ISSN
2980-2091

EUR@SIAN DENTAL RESEARCH

'03

VOLUME 1
ISSUE 3

EUR@SIAN DENTAL RESEARCH

December 2023, Volume 1, Issue 3

Publisher
Biruni University Facult of Dentistry

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Designer
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The publication languages of the journal English.

This is a scholarly, national, peer-reviewed and open-access journal published triannually in April, August and December

Publication Type: Periodical

BİRUNİ UNIVERSITY
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FROM THE EDITOR

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

Eurasian Dental Research aims to contribute to the literature by publishing manuscripts at the highest scientific level on all fields of dentistry. The journal publishes original articles, and rare case reports that are prepared in accordance with ethical guidelines.

The journal is the official publication of Biruni University and published triannually in April, August, and December. The publication language of the journal is English.

No fees or charges are required for manuscript processing and publishing with Eurasian Dental Research.

We aim to be accepted in the internationally respected indices and discovery services in the coming years.

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

Best regards,

Prof. Dr. İlknur ÖZCAN
Editor in Chief

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Investigation of the Incidence of Nutrient Canals in Diabetic Patients

Murat Mert ATAPEK[1], Mehran MOGHBEL[2]

Abstract

Aim The purpose of this study is to put emphasis on the importance of identifying certain changes of anatomical structures on routine radiographic examinations which can lead to diagnosis of various systemic diseases and may direct the patient to consultation.
Material and method Our research was conducted by analyzing radiographs taken from 100 healthy patients above 20 years of age who applied to Istanbul University Faculty of Dentistry and 108 patients with diabetes above 20 years of age who applied to Istanbul University Faculty of Medicine's Experimental Medicine Research Center (DETAM).
Results The relationship between type 1 and type 2 diabetes is presented in the tables.
Conclusion According to results, the length of destruction period of diabetes type 1 has a significant role and tends to form more significant numbers of nutrient canals.

Keywords Dentistry, Diabetes, Nutrient canals, Mandible, Radiography

Introduction

The nutrient canals were first described by Hirschfeld in 1923. Other names for nutrient canals are vascular canals or interdental nutrient canals, interdental canals, circulatory canals. In 1942, Sweet found the term 'nutrient canal' to be more appropriate. These canals show linear radiolucency and different relationships with the roots of the teeth (1,2).

In 1977, Britt examined mandibles of cadavers with histologic and radiographic studies and discovered that these canals contain veins and connective tissue elements. For this reason, these are real canals and tend to extend not horizontally but vertically in the antero-posterior direction (3,4).

The incidence of nutrient canals can increase due to factors such as high blood pressure, race, age, periodontal disease or unknown etiology. [5] In this aspect, relation between diabetes and nutrient canal has a positive correlation. This created many comments on the issue (5-7). The current understanding is that the presence of nutrient canals is closely related to systemic diseases (4). Diabetes mellitus, is a disease of high plasma glucose levels and lacking the sufficient insulin. The main characteristic of diabetes is low secretion of insulin and an absolute or relative lack of its usage. Lack of insulin activity can occur due to a decrease in the number of beta cells (8).

Two types of Diabetes Mellitus are presented:
1-Insuline related (Type 1, Juvenile) Diabetes
2-Non-Insuline Related (Type 2, Insulin Resistant type) Diabetes

Type 1 diabetes is characterized by reduced secretion or lacking secretion of insulin. Etiology of the disease is not exactly known but a hypothesis is common where a viral reagent damage to beta cells creates diabetes.

Type 2 diabetes usually occurs more commonly and starts beyond the age of 40. Most of the patients have obesity. It is usually asymptomatic on course and discovered via routine laboratory examinations.

The purpose of this study is to put emphasis on the importance of identifying certain changes of anatomical structures on routine radiographic examinations which can lead to diagnosis of various systemic diseases and may direct the patient to consultation.

Material and Methods

Our research was conducted by analyzing radiographs taken from 100 healthy patients above 20 years of age who applied to Istanbul University Faculty of Dentistry and 108 patients with diabetes above 20 years of age who applied to Istanbul University Faculty of Medicine's Experimental Medicine Research Center (DETAM). The healthy individuals consisted of 54 males and 46 females. The diabetic individuals consisted of 47 patients with type 1 diabetes and 61 patients with type 2 diabetes. These groups were further divided into males and females accordingly. Individuals selected for the research procedure did not have severe periodontal disease. Also the criteria of having at least 2 teeth on the sections of two jaws as frontal, left and right sides was sought. Radiographs taken using a paralleling technique were examined under a negatoscope and classified as either having or not having nutrient canals. All data was statistically tested with chi-square and precise chi-square tests and nutrient canal relationship with gender, type 1 diabetes and type 2 diabetes.

Results

Table 1 reveals the findings on radiographs from the healthy group. Nutrient canal and gender relationship presented on table 2. Nutrient canal and diabetic patient relations are presented on table 3. The results presented in Table 3 have also been discovered and discussed by various researchers previously, but no classifications of diabetic patients or selection criteria were used. Table 4 presents the relationship between type 1 and type 2 diabetes. Table 4 also presents a dividend of canal and no canal

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Received: 08.08.2023 / Accepted: 17.08.2023 / Published: 20.12.2023

statement for two types of diabetes.

Table 1: Control group

Canal	No Canal	Total
42	58	100

Table 2: Gender-nutrient canal relation

	Canal	No Canal	Total
Male	26(49%)	28	54
Female	16(35%)	30	46

Table 3: Diabetes-nutrient canal relation

	Canal	No Canal	Total
Diabetic Patients	70(64%)	38(36%)	108

Table 4: Nutrient canal relation with type 1 and type 2 diabetic patients

	Canal	No Canal	Total
Type 1 Diabetes	35(74%)	12(26%)	47
Type 2 Diabetes	35(58%)	26(42%)	61

Discussion

The importance of intraosseous space nutrient canals, which contain veins, nerves, and connective tissues, has been discussed in many research studies(9).Some researchers, such as Lovett and Ryder, state that nutrient canals are normal anatomic structures that tend to appear on all segments of the mandible and maxilla, regardless of whether they are edentulous or dentulous(10). Goodman-Topper's work on children between the ages of 6-10 revealed that these structures are not pathological but rather anatomically normal (4,7). Researchers reported these canals appear mostly on mandible incisor site, followed by mandibular molar site and then maxillary molar sites (5,7,11). Researchers determined through radiographic studies that anterior mandibular bone density and the incidence of finding nutrient canals increased. They also found that these canals appear on the labial or vestibular sides of teeth (7,12).

Kanji Kishi discovered through research on mandibles that the incidence of finding nutrient canals tends to increase in cases of severe periodontal problems, advancing age, and edentulous patients (2,3). Emphasis was placed on the presence of canals; alveolar bone thickness, spongy and cortical bone quality, and edentulous presence in the mandible were considered important factors. The presence increases with higher than average bone density with smaller trabeculae of bone (10). An increased density creates a sclerotic boney change of the trabeculae in the presence of periodontal disease (5,13).

