	**100%**
43	2 mm	1.5 mm	**25%**

EQ: [(PRE-OP GRD-POSTOP GRD)/ PRE-OP GRD] × 100

First, using a flame-shaped bur and high-speed airotor handpiece (NSK), the root surface prominences (convexity) of 43, 33 and 32 were reduced; following which the surgical procedure was conducted according to the planned treatment outline (Figure 2, Note the surgical outline for semilunar coronally advanced flaps in upper canine bilaterally, to be performed). Starting from 42, after administering local anesthesia by infiltration, using a #15c blade and handle, marginal gingiva was resected with a V-shape incision around the exposed root surface of 42 and a beveled incision was given in the opposite side of the donor area (to permit overlap of flap). Vertical and horizontal incision around the donor site of 41 were outlined– the donor flap was designed at 1.5x wider than the recession width and 3-4x longer than its width. A partial-full thickness pedicle flap was reflected using sharp followed by blunt dissection until beyond the mucogingival junction (MGJ), in order to facilitate coronal advancement. Releasing/cutback incision was made to eliminate tension on the pedicle while laterally positioning onto recipient site, and the partial thickness pedicle was sutured to the periosteum covering bone irt 42 using 5-0 black silk. The procedure was repeated for 43, 31 and 33. For 32, V-shaped incision around the recession was given and undermined apically using sharp dissection until beyond the MGJ to advance coronally and stabilize with sling sutures. Following haemostasis, the surgical site was irrigated with normal saline and a non-eugenol periodontal pack was placed (Figure 4, a-d). Patient was prescribed non-steroidal anti-inflammatory drugs (Ibuprofen 400 mg+ Paracetamol 325 mg+ Caffeine 25 mg salt) as required (SOS) and Diclofenac 50 mg+ serratiopeptidase 10 mg salt twice a day for 3 days to reduce post-surgical pain and inflammation along with undiluted 10 mL Chlorhexidine gluconate mouthwash (0.2% w/v) twice a day for 7 days post-surgery to maintain oral hygiene at the operated region. Instructions including to avoid brushing and to not disturb the periodontal pack were given.

Results

The pack and sutures were removed 15 days after the procedure, and the operated region was irrigated carefully. It was observed that there was mild erythema and edema at the operated region, progressive epithelial healing at 15th day showed no abnormalities on visual examination (Figure 5), CRC was already achieved at 42 while mild to moderate degrees of closure of recession depth and width was seen irt the other teeth, as is documented in Table 1. Oral hygiene instructions and Modified Stillman's technique for brushing were advised. The patient was put on recall to monitor progression of healing and maintenance of hygiene.

On the final assessment at 90 days after the procedure (Figure 6), good coverage and reduced sensitivity was seen, along with improved aesthetics (Table 2). The final range of coverage achieved for the recessions were in a range of 75% to 100% (with a mean 90%) for the mandibular aesthetic zone.

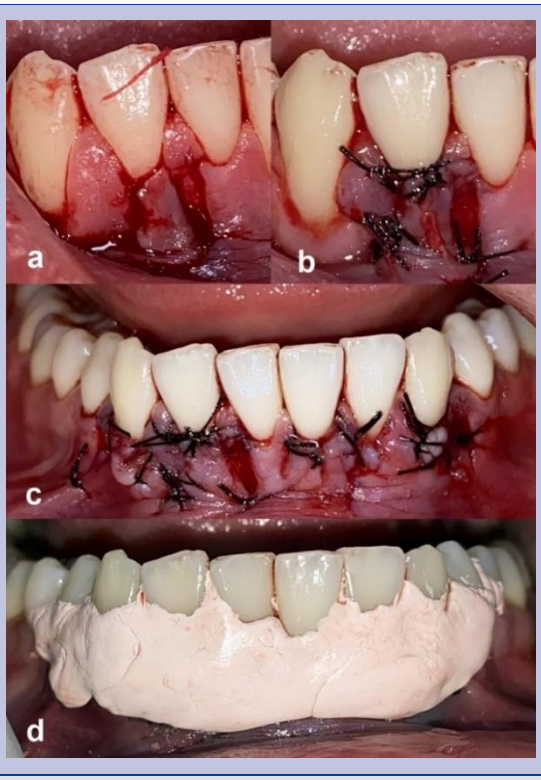

Figure 4. (a) Incision for LPA in 42; (b) Lateral placement and suturing with 5-0 black silk; (c) final immediate post-operative appearance after suturing and haemostasis in mandibular anteriors; (d) placement of non-eugenol periodontal dressing.