Patel and Wuehrmann discovered an increased incidence of nutrient canals in patients with severe periodontal problems through radiographic studies (14). Bilge and Kansu's research reveals that an increased number of nutrient canals detected on patients with periodontal issues and periodontal issues are related with age - therefore, periodontal compromised patients showing increased nutrient canals is related to advancing of the age of the patients (1,15).

In this research, a relation between diabetes mellitus and nutrient canal presence was searched. According to our research nutrient canals and diabetes mellitus has a relation. These findings concurs with Patel and Wuehreman (10,13,14), but differs with Kansu's research. However, the researchers mentioned above did not classified diabetes mellitus as type 1 and 2 on their research. In our research this differentiation was made with a value of $p<0,05$ with type 1 and $p>0,06$ with type 2 high significance. When these considered; both proportional difference of values and different outcomes has a clear showing on the topic.

Conclusion

According to these results, the length of destruction period of diabetes type 1 has a significant role and tends to form more significant numbers of nutrient canals

Declarations

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

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

Financial Disclosure: *Authors declared no financial support.*

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Comparison of the Mechanical Properties of Various Microhybrid Dental Composites

Merve YILDIRIM ÜÇÜNCÜ[1], Musa Kazım ÜÇÜNCÜ[2]

Abstract

Aim The objective of this study was to investigate the surface microhardness and roughness of several michrohybrid dental composite restorative materials comparatively.

Material and method The study encompassed four distinct brands of microhybrid-type dental composites, including two newly introduced ones, Dentac Myra and Dentac Pergamon, alongside Gradia Direct Posterior and 3M Z250. Additionally, a newly manufactured Parion Flow flowable composite was also included. For surface microhardness testing, 45 composite discs were prepared with a diameter of 5 mm and a thickness of 2 mm for each group (n=9). For surface roughness, 45 composite discs with a diameter of 8 mm and a thickness of 2 mm were prepared (n=9). Surface microhardness was measured using the Vickers Hardness Test device, and surface roughness was measured using a contact profilometer. One-Way ANOVA with Tukey's HSD analysis and the Kruskal-Wallis H test with Dunnett's correction were used for intergroup comparisons.

Results Strongly significant differences were observed among groups in terms of microhardness ($p < 0.0001$; $F = 94.75$). The highest Vickers hardness number (VHN) was obtained for 3M Z250, while Gradia Direct Posterior exhibited inferior values compared to Myra ($p > 0.05$) and Pergamon ($p = 0.0378$). Significant differences were found among groups in terms of surface roughness ($p < 0.0001$; $H = 34.36$), with Gradia Direct Posterior having the highest roughness value.

Conclusion Myra and Pergamon demonstrated better performance in terms of surface roughness and microhardness values compared to Gradia Direct Posterior. The similar performance was not observed compared to 3M Z250

Keywords Dental composite, Inorganic fillers, Microhybrid mechanical properties, Surface microhardness, Surface roughness

Introduction

Resin-based composites, widely employed among dental restorative materials, are extensively utilized by clinicians in both anterior and posterior regions due to their enduring lifespan and remarkable aesthetic performance (1). For dental composites chosen for treatment purposes, it is necessary that certain mechanical, physical, and aesthetic attributes to be at an elevated level, and the components constituting the composite structure be formulated in specific proportions (2).

Fundamentally, the content of the inorganic phase in dental composites, which is primarily composed of organic (3), inorganic (4), and intermediary phases binding these two (5), significantly influences the physical properties, characteristics, and thus, the longevity of the restorative material within the oral environment (1). The presence of various fillers constituting the inorganic phase in different weights and volumes contributes to the production of composites with enhanced mechanical properties and durability (6). Depending on the particle sizes of these fillers, they can be classified as macrofills, microfills, or hybrids (7). The particle size and quantity of the fillers composing the structure of dental composites are associated with characteristics such as polymerization shrinkage, mechanical adequacy in areas of high occlusal load, fracture and wear resistance, and surface roughness, directly impacting the performance of the composite.

The physical, mechanical, optical, and efficacy against microorganisms of dental composites can be tested using various methods in a laboratory environment. In the literature, test methods such as microhardness (8), color stability (9), surface roughness measurement (10), water absorption (11), monomer conversion (12,13), dental biofilm and microorganism adhesion (14) are observed to be used to assess the properties of resin-based materials.

In light of this information, the aim of this study is to investigate the mechanical properties of produced microhybrid-type dental composite materials using Vickers microhardness and contact surface roughness test methods. Given the limited number of studies in the literature concerning newly produced dental composite materials (Dentac Myra & Dentac Pergamon), this study was conducted. The null hypothesis of the study is that there is no statistically significant difference among dental composites in terms of both microhardness and surface roughness values.

Material and Methods

Preparation of Samples and Determination of Sample Size

This study's experimental design was conducted in a laboratory setting. The determination of group sample sizes for both methods was realized using the statistical analysis program G. Power 3.1.7. Power analysis was performed, expressing the study's

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Received: 25.08.2023 / Accepted: 04.09.2023 / Published: 20.12.2023

power as 1-ß (ß = Type II error probability). For the surface microhardness test, an effect size of f = 2.77 was determined, considering the values from Marović et al.'s study (15). To achieve an 80% power at α: 0.05, a minimum of 8 composite disk samples was calculated to be required in each group. For the surface roughness test, with an effect size (d) of 1.6641106 based on Junior et al.'s study (16), and with the study's power set at 80% at a: 0.05 level, a minimum of 6 composite disk samples per subgroup was determined.

Table 1: The origins, compositions, and characteristics of dental composites

Name	Manufacturer, Origin	Ingredients (Organic / Inorganic)	Filler load (wt%/ vol%	Type	The recommended polymerization type	Lot number
Parion Flow	Dentac T-Resto, Türkiye	BIS-GMA BIS-EMA UDMA TEGDMA / inorganic filler, silica, quartz	60/40	Flowable	LED A1-A2 : 10 sec A3,5-A4: 20 sec	DC741A2
Myra	Dentac T-Resto, Türkiye	BIS-GMA BIS-EMA UDMA TEGDMA / inorganic filler, silica, quartz	77-78/66	Microhybrid*	LED A1-A2 : 10 sec A3,5-A4: 20 sec	DC702A2
Pergamon	Dentac T-resto, Türkiye	BIS-GMA BIS-EMA UDMA TEGDMA / inorganic filler, silica, quartz	77-78/66	Microhybrid	LED A1-A2 : 10 sec A3,5-A4: 20 sec	DC731A2
Gradia Direct Posterior	GC Dental Products, Japan	UDMA, dimethacrylate, co-monomers / Fluoro-alumino-silicate glass, prepolymerised filler, silica	77/65	Microhybrid	High power LED (more than 1200 mW/cm2) : 10 sec Halogen / LED (700 mW/cm2) : 20 sec	2111021
Z250	3M ESPE, USA	BIS-GMA, UDMA, BIS-EMA / zirconia-silica, particul size range of 0.01 – 3.5 µm	77.5/ 60	Microhybrid	Halogen or LED minimum intensity 400 mW/cm2 : 20 sec	NC38554

Abbreviations: BIS-GMA: Bisphenol A diglycidyl methacrylate, UDMA: Urethane dimethacrylate, TEGDMA: Triethylene glycol dimethacrylate, BIS-EMA: Bisphenol A ethoxylate dimethacrylate, LED: Light Emitting Diode, n.i: not informed.
*According to the information obtained from the product manager, in the Myra composite, a small amount of certain nanopartides has been incorporated into the structure, distinguishing it from Pergamon. The product is marketed as a microhybrid.

For both testing methods, a total of 90 composite disk samples were prepared, with 9 samples in each subgroup (n=9). In the assessment of surface roughness, the sample discs of 2 mm thickness and 8 mm diameter were created. Conversely, the microhardness examination involved the utilization of specimens characterized by a thickness of 2 mm and a diameter of 5 mm. The names, brands, origins, and content information of the dental composites used in the study are presented in Table 1.

Evaluation of the Surface Microhardness

The composite samples to be used for the microhardness test were prepared with a thickness of 2 mm and a diameter of 5 mm. With the assistance of a specialized teflon mold, a total of 45 samples were prepared, with at least 9 samples in each group. Initially, a glass substrate was placed at the bottom. Transparent mylar strip was applied to both surfaces of the teflon mold placed on the glass. The polymerization process of each sample was carried out using a recommended light source and duration (Valo, Ultradent Inc., Utah, USA) in accordance with the manufacturer's instructions. A Vickers hardness-testing device (Shimadzu HMV-G31D, Shimadzu Corporation, Japan) was used for the microhardness test. Using a Vickers Hardness tester, notches were created on the composite discs by applying a ≈50 g (490.3 mN) force for 15 seconds. The led beam from the Vickers test arm of the device was used to attempt to create the notches at the center of the composite disc. The diagonal lengths of each created notch were calculated using an ocular lens magnified to 40x. The following equation was used to measure surface microhardness: $H= 1854.4 (Pd^{-2})$. Where H represents Vickers hardness (kg/mm^2), P denotes the applied force (g), and d signifies the average length of the diagonals (µm). The obtained results were expressed as Vickers hardness number (VHN).

Evaluation of the Surface Roughness

For the measurement of surface roughness of the included composites in the study, composite discs were prepared using a specialized teflon mold. The prepared discs had a thickness of 2 mm and a diameter of 8 mm, with a total of 45 samples, 9 in each composite group. Composite disc samples were prepared by applying transparent polyester tape to both surfaces of the Teflon mold on a glass substrate. The polymerization process of each sample was carried out using a recommended light source and duration (Valo, Ultradent Inc., Utah, USA) in accordance with the manufacturer's instructions. A contact profilometer device (Surtronic S128, Taylor Hobson, Leicester, United Kingdom) was used to measure surface roughness. Prior to measurement, the upper surface of the composite discs underwent a low-speed micromotor finishing-polishing process using a finishing-polishing kit (Sof-Lex Disc 3M ESPE, St. Paul, USA) to create a uniform area for measurement and ensure standardization. To establish a standardized measurement surface for all samples, the thickest-grit disc of the relevant kit was used to roughen the measurement surface of the composite discs without water. Then, the debris on the sample surfaces was washed and rinsed, and the samples were incubated in an oven at 37°C for 24 hours until the measurement time. The preparation and measurement of all samples were conducted by a single researcher (M.K.U.) to ensure standardization. Prior to measuring each composite group, the device was calibrated using its calibra-

tion mode. Measurements were taken from three different regions for each sample, and their averages were calculated. Using a portable contact profilometer, the roughness values of each sample were calculated in terms of Ra. The profilometer device was used with a stylus having a 0.2 mm cutoff length, a 2 mm evaluation length, within the range of up to 400 μm.

GraphPad Prism software (GraphPad Software, Inc., California, USA) was used for statistical analyses. While assessing the study data, in addition to the descriptive statistical methods (mean, standard deviation, minimum, maximum), the normality of quantitative data, where n<50, was examined using the Shapiro-Wilk test. Furthermore, confirmation of normal distribution was verified through Q-Q plots and computation of skewness-kurtosis values. If normal distributiona was established, the presence of statistically significant differences in multiple comparisons was explored utilizing the One-Way ANOVA with Tukey's honestly significant difference (HSD) analysis. If normal distribution was not observed, the presence of statistically significant differences in multiple comparisons was examined using the Kruskal-Wallis H test with Dunnett's correction. Significance was evaluated at the lowest level p<0.05.

Results

In present study, the results obtained for Vickers surface microhardness are presented in Table 2-3 (Figure 1), and the results for surface roughness are shown in Table 4 (Figure 2). Regarding microhardness, a statistically strong significant difference was detected among the composites (p < 0.0001; F = 94.75), and additional tests revealed from which groups the difference originated (Table 3). The microhardness values of the composites were ranked from highest to lowest as follows: Z250 (70.92 VHN) > Pergamon (58.82 VHN) > Myra (53.87 VHN) > Gradia Direct Posterior (52.74 VHN) > Parion Flow (30.67 VHN). Parion Flow had significantly lower microhardness values with a very strong statistical significance compared to all other composites (p<0.0001), conversely, this was observed for Z250 (p<0.0001). No statistically significant difference was observed between Myra and Pergamon or Gradia Direct Posterior in terms of VHN (p>0.05). On the other hand, a significant difference was found between Pergamon and Gradia Direct Posterior (p=0.0378). With respect to surface roughness among the composites, a statistically strong significant difference was found (p<0.0001; H = 34.36), and additional tests showed from which groups the difference originated (Table 4). The surface roughness values of the composites were ranked from highest to lowest as follows: Gradia Direct Posterior (3.056 Ra) > Pergamon (2.474 Ra) > Z250 (1.959 Ra) > Myra (1.844 Ra) > Parion Flow (1.296 Ra).

Table 2: ANOVA analysis result

ANOVA table	SS	DF	MS	F (DFn, DFd)	p
Treatment (between columns)	22923	4	5731	F (4, 130) = 94.75	<0.0001
Residual (within columns)	7863	130	60.49		
Total	30787	134			

Parion Flow did not exhibit a statistically significant difference with Myra (p>0.05), while Pergamon showed a strong (p<0.001) and Gradia Direct Posterior exhibited a very strong (p<0.0001) statistical significance.