Figure 5. Clinical picture taken at 15 days post-op.

Figure 6. Clinical picture taken at 90 days post-op. Note the CRC achieved at teeth #31, 32 and 42. The mandibular canines show a recovery of GRD dimensions upto 75%.

Table 2. Final recovery of gingival recession after 90 days

TOOTH #	PERCENTAGE OF GRD COVERAGE		
	PRE-OP	POST-OP	EQ
31	3 mm	0 mm	**100%**
32	3 mm	0 mm	**100%**
33	2 mm	0.5 mm	**75%**
42	3 mm	0 mm	**100%**
43	2 mm	0.5 mm	**75%**

EQ: [(PRE-OP GRD—POSTOP GRD)/ PRE-OP GRD] × 100

Discussion

In this case report, multiple separate laterally displaced pedicled autograft technique were used to achieve root coverage of multiple gingival recessions in adjacent teeth in the mandibular aesthetic region. This technique has previously been used for very good management of denuded roots. It can be highly useful as it bypasses the need for another surgical site as is required by either free autografts, or harvesting of SCTG, but only in case where the tissue thickness is adequate prior to surgery. It is often seen in case of free autografts that vascular supply as well as stabilization of the graft can get hampered, which does not arise in case of lateral pedicle technique.[4]

Previously, several case series have been published using the technique of modified lateral sliding flap to treat multiple adjacent recession cases, but the main differences from the technique we've used here is firstly, in the flap design, i.e., a combined flap created by oblique incisions at the proximal and distal borders of the area requiring root coverage and displacing it laterally to suture it in position. Secondly, all of these previous attempts have been done using a combination of the lateral pedicled flap as well as placing soft tissue autografts, which included a bilaminar approach using sub-epithelial connective tissue graft, to increase tissue thickness as well as achieve root coverage.

The patient was recalled at day 15 for assessment of initial epithelialization of soft tissue at the surgical site as per Pippi *et al.*[5] and at day 90 for evaluation of completion of wound healing and keratinization.

Limitations

In the present case report, CRC was achieved only in relation to 31, 32 and 42. On the mandibular canines, there was partial recovery of the width and height of the recession. This could be attributed to the decreased zone of attached gingiva present in the region along with the anatomy of the mandibular canine (root prominence), which makes it a difficult area to achieve CRC in. Additionally, the surgical design of the pedicle flap against gravity could also be a contributing factor for low MRC in 33 and 43. In this case, the outcome of coverage via LPA is 90%[6], and need for a second surgery is bypassed.

Conclusions

The alternatives considered for the management of recessed gingiva traditionally include either free or pedicled autograft of gingival tissue. In case of treatment considered for a single root or an isolated case, coverage is usually excellent and can be expected to achieve complete resolution in case of Class I and II recessions according to Miller's Classification using horizontally displaced pedicled flaps with good visual results. However, the challenge persists when considering root coverage of multiple adjacent recessions, and in presence of adequate tissue thickness of adjacent gingiva, multiple pedicles can be created and displaced laterally to achieve root coverage. Studies investigating its efficacy as a

routine or standalone measure for cases satisfying these indications are still required currently.

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Wiedemann–Rautenstrauch Syndrome: Case Report

İrem İpek[1,a,*], Cansu Derdiyok[2,b], Fatih Öznurhan[2,c]

[1]*Department of Pediatric Dentistry Faculty of Dentistry, Fırat University, Elazığ, Türkiye*
[2]*Department of Pediatric Dentistry Faculty of Dentistry, Sivas Cumhuriyet University, Sivas, Türkiye*
**Corresponding author*

Case Report

History

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ABSTRACT

Neonatal-progeroid syndrome known as Wiedemann Rautenstrauch syndrome (WRS) is an extremely rare, autosomal recessive disorder. Neonatal progeroid disease characterized by progeroid appearance growth retardation, lipodystrophy, an unusual face (triangular shape, sparse hair, small mouth, macrocephaly, pointed jaw), thin skin, hard and thick joints and dental anomalies (newborn tooth; hypodontics). A 5-year-old boy case diagnosed with hypodontics is presented. In this case, a child prosthesis was performed to facilitate the nutrition of the patient and to increase the quality of life.