Table 3: Comparison of the surface microhardness values

VHN	Mean ± sd (Min – Max)	p*	Differences
Parion Flow (A)	30.67 ± 6.72 (17.60 - 49.20)	$<0.0001^{B\text{-}C\text{-}D\text{-}E}$	B-C-D-E
Myra (B)	53.87 ± 7.97 (34.00 - 66.10)	$<0.0001^{A\text{-}E}$	A-E
Pergamon (C)	58.82 ± 5.63 (48.80-71.50)	$<0.0001^{A}$ 0.0378^{D} $<0.0001^{E}$	A;D;E
Gradia Direct Posterior (D)	52.74 ± 6.39 (36.10 - 62.60)	$<0.0001^{A\text{-}E}$ 0.0378^{C}	A-E;C
3M Z250 (E)	70.92 ± 11.00 (46.30 - 88.00)	$<0.0001^{A\text{-}B\text{-}C\text{-}D}$	A-B-C-D

**One-way ANOVA with Tukey's HSD (p<0.05)*

A significant difference was also detected between Z250 (p<0.05). No statistically significant difference was found between Gradia Direct Posterior and Z250 (p>0.05), and there was no statistical significance between Myra and Pergamon (p>0.05). The microscopic images of all dental composites included in the study at a magnification of x40 are presented in Figure 3.

Table 4: Comparison of the surface roughness values

Surface Roughness	Mean ± sd (Min – Max)	p*	Differences	H	p**
Parion Flow (A)	1.296 ± 0.762 (0.6 – 3.5)	$<0.001^{C}$ $<0.0001^{D}$ $<0.05^{E}$	C;D;E		
Myra (B)	1.844 ± 0.859 (0.9 – 3.9)	$<0.05^{D}$	D		
Pergamon (C)	2.474 ± 1.182 (0.7 – 4.8)	$<0.001^{A}$	A	34.36	<0.0001
Gradia Direct Posterior (D)	3.056 ± 1.337 (0.9 – 6.2)	$<0.0001^{A}$ $<0.05^{B}$	A;B		
3M Z250 (E)	1.959 ± 0.766 (1 – 3.6)	$<0.05^{A}$	A		

**Kruskal-Wallis H test with Dunnett's correction (p<0.05), **Kruskal-Wallis H test*

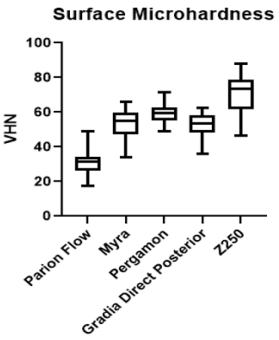

Figure 1: Graphical representation of the surface microhardness values

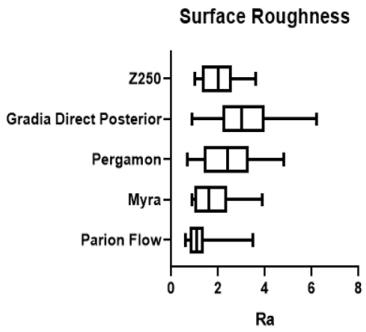

Figure 2: Graphical representation of the surface roughness values

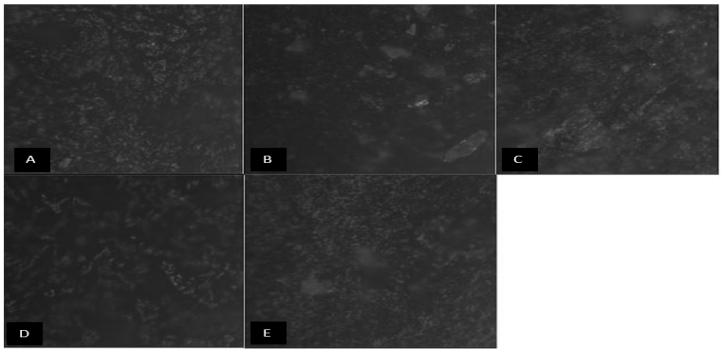

Figure 3: The images of dental composites at a magnification of x40. (A: Gradia Direct Posterior, B: Dentac Myra, C: Dentac Pergamon, D: Dentac Parion Flow, E: 3M Z250)

Discussion

The null hypothesis of the study was disproven based on the obtained data. According to both methods, statistically significant differences were found among dental composites. Through research in the field of composites, inferences about the success of restorations can be drawn, and restorative materials are constantly improved, striving towards achieving the most optimal restorative material (2). Clinicians need to have a comprehensive understanding of the components, advantages, and disadvantages of any biomaterial, as this holds crucial importance for the accurate selection of restorative materials (17). A study revealed that microhybrid composite materials are preferred to nanohybrids in higher proportions (55.9% and 44.10%, respectively) (17). Additionally, in the study by Kazier et al., out of 38 identified composites in the literature, 31 were determined to be of the microhybrid type (1). Microhybrid composites exhibit high wear resistance and can be endowed with improved mechanical properties, displaying abrasion capability similar to that of enamel (18). Consequently, they are suitable for dental restorations that require high occlusal stress-bearing capacities (19). As a result of the inadequate polishing efficacy exhibited by hybrid composites, manufacturers have opted to diminish the dimensions of larger filler particles. This alteration is aimed at improving the potential for achieving a smoother finish, all the while preserving a substantial filler content. Thus, microhybrid composites, which offer approximately 75-85% filler loading, have been introduced as materials with good durability, lacking particles larger than 1 μm, and are safe for use in both anterior and posterior restorations. Based on this information, our study comprehensively examined the performance of four microhybrid dental composite restorative materials, including two newly introduced ones (Dentac Myra and Dentac Pergamon), in terms of surface hardness and surface roughness.

Hardness is defined as the measure of resistance that emerges as a material undergoes plastic deformation at the point where force is applied, either through an indenter or as a result of an applied force. Today, non-destructive testing (NDT) methods have gained importance, allowing the measurement of material performance without any invasive intervention into the material being tested (20). Among hardness testing methods, it is noted that macro, micro, and nano-indentation tests are used. Additionally, methods such as Brinell, Knopp, Rockwell, and Vickers are applied, with load ranges in microhardness methods varying from 1 to 1000 grams (21). In the field of dentistry, Knopp and Vickers tests are the most commonly encountered in the literature; the Vickers test is a non-destructive method that can be applied across a wide range of materials. Moreover, the diagonal length of the square formed by the diamond indenter can be automatically measured using devices, and the aforementioned formulation can be computed automatically in a computer environment (21). Hence, in this study, the Vickers surface microhardness test was utilized. Although there is an ISO standard attributed to this method in the literature (22), it is observed that different forces and holding times are applied in studies. Examples include 300 g – 20 sec (23), 300 g – 15 sec (24), 200 g - 10 sec (25), 100 g - 10 sec (8), and 5 g or 10 g (15). Moreover, disks of different thicknesses and diameters have been used, such as 1x7mm (24), 2x8mm (26), 4x6mm (8), and 2x10mm (23). Although these variations might appear as a lack of standardization, each study is conducted uniquely with distinct purposes and various resources (financial and laboratory conditions). Therefore, researchers can consider different loading forces, application durations, and disk sizes based on their objectives. In our study, an approximate force of 50 g was applied to the sample surfaces for 15 seconds. Following measurements, the highest VHN value was observed in Z250, while the lowest value was in Parion Flow. The values of Gradia Direct Posterior were found to be lower than those of Myra and Pergamon. The nature and quantity of the inorganic structure can directly influence microhardness values (27). In Z250 samples (77.5 wt%, 60 vol%), higher values in Myra (77-78 wt%, 66 vol%), Pergamon (77-78 wt%, 66 vol%), and Gradia Direct Posterior (77 wt%, 65 vol%) could be attributed to the higher filler content compared to others (8). Additionally, the amount of residual monomers and different matrix polymers can lead to different results (28,29). Prior to testing, these materials were stored in distilled water at 37°C for 24 hours. Z250's structure includes zirconia-silica particles. It is known that zirconia-silica can be affected by water over time due to its spherical structure, potentially leading to water uptake and adversely affecting the connection with the resin matrix and mechanical properties (29). However, as this study only involved immersion in water for 24 hours, these negative effects were not realized, and hence, higher values were observed in Z250. Additionally, zirconia-silica can behave like nanoclusters, enhancing the mechanical properties of the structure