Keywords: Alkaline Phosphatase, Orthodontics, Osteoclasts, Risedronic Acid, Tooth Movement.

[a] *iremipek4493@gmail.com* *https://orcid.org/0000-0002-3542-7122*
[b] *cansuu.dt93@gmail.com* *https://orcid.org/0000-0002-6886-1662*
[c] *fatihozn@hotmail.com* *https://orcid.org/0000-0002-7797-0932*

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Introduction

Neonatal-progeroid syndrome known as Wiedemann–Rautenstrauch syndrome (WRS) is an extremely rare, autosomal recessive disorder [1] and was first described by Rautenstrauch and Snigula in 1977 and delineated by Wiedemann in 1979.[2] Neonatal progeroid disease characterized by progeroid appearance growth retardation, lipodystrophy, an unusual face (triangular shape, sparse hair, small mouth, macrocephaly, pointed jaw), thin skin, hard and thick joints and dental anomalies (newborn tooth; hypodontics).[3] Although Jay *et al.*[3] reported bi-allelic truncating variations in *POLR3A* in a single patient and hypothesized these to be causal for WRS, the main cause for WRS still remain unknown.[4] It is inherited autosomal recessively and biallelic pathogenic variants in the POLR3A gene form the basis of the WRS phenotype.[5] Most of these patients die in the first days and months after birth[6] but there are reports presenting survival into 16-17 years of age.[7,8]

Here in this case, we report a 5-year-old male that has classical clinical features of WRS.

Case Report

A 5-year-old boy presented to Sivas Cumhuriyet University Faculty of Dentistry Department of Pedodontics with a complaint of not being able to eat due to lack of teeth. The parents did not have any congenital anomalies and he was the first child of the family. According to the anamnesis taken from the parents, it was learned that the parents had the same syndrome in their second child. In extra-oral examination performed in our clinic, it was observed that hair formation was rare, scalp veins were prominent and facial features was abnormal. In addition, cranio-facial disproportion was observed according to age due to micrognathia, hypodontia, small mouth with thin upper vermilion, prominent scalp veins, widespread hair loss, deep set eye (Figure 1). The patient's mental development was also normal.

In intra-oral examination of the patient, only right maxillary canine (53), left maxillary lateral (62) and mandibular central teeth (71, 81) were seen in the mouth and shape anomalies were observed in these teeth. The mandibular crest had a knife edge appearance and the tongue size was normal. When the patient's panoramic radiograph was examined, it was seen that the deciduous teeth did not have root development and there were no permanent tooth germs underlying deciduous teeth. However, mandibular permanent 1st molar germs were seen in panoramic radiograph (Figure 2).

As a result of the examinations and the patient's complaint of inability to feed, a child prosthesis was planned for this patient. A 3-month follow-up was recommended to the patient, and his parents were informed that the prosthesis could be renewed depending on the eruption of the teeth and growth and development of jaws (Figure 3).

Figure 1.

Figure 2.

Figure 3.

Discussion

WRS is a rare autosomal recessive disease of unknown pathogenesis with progeroid appearance from birth.[9] Patients with this syndrome can be diagnosed at birth due to a range of abnormalities such as short stature, growth retardation, progeroid appearance, large fontanelles and sutures, prominent skin vessels, hypoplasia of facial bones, sparse scalp and eyebrows.[2,10] Pathogenic variants in the POLR3A gene are associated with hypomyelination, hypodontics, and hypogonadotropic hypogonadism.[5] Hutchinson-Gilford progeria syndrome (HGPS), Cockayne syndrome, Hallermann - Streiff syndrome (HSS), Werner's syndrome or Pelizaeus Merzbacher disease may phenotypically mimic WRS, but WRS is different from other premature aging syndromes[2,11], because all these changes are present at birth.[6,7,10,12,13]