(30). According to information obtained from the product manager, Myra's structure contains some nanoparticles in addition to the normal content. Although not statistically significant, the difference in VHN values between Myra and Pergamon and Myra's higher value may be attributed to this aspect. Gradia Direct Posterior contains pre-polymerized fillers with C=C bonds. This structure can form covalent and hydrogen bonds with the methacrylate matrix. Moreover, it can be stated that Gradia Direct Posterior is a more hydrophobic composite due to the use of a more hydrophobic silane treatment compared to conventional silanol treatment (31). The hydrophobic or hydrophilic nature of the polymer structure and the degree of conversion are factors that can affect water absorption (32). Additionally, a low degree of conversion hampers polymer cross-linking in the composite, rendering it susceptible to water absorption, resulting in a decrease in hardness and mechanical properties (33). Regarding monomers, TEGDMA has a higher water-absorbing character compared to other methacrylates, and when used in conjunction with BIS-GMA, it increases the composite's hydrophilic character and invites deterioration in mechanical properties in water-based environments (34). In light of this information, despite Gradia Direct Posterior having a low viscosity due to containing only UDMA as a monomer (3) and having a more hydrophobic structure due to the aforementioned features, its lower microhardness values compared to composites with BIS-GMA and TEGDMA might also be related to the degree of conversion of the composite. This introduces a limitation in the study, requiring a future research agenda in this field.

In surface roughness studies, surfaces can be scanned using mechanical or optical probes, and they can also be visualized in either 2D or 3D. While non-contact optical profilometers that perform three-dimensional measurements are much more successful in distinguishing and detailing surface topography (35), in this study, a contact surface profilometer was used due to laboratory facilities and its frequent utilization in the literature for obtaining rapid results (1,36,37). The necessity of maintaining specific standards for surface roughness has been discussed for the long-term preservation of the esthetic characteristics of composites and the prevention of microbial colonization on the structure. In this context, the result of a systematic review indicated that for preventing bacterial accumulation in composites in most in vivo studies, the threshold value for surface roughness should be 0.2 μm (38). In our study, during the preparation of composite samples, the coarsest-grit disk from a finishing-polishing set was used without water. According to the literature, it is reasonable to consider that lower values might be observed in samples where all components of a similar set are used compared to our samples (10,39).

The objective of this study is to measure the surface roughness values of composites in their most natural state, and it is not one of the purposes to evaluate how effective any polishing set is. In this context, in order to make the most accurate assessment, all components of a polishing set were not applied. Different grit sandpapers were reported to be used in the preparation of composite samples (27). This situation emerges as a limitation of the study, and the investigation of surface roughness values that would be obtained after using various finishing and polishing systems with the materials used in the study is a topic for future research. In our study, the lowest surface roughness was observed in Parion Flow, while the highest value was obtained in Gradia Direct Posterior. Myra and Pergamon exhibited lower values compared to Gradia Direct Posterior, while Pergamon showed higher values than Myra, albeit not statistically significant. In a systematic review where various types of composites (submicron-nanofillers-microhybrids) were evaluated in terms of roughness and gloss, although there is no definitive evidence in the early stages of the study that the composite type affects the roughness performance (1), nanofilled or submicron composites may perform better in terms of roughness than microhybrids (1). Although Myra and Pergamon resemble each other in terms of content on paper, a difference was observed in surface roughness values, albeit not statistically significant, indicating that Myra is better than Pergamon in terms of roughness. According to information obtained from the product manager, it is believed that this difference arises due to the addition of a small amount of nanoparticles to the Myra structure. It is evident that as the particle size in the inorganic structure decreases, smoother surfaces will form, and it has been reported that contemporary microhybrids have particle sizes up to an average of 1 μm (1). According to the usage guidelines of the composites included in the study and information obtained from the product manager, the average particle size of Z250 is 0.6 μm (range: 0.01 - 3.5 μm), the average particle size of Gradia Direct Posterior is 0.85 μm (range not specified), and the particle size of Myra and Pergamon is reported as (>1 μm). In light of this information, although different surface roughness values were observed between Myra, Pergamon, and Z250, there is no statistically significant difference, and the average particle size may not parallel surface roughness. However, there is a statistically significant difference between Gradia Direct Posterior and Myra, and this difference is thought to be due to Myra containing a small amount of nanoparticle structure.

Surface roughness is influenced not only by particle size but also by factors such as particle shape, size distribution, resin matrix composition, and degree of conversion (40). Furthermore, an increase in surface roughness adversely affects color stability, and multi-step polishing techniques applied to reduce surface roughness create a smooth surface that ensures color stability (41). In a retrospective clinical study, the 10-year performance of four different microhybrid composites was examined. Among these composites, Gradia Direct Posterior showed acceptable clinical performance, but there was a statistically significant difference in terms of color stability, and its failure rate (8.57%) was higher compared to the others. The study also found that Z250 had the lowest failure rate (0.9%) among the composites (42). A similar prospective study also reported a failure rate of 8.5% for Gradia Direct Posterior (43). Lempel et al. suggested that significant color changes in the material might be attributed to the higher average particle size of Gradia Direct Posterior compared to other our study's results are in line with these findings (42). Z250 has a lower average particle size compared to Gradia Direct Posterior and exhibited lower surface roughness. The lower values of Myra and Pergamon compared to Gradia Direct Posterior could stem from various factors, such as other inorganic fillers in the composition (quartz, fluoro-aluminosilicate, etc.) or unreacted matrix monomer (degree of conversion). In future studies on dental composites, SEM imaging along with EDX elemental analysis will contribute to a better understanding of the obtained results. An in vivo study focusing on

surface roughness revealed that individuals can perceive roughness differences in the range of 0.25 to 0.50 μm, which covers the natural enamel roughness. Consequently, it has been emphasized that the maximum roughness should not exceed 0.50 μm during finishing and polishing procedures of restorative materials to ensure they go unnoticed by patients (44). The amount of roughness can affect not only patient awareness but also the formation of biofilms due to plaque and bacterial adhesion (14). Bacterial adhesion not only contributes to the development of decay and other oral diseases but also compromises the mechanical properties of the material. For instance, in resin-based materials, a one-month S. mutans adhesion increases surface roughness and promotes bacterial attachment, creating a potentially incessant loop (45).