HGPS has different facial features and includes prominent eyes and a beaked nose, with a characteristic bird-like facial appearance. Typical craniofacial features include easy visualization of scalp vessels, alopecia, micrognathia, and craniofacial disproportion.[14] Disorder in the growth of both maxilla and mandible, tooth crowding, irregular tooth eruption and localized enamel hypoplasia are seen.[15-18] Although the dental symptoms are partially similar with the patients with WRS, their phenotypic features are different. Characteristic features of Cockayne syndrome; microcephaly, cachectic dwarfism and progressive neurological degeneration, sensorineural hearing loss, cataracts, pigmentary retinopathy, photosensitivity and dental caries.[19,20] It differs from WRS because of these features. In addition, patients with WRS have hypodontia and oligodontia[3] and dental caries are uncommon.

HSS patients typically have bird-like facial features. Hypotrichosis, various ophthalmic disorders and dental abnormalities such as oligodontia, natal-neonatal teeth, enamel hypoplasia and supernumerary teeth are seen.[21,22] Although dental anomalies seen in this syndrome are also seen in patients with WRS, they do not show the ocular findings of HSS and are slightly similar in terms of facial features.

In our case report, patient has hypodontia and the erupted teeth had abnormal morphological structures and the lack of tooth structure may cause speech disorders, problems in the temporomandibular joint.[23,24] Due to the patient's nutritional problem, the progress of body development may slow down and a child prosthesis can overcome this problem by eating different kinds of nutritional products. A child prosthesis can increase the upper face height and get rid of the patient from elderly facial seem. For these reasons, a child prosthesis was performed to facilitate the nutrition of the patient and to increase the quality of life.

Conclusions

As a result, child prosthesis can be made to maintain the physical and functional development of these patients, to support them psychologically, and thus to increase their quality of life.

Consent

Informed consent was obtained from the patient parent for publication of this case report and accompanying images.

Acknowledgements

None

Conflict of Interest Statement

The authors deny any conflicts of interest related to this study.

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Rehabilitation of Aramany Classification I Defect on a Completely Edentulous Patient: A Clinical Case Report

Pl Ranganayakidevi S Palaniappan[1,a]

[1]*Department of Restorative Dentistry, Faculty of Dentistry, University Malaya, Malaysia.*

Case Report

History

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ABSTRACT

This clinical case report describes a prosthetic rehabilitation for a patient who had partial maxillectomy surgery following the diagnosis of maxillary squamous cell carcinoma in 1991. She was also previously diagnosed with parotid gland pathology on the right and required complete removal of gland along with facial nerve. Her previous prosthesis is 18 years old and claims it not as retentive as before. Intraorally there was a large oval shaped defect on the right side of the maxilla sparing the left alveolus. Defect extends more than 2/3rd of the palatal area with communication to the nasal floor. Presence of buccal frenal pull on the right side on the upper and lower jaws due to the wound contracture on that side of the face. The extraoral facial asymmetry and weakness of facial muscles in this patient may lead to improper denture border seal of the prosthesis. Patient was provided with maxillary acrylic obturator and mandibular acrylic complete denture as a definitive treatment with careful denture extension planning. She was reviewed multiple times till prosthesis stability intraorally was achieved. This improved the prognosis for this patient. The only option for retaining prosthesis in this case, without implants, is optimum engagement of the available soft-tissue undercuts found within the defect space and the non-affected side.

Keywords: Completely Edentulous, Obturator, Facial Nerve, Prognosis, Case Report.

Tam Dişsiz Bir Hastada Aramany Sınıflandırma I Defektinin Rehabilitasyonu: Klinik Bir Vaka Sunumu