One limitation of the study is the comparison of only microhybrid-type dental composites. In subsequent studies, a comprehensive investigation can be conducted by comparatively testing dental composites of different types. Another limitation is that certain materials that are not explicitly stated in the ingredients list mentioned in the usage guidelines of dental composites might be considered trade secrets, and these materials could directly affect the test results. Looking towards future research, similar to Myra and Pergamon, the recently produced and developed flowable composite, Parion Flow, can be evaluated against other existing flowable composites on the market. Other mechanical tests, biocompatibility assessments, and methods for color stability that were not covered in this study should be taken into consideration. Tests related to monomer conversion and monomer release of newly developed composites should be performed. Additionally, the effectiveness of aging methods on dental composites can be explored using various aging techniques.

Conclusion

Despite the apparent superiority of the recently introduced dental composites - Myra and Pergamon - over Gradia Direct Posterior - in terms of surface roughness and surface microhardness values, the recently introduced dental composites have demonstrated somewhat inferior performance in comparison to Z250. It should be noted that the surface roughness values do not exhibit a direct correlation with the average particle size.

Declarations

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

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

Financial Disclosure: *Authors declared no financial support.*

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ORIGINAL ARTICLE

Electric Pulp Testing with Examination Gloves

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Abstract

Aim The objective of this study is to determine differences between EPT results for the same teeth with the operator's hands being gloved and ungloved.
Material and method Electric pulp tests were conducted for the same teeth with the operator's hands being gloved and ungloved. Twenty male and twenty female patients were included in this study.
Results Statistically significant differences between EPT results for the same teeth with the operator's hands being gloved and ungloved were observed.
Conclusion In conclusion, the clinician should not use the EPT while wearing examination gloves.

Keywords Dental pulp tests, Electric pulp testing, Examination gloves, Pulp sensibility, Pulp vitality

Introduction

Dental pulp tests provide beneficial diagnostic aid and contribute to the treatment plan. Pulp testing techniques can be categorized as ''pulp sensibility testing" and ''pulp vitality testing". Pulp sensibility tests aim to extrapolate pulp health from sensory response while pulp vitality tests examine the pulp blood flow. Test cavities, electric and thermal tests can be categorized as ''pulp sensibility tests". In addition, ''pulp vitality tests" include Laser Doppler flowmetry and pulse oximetry. The method used for assessing the state of the dental pulp should be accessible, inexpensive, painless, objective and easily performed (1).

Pulp sensibility tests are most favored clinical tests and electric pulp test (EPT) is a commonly preferred method to test pulp sensibility. Magitot mentioned using electricity to localize painful teeth with carious lesions in his book Treatise on Dental Caries in 1867. After that, Marshall used electrical current for the differential diagnosis. He defined the terms ''vital" and ''non-vital" teeth depending on test results in 1891 (2).

Basically, EPT raises the electrical potential through the enamel and dentine into the pulp in order to provoke a measurable response from the pulp. Direct stimulation of the pulp nerve fibres makes the patient feel a sensation. However, this sensation might not indicate that the pulp is healthy and intact. Necrotic and disintegrating pulp often leaves electrolytes which conduct the electric current to the nerves further down the pulp space. Thus, a normal response can occur. Generally, a positive response indicates that there are sensory fibres present within the pulp, which can respond to the electrical stimulus. A lack of response to the EPT suggests the lack of responding nerve fibres, and this usually means that there is likely to be necrosis of the pulp (2).

Wearing gloves while performing electric tests has been controversial, with routine use of gloves for infection control when treating patients. Latex gloves act as a capacitance, altering the electrical output from the EPT. In 1977, King & King reported that the EPT could be used effectively with the operator wearing latex gloves, but higher readings were obtained. Lado, stated that rubber gloves should never be used during the testing of a pulp with an EPT. Cooley et al said that it is not possible to use EPT unit while wearing surgical gloves. However, Dean et al expressed that the mean differences in EPT results were small and were diagnostically insignificant for clinical situations (3).

This study was conducted to determine differences between EPT results for the same teeth with the operator's hands being gloved and ungloved.

Material and Methods

Twenty male and twenty female patients of Istanbul University, Faculty of Dentistry took part in this study. All participants completed a health questionnaire. None of the subjects wore a cardiac pacemaker. Each patient had two healthy teeth free of caries and restorations. The teeth tested were the right maxillary central incisor [designated as tooth No.11 in Fédération Dentaire International (FDI) system] and the right mandibular second premolar (designated as tooth No.45 in FDI system). Supragingival calculus had been removed before the tests. The teeth were isolated with a cotton roll and dried with and an air blast in every test. A gel was applied as the conducting medium on the tip of the pulp tester probe. The teeth were tested with an electric pulp tester (Waldent Electric Pulp Tester, Waldent Co.Ltd., New Delhi, India) both with and without latex examination gloves. The electric pulp tester used in this study was battery-powered. This type of electric pulp testers are easily applicable and do not have any wire or buttons. Moreover, the battery provides constant voltage and displays a green light when it is on.

The subject was advised to raise a hand when he or she first detected a painful sensation in the tooth being tested. When the subject responded, the probe tip was immediately removed from the tooth and the dial number on the pulp tester was recorded.

Each tooth was tested three times with the operator waiting approximately 30-40 seconds from the end of one pulp test to

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Received: 13.10.2023 / Accepted: 20.10.2023 / Published: 20.12.2023

the commencement of the next test. The mean of three values is calculated as vitalometric value. Attempts were made to avoid raising the pain threshold of the patients. Half of the subjects (in both groups) had the two different teeth tested three times each with gloves being used first, and the remaining half had testing done first without gloves. EPT values were recorded for tooth 11 with and without gloves and for tooth 45 without and with gloves being worn by the operator. Symmetrical teeth of 11 and 45 were tested as a control group and the values had been matched. Patient groups were control groups at the same time. To perform the statistical analyses for this study, SPSS v.20.0 software (IBM Corp, Somers, NY) and T test were used.

Results

There were 40 subjects consisting of 20 male and 20 female, with an age range of 20 to 30 years. Each tooth was tested three times with the operator waiting approximately 30-40 seconds from the end of one pulp test to the commencement of the next test. As a result, for each tooth, three EPT values were obtained. The values were close but not equal. Thus, the mean of three EPT values were calculated.

The EPT values of male patients are listed in Table 1-2. There were statistically significant differences between gloved and ungloved tests of maxillar right incisor (No.11). Patient number 16 and patient number 19 had a negative value difference. In other 18 patients, high values like 1.9 were measured. The results of No.45 teeth of male patients were found statistically significant. Similar results were obtained from female patients.

Table 1: EPT Values of No.11 Teeth In Males

	Gloved	Ungloved	Difference
1	2.40	1.73	0.67
2	3.16	1.26	1.9
3	3.70	3.60	0.1
4	2.06	0.96	1.1
5	1.96	1.83	0.13
6	2.53	2.03	0.5
7	1.70	0.96	0.74
8	2.83	1.30	1.53
9	2.76	1.50	1.26
10	3.33	2.36	0.97
11	3.10	1.30	1.8
12	2.46	1.76	0.7
13	2.80	1.66	1.14
14	1.53	1.36	0.17
15	2.00	2.00	0
16	2.70	2.76	-0.06
17	3.23	3.13	0.10
18	2.36	1.33	1.03
19	1.66	1.90	-0.24
20	2.36	1.86	0.5

Table 2: EPT Values of No.45 Teeth In Males

	Gloved	Ungloved	Difference
1	3.46	2.03	1.43
2	3.33	2.06	1.27
3	3.70	3.60	0.1
4	2.66	2.36	0.3
5	3.83	1.90	1.93
6	3.66	2.46	0.2
7	3.60	3.36	0.24
8	3.26	1.66	1.6
9	2.96	1.53	1.43
10	3.76	2.63	1.13
11	3.83	2.93	0.9
12	3.86	2.63	1.23
13	3.9	2.4	1.5
14	3.33	1.53	1.8
15	3.23	2.13	1.1
16	3.66	3.53	0.13
17	3.53	2.83	0.7
18	3.53	2.83	0.7
19	2.93	1.63	1.3
20	3.26	2.0	1.26

Discussion

Dental pulp tests are investigations that provide valuable diagnostic and treatment planning information to the dental clinician. If pathosis is present, pulp testing combined with information taken from the history, examination, and other investigations such as radiographs helps the diagnosis of the underlying disease which can usually be reached relatively easily.

Our study shows the disadvantage of gloves for diagnosis. Results of our study correlate with other studies in the literature (1-5). However, in some studies, it was stated that the difference between tests has no relevance with clinical practice (1-3). We emphasize that the value deviations of sound teeth; which has no tissue loss and trauma, retrograde pulpitis or of the teeth that are affected by apical lesions of adjacent teeth, are important for diagnosis.

Conclusion

In conclusion, we do not recommend wearing latex examination gloves throughout electric pulp tests.

Declarations

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

M.M.

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

Financial Disclosure: *Authors declared no financial support.*

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ORIGINAL ARTICLE

Endodontic Treatment Indications Classification in 400 Patients

Ünal ALBAYRAK[1], Buğra DOĞAN[1], Mehran MOGHBEL[2]

Abstract

Aim The aim of this study is to determine the distribution of etiological factors for endodontic treatment and to assess the condition of teeth and cases before endodontic treatment.
Material and method This study included the first 400 patients who sought treatment and were indicated for endodontic treatment
Results Among the teeth indicated for endodontic treatment, 195 (48,75%) had irreversible pulpitis, 63 (15,75%) had defective restoration, 81 (20,25%) had root canal treatment failure, 41 (10,25%) had necrosis and/or periapical lesions, and 20 (5%) had trauma as the etiological factors.
Conclusion This study revealed that irreversible pulpitis is the most important etiological factor for endodontic treatment. Root canal treatment failure and defective restorations are also significant factors. The most commonly affected teeth are the mandibular molars, maxillary molars, and maxillary central incisors.

Keywords Dental pulp necrosis, Incisor, Molar, Pulpitis, Trauma

Introduction

Dentists are well aware of the negative effects of dental diseases on overall health and try to avoid them as much as possible. As a result, conservative and endodontic treatments have gained more importance in dental practice (1-3).

The aim of endodontic treatment is not only to restore teeth with root canal therapy but also to preserve the health of periapical tissues. Therefore, endodontic treatment is indicated when progressive degeneration of periapical tissues occurs due to pulp diseases, as well as when pulp diseases and necrosis result in the destruction of surrounding dental tissues (4-8).

The most common causes of pulp diseases are bacterial, traumatic, iatrogenic, systemic, and idiopathic factors. Therefore, the etiological factors of endodontic treatments and the condition of teeth and cases before endodontic treatment are examined by researchers. The clinical and radiographic diagnosis of pulp diseases is crucial in determining the indication for endodontic treatment (9-15).

The aim of this study is to determine the distribution of etiological factors in 400 patients who were admitted for endodontic treatment and to assess the condition of teeth and cases before endodontic treatment.

Material and Methods

This study included the first 400 patients who sought treatment and were admitted for endodontic treatment at the Department of Oral Diagnosis and Radiology of our Dental Faculty (Istanbul University Faculty of Dentistry) between March 13 and May 5, 2023. A form was prepared to record the necessary clinical and radiographic evaluations of the patients, and the indication for endodontic treatment was marked on the form (Figure 1).

Protocol No:			Age:			
Tooth:						
Preoperative Pain			Yes		No	
Percussion Pain	Vertical		Yes		No	
	Horizontal		Yes		No	
Vitality			Vital		Non – vital	
Etiological Factor	Necrosis and/or Periapical Lesion					
	Irreversible Pulpitis					
	Defective Restorations					
	Root Canal Treatment Failure					
	Trauma					

Figure 1: The form in which the indications for root canal treatment are marked.

Etiological factors are classified according to the following criteria. These criteria were determined according to literature review.

1. Necrotic pulp and/or periapical lesion: All investigated teeth were subjected to electrical pulp vitality testing and diagnosed with necrosis if they did not respond to the test. In radiographic examination, electrical pulp testing was applied to distinguish it from any lesions around the root. The test results were compared in symmetric teeth. Root canal treatment failures were not included in this group.
2. Irreversible Pulpitis: These cases presented with severe and continuous pain, especially at night. The most common cause of irreversible pulpitis among our cases was determined to be dental caries. Pulp inflammations resulting from defective restorations were not included in this group.
3. Defective Restorations: This patient group consists of cases with pulp inflammation due to faulty composite and silicate fillings and faulty crown restorations.
4. Root Canal Treatment Failure: This patient group re-

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Received: 17.10.2023 / Accepted: 25.11.2023 / Published: 20.12.2023

quires root canal treatment due to reasons such as incomplete filling, instrument fracture inside the root canal, etc., despite having undergone previous endodontic treatment.