Süreç

Geliş: 05/06/2021
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ÖZ

Bu klinik vaka raporu, 1991 yılında maksiller skuamöz hücreli karsinom tanısı ile parsiyel maksillektomi ameliyatı olan bir hastanın protetik rehabilitasyonunu anlatmaktadır. Daha önce sağda parotis bezi patolojisi teşhisi konmuş ve fasiyal sinir ile birlikte bezin tamamen çıkarılmasını gerektirmiştir. Önceki protezi 18 yaşında ve eskisi kadar kalıcı olmadığını iddia ediyor. Ağız içinde sol alveolü koruyan maksillanın sağ tarafında oval şekilli büyük bir defekt vardı. Defekt, nazal tabanla iletişim ile damak bölgesinin 2/3'ünden fazlasına uzanır. Yüzün o tarafındaki yara kontraktürü nedeniyle üst ve alt çenelerde sağ tarafta bukkal frenal çekme varlığı. Bu hastada ağız dışı yüz asimetrisi ve yüz kaslarının zayıflığı, protezin uygunsuz protez kenar sızdırmazlığına neden olabilir. Hastaya dikkatli protez uzatma planlaması ile kesin tedavi olarak maksiller akrilik obtüratör ve mandibular akrilik tam protez verildi. Ağız içinde protez stabilitesi sağlanana kadar defalarca gözden geçirildi. Bu, bu hasta için prognozu iyileştirdi. Bu durumda implant olmadan protezi sabitlemek için tek seçenek, defekt alanı ve etkilenmeyen taraf içinde bulunan mevcut yumuşak doku alt kesiklerinin optimum şekilde bağlanmasıdır.

Anahtar Kelimeler: Tamamen Dişsiz, Obturator, Yüz Siniri, Prognoz, Olgu Sunumu.

[a] *ranganyaki@msn.com* *https://orcid.org/0000-0002-3031-5287*

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Introduction

Functional rehabilitation for a totally edentulous patient with a maxillary palatal defect may be a clinical challenge. Additionally, to understanding the basics of fabricating a functional complete denture, the dentist also must understand the physiology to modify the extension and design of the prosthesis. Only then, it can fulfil all the specified oral functions and improve the prognosis of the treatment provided.

Surgical consequences of the tumour removal will end in the patient having hypernasal speech, fluid leakage into the nasal cavity, impaired masticatory function, facial asymmetry and cosmetic deformity. Management of the patient becomes slightly harder if the patient also has seventh cranial nerve removal. In such cases, patients may present with striated muscle paralysis, weakness or twitching of the face on the affected side. In this case, the patient had maxillary squamous cell carcinoma and salivary gland pathology. Following this, she had partial maxillectomy and complete removal of the salivary gland together with the cranial nerve. This caused the patient to possess muscle weakness on the concerned side. Since the resection was done in the anterior midline region, this patient is assessed as Aramany Class 1.

Surgical reconstruction in comparison to obturator prosthesis being provided has shown to provide a more robust quality of life and performance to the patient.[1] Patients who undergo surgical management often undergo postoperative complications such as graft rejection, repeated surgeries, and psychological impact.[2] As an alternate, simple prosthetic management is an option. Management of this patient was done conventionally without any auxiliary retentive components like dental implants or surgical procedure. It demonstrates that with a correct extension of the prosthesis, retention are often well achieved. The prosthesis used to rehabilitate the maxillary defects are generally remarked as an 'obturator'.[3]

Case Report

A 78-year-old Chinese female was referred to the Prosthetic Clinic of the University of Malaya. She complains of a loose maxillary denture. The patient was diagnosed with maxillary squamous cell carcinoma in 1991 at Hospital Kuala Lumpur, Malaysia. There was partial maxillectomy surgery performed then and was provided with a maxillary obturator. She does not have a lower prosthesis. Currently, the maxillary obturator is not as retentive as before. Her prosthesis is 18 years old with under extended borders and worn off denture teeth. Since she does not have a lower denture, the patient is unable to eat well. Due to this, she frequently has indigestions and loss of weight. There is a previous history of some parotid gland pathology on the right side for an unknown reason. The entire gland was removed along with the facial nerve. This resulted in the eye on the affected side being unable to blink, thus patient uses, moisturizing eye drops.

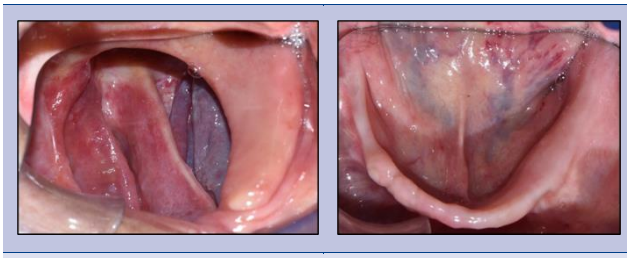
Extraoral (Figure 1), there was severe wound contraction on the right side of the face that caused the facial asymmetry. The patient also presented with depressed and unsupported upper and lower lips. There was overclosure of the lower to the right side at rest when not wearing the prosthesis. Deviation when opening and closing of mouth was noted. The patient had a convex facial profile. She was unable to blink her right eye and also presented with hypoesthesia over the right infra-orbital, nasal and upper lip region.

Intraorally (Figure 2), a large oval-shaped defect on the right side of the maxilla sparing the left alveolus. Defect extends more than 2/3rd of the palatal area with communication to the nasal floor. Presence of buccal frenal pull on the right side due to the extraoral wound contracture on that side of the face. Well defined alveolar ridge and retromolar region on the left side. Completely edentulous maxilla and mandible. Diagnosis for this patient is (i) Maxilla: Aramany Class I defect with completely edentulous arch, (ii) Mandible: Completely edentulous arch.

The aim of the treatment for this patient is (i) Function, (ii) Mastication, (iii) Aesthetic, and (iv) Speech. Thus, maxillary acrylic hollow bulb obturator opposing mandibular removable acrylic complete denture was planned.

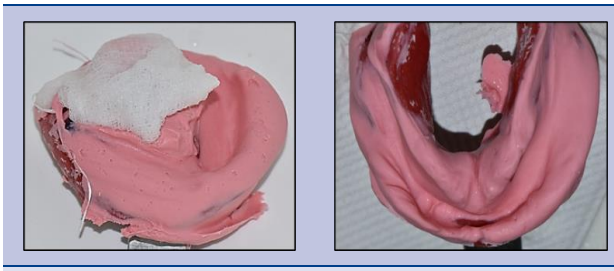
(a) (b) (c)

Figure 1. Extraoral pictures of patient without prosthesis: Right lateral view (a), Frontal view (b), Left lateral view (c).



(a) (b)

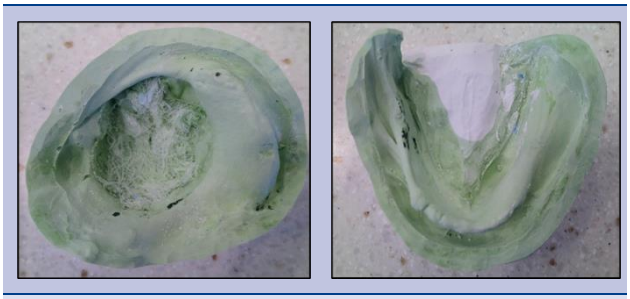
Figure 2. Intraoral view (a) maxilla, (b) mandible.



(a) (b)

Figure 3. Maxillary (a) and mandibular (b) primary impression.

Figure 4. Maxillary (a) and mandibular (b) primary impression.



(a) (b)

Figure 5. Maxillary (a) and mandibular (b) secondary cast.

She preferred simple, treatment with lesser appointments and the most conventional treatment. The patient was fully informed about the treatment and written consent was taken before treatment procedures.

Preliminary model prepared for maxilla and mandible prepared using a stock tray. Before the impression, the maxillary defect was covered with gauze. The impression compound was used and washed with irreversible hydrocolloid (Kromopan, Lascod, Illinois, USA) (Figure 3). The impressions were poured with type III dental stone (Elite Rock, Zhermack SpA, Via Bovazecchino, Badia Polesine, Italy) to produce casts.

Following the clinical trial fitting appointment, the proceeding step for processing the prosthesis was done. The maxillary obturator prosthesis was processed as a closed hollow bulb. The palatal part of the prosthesis cut was cut open (Figure 6). Later the sulcus and teeth portion were waxed-up and secured. At the defect site; the fitting surface was waxed up. The cover lid at the palate was also waxed-up separately following the piece that was cut out previously. Both the separate parts were processed individually and later the bulb and lid portions were joined using the auto-polymerizing resin. The mandibular prosthesis was fabricated with the conventional denture processing method.

In the consecutive appointment, a prosthesis was issued to the patient. The fitting surfaces of the prosthesis were checked with a fit checker and were adjusted accordingly. Occlusion and posterior extension were verified (Figure 7,8). The frenal full on the right mandibular area was causing the prosthesis to be lifted. The extension was checked multiple times till the prosthesis was stable. Before leaving, the patient was given postinsertion instructions for the prosthesis. The patient was reviewed 1-week post-insertion. During the review, the patient was asked to drink with the prosthesis intraorally to access any leakage of fluid. Phonetics and occlusion were also reassessed multiple times. Oral hygiene instructions were reinforced to the patient. The patient's voice was clearer and more understandable. Facial profile of the patient improved to straight.

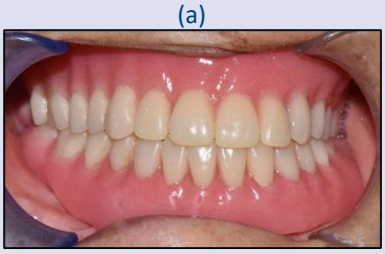
The prognosis of the treatment provided is considered good. The patient was happy with the treatment outcome; oral hygiene was good. Since the maxillary and mandibular prostheses were stable and retentive, the patient could use the prosthesis well.

Discussion

Successful denture therapy for a completely edentulous patient is influenced by the biomechanical phenomena of retention, stability and support.[4] In this case, the stability and support of the maxillary obturator are compromised because of the defect which is at the primary stress-bearing area; the hard palate. Both within the maxilla and also the mandible, there's a buccal frenal pull that disrupts the peripheral seal. Overclosure and wound contraction on the affected side causes the denture to lift easily. This compromises the retention of the prosthesis. Thus, external denture contours were critical.[5] Conversely, poorly designed prostheses that don't accommodate anticipated muscular function may yield compromised denture stability and reduced retention.

Figure 6. The palatal portion of the prosthesis is cut open before wax-up of the bulb portion.

(a)



(b)

(c)

Figure 7: Intraoral view after issue of dentures. Right Lateral view (a), Anterior view(b), Left Lateral view (c).

Figure 8: Posterior palatal extension of obturator intraorally.

Adjustment of the denture flanges that are over-extended is mandatory. The patients' hypesthesia, may lead to ulcers but might not present any pain in the slightest degree. Visualizing the denture extension into the sulcus are often difficult clinically. Pressure indicating paste is used during the review. After drying the denture border within the area being evaluated, the paste was placed and so carefully seated intraorally. Once seated, the denture was held border moulding movements were performed. Overextended borders had the materials removed. These areas were marked and so trimmed with a carbide bur. Finally smoothened and polished before giving it to the patient.

After adjustments to the denture fitting surfaces to be more stable, the patient can manage the prosthesis well despite the lack of any retentive components and also the large defect site. Since this patient is an obturator wearer for over 18 years, she knows well the way to manage the prosthesis. The patient's ability to manage dentures involves a learning process that, initially, could be a conscious endeavour. As a result of repetition, new reflex arcs are founded within the central systema nervosum and also the conscious effort has been replaced by a subconscious behaviour pattern. Constant repetition of impulses lowers the synaptic resistance and facilitates the formation of conditioned reflexes. At the identical time, however, it must be realised that the synaptic resistance are increased within the absence of those repeated stimuli.[6]

This obturator prosthesis incorporates a hollow bulb that's light but bulky. Besides fully engaging the undercuts within the defect with the bulb within the prosthesis, the treatment outcome is restricted because of the path of insertion that becomes complicated. A vital point to notice is that the weight of the prosthesis will cause loss of restraint and also to the propelling forces intraorally.[7] the employment of endosseous dental implants will further improve the prognosis for completely edentulous patients. Individuals wearing implant-assisted prostheses typically report improved oral comfort and function in comparison to conventional, mucosa-supported prostheses.[8] Using Zigomatic Implant in the edentulous maxillary defect was found more advantageous, in terms of compression and tensile stress and retention, when compared with conventional dental Implant.[9]

Except when contraindicated due to financial or surgical considerations, implant-assisted overdentures are usually the treatment of choice. During this case, although the patient understands the advantages of implant-supported prosthesis she isn't interested and only prefers a non-invasive conventional treatment.

Conclusions

With careful planning of denture extensions is executed; along with good impression making and proper fitting of dentures within the anatomical limits, an overall satisfactory treatment outcome can be achieved. A good knowledge understanding of the patients' needs would enable the successful rehabilitation and a comprehensive management.

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