5. Trauma: These cases have a history of chronic or acute trauma to their teeth.

Results

The results of the study are presented in Table 2-9. According to the results:

1. Of the selected 400 cases, 207 (51,75%) were male and 193 (48,25%) were female. (Table 1)
2. 219 patients (54,75%) reported preoperative pain. (Table 2)
3. 32 patients (8%) showed pain on vertical percussion, 17 patients (4,25%) showed pain on horizontal percussion, and 4 patients (1%) showed pain on both vertical and horizontal percussion. (Table 3)
4. Among the 400 examined teeth, 43 (10,75%) were non-vital, 293 (73,25%) showed vital reactions, and 64 (16%) had root canal treatment failure. (Table 4)
5. Among the teeth chosen for endodontic treatment, 195 (48,75%) had irreversible pulpitis, 63 (15,75%) had defective restoration, 81 (20,25%) had root canal treatment failure, 41 (10,25%) had necrosis and/or periapical lesions, and 20 (5%) had trauma as the etiological factors. (Table 5)
6. The average age of the patients was 34,3. When considering the etiological factors, the highest average age was 45 - 41 in patients with necrosis and/or periapical lesions, while the lowest average age was observed in children who experienced trauma (17,22). (Table 5)
7. The most commonly indicated teeth for endodontic treatment were the first mandibular molars (18%), followed by the first maxillary molars (14,75%) and the maxillary central incisors. (11.5%). (Table 6)
8. In maxilla, 220 teeth were indicated for root canal treatment, accounting for 55% of all cases. (Table 6)
9. In mandible, 180 teeth were indicated for root canal treatment, accounting for 45% of all cases. (Table 6)
10. In maxilla, 102 teeth were indicated for irreversible pulpitis, 48 teeth had defective restorations, 30 teeth had root canal treatment failure, 23 teeth had necrosis, and 17 teeth had trauma. (Table 8)
11. In mandible, 93 teeth were indicated for irreversible pulpitis, 15 teeth had defective restorations, 51 teeth had root canal treatment failure, 18 teeth had necrosis, and 3 teeth had trauma. (Table 9)
12. Dental trauma are mostly observed in the maxillary anterior teeth. Root canal treatment failure is most common in the mandibular molars. Defective restorations are also more common in the maxillary anterior teeth. Irreversible pulpitis is almost equally seen in both the maxilla and mandible, but it is more prevalent in the posterior compared to the anterior.

Table 1: Distribution of patients according to their gender.

Man	207	51,75%
Woman	193	48,25%
Total	400	

Table 2: Examination of patients in terms of preoperative pain.

Has preoperative pain	219	54,75%
Has not preoperative pain	181	45,25%
Total	400	

Table 3: Percussion examination results.

Vertical percussion	32	8,00%
Horizontal percussion	17	4,25%
Vertical and horizontal percussion	4	1,00%

Table 4: Vitality test results.

Vital	293	73,25%
Non-vital	43	10,75%
Root canal treatment failure	64	16,00%
Total	400	

Table 5: Distribution of etiological factors and average age of patients.

Etiological Factor	Number of Patients		Average Age
Irreversibl Pulpitis	195	48,75%	32,16
Root Canal Treatment Failure	81	20,25%	37,72
Defective Restorations	63	15,75%	39,01
Necrosis / periapical lesion	41	10,25%	45,41
Trauma	20	5,00%	17,22
Total	400		34,304

Table 6: Distribution of root canal treatment indications by teeth.

Tooth	Number of Teeth	
Maxilla		
3. Molar	0	0,00%
2. Molar	26	6,50%
1. Molar	59	14,75%
2. Premolar	16	4,00%
1. Premolar	14	3,50%
Canine	31	7,75%
Lateral Incisor	28	7,00%
Central Incisor	46	11,50%
Mandible		
3. Molar	0	0,00%
2. Molar	42	10,50%
1. Molar	72	18,00%
2. Premolar	24	6,00%
1. Premolar	21	5,25%
Canine	10	2,50%
Lateral Incisor	4	1,00%
Central Incisor	7	1,75%
Total	400	

Discussion

In this study, it was found that the number of male patients seeking endodontic treatment was slightly higher than female patients. This finding contradicts with the study by Wingsten in 2019. Wingsten et al. reported a male-female ratio of 47,3% to 52,7% (1). Our study showed a ratio of 51,75% male to 48,25% female.

The most important etiological factor identified in our study was dental caries. This finding is in line with the findings of Wingsten et al. and Scavo et al. (1,2). However, Cyr et al. reported that defective restorations were the most important etiological factor (3). In our study, defective restorations ranked third.

Among the etiological factors, all of them affected the age group to some extent, but trauma had a lower average age. This is due to the fact that children who experienced trauma to their teeth were included in our study. This finding is consistent with the findings of Saad and Clem (4).

Our study showed that the most commonly affected teeth were the first mandibular molars, followed by the first maxillary molars. Al-Negrish, reported that the most affected teeth were the maxillary central incisors (5). In our study, about 54.75% of the patients reported preoperative pain. This finding is consistent with Saad and Clem's findings (4).

Conclusion

Our study revealed that irreversible pulpitis is the most prevalent etiological factor for endodontic treatment. Root canal treatment failure and defective restorations are also significant factors. The most commonly affected teeth are the mandibular molars, maxillary molars, and maxillary central incisors. Preoperative pain was observed in slightly more than half of the patients in this study.

Declarations

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

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

Financial Disclosure: *Authors declared no financial support.*

Acknowledgments: *Sedef Ayşe Taşyapan, Muhammet Cihat İntepe*

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Amalgam-Associated Oral Lichenoid Reactions: A Case Series

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ABSTRACT

Aim This case series report aims to discuss clinical findings of lichenoid reactions that were induced by amalgam fillings in 3 patients.
Case Report Three patients who applied to our clinic with the complaint of a burning sensation in the buccal mucosa were referred to our clinic. All patients were males who had amalgam restorations. Only one of the patients described a burning sensation in both the buccal mucosa and the lateral side of the tongue. In all three patients, intraoral examination revealed white lichenoid lesions which are located at the relevant complaint areas and were close to a large amalgam restoration that is in contact with the mucosa. The lesions were associated with amalgam fillings. One of the cases had a patch test regarding the dental materials and had a positive patch result to dental amalgam which is important in the oral lichenoid lesions diagnosis.
Discussion Two studies in the literature suggest a link between metal dental fillings and immunopathological lesions in the oral mucosa. Sensitization to mercury, found in amalgam fillings, is associated with oral lichenoid lesions. Corrosion of dental alloys is correlated with the development of lichenoid lesions. Dental amalgam can induce immunological reactions, including increased autoantibody production. Replacing amalgam fillings resulted in complete remission of lesions in patients without other metal restorations.
Conclusion Burning sensation in the buccal mucosa was common in 3 patients and this was the main complaint.

Keywords Amalgam filling, Autoimmunity, Mercury, Oral lichen planus, Oral lichenoid reactions

Introduction

Autoimmunity is the immune response to one's antigens. Although it plays a certain physiological role, a poorly regulated, exaggerated, and misdirected autoimmune response can lead to autoimmune diseases (AD), which are characterized by tissue/cell damage. AD represents a breakdown of self-recognition mechanisms (1). ADs are a heterogeneous group of diseases with common key links in pathogenesis and risk factors. Various environmental factors play an important role in the development of pathological autoimmunity, including infections, xenobiotics, vitamin D deficiency, ultraviolet radiation, stressors, and exposures that disrupt melatonin regulation. Such factors often have regular seasonal dynamics, which can affect the development of the disease, its severity, and its course (2). Adjuvant and adjuvant-like substances are widely used in dental practice for the manufacture of implants, prostheses, and fillings and can cause autoimmune reactions. Metals that are part of fillings are one of the main adjuvants - triggers of AD (3). Thus, in dentistry, for permanent restoration of teeth, mercury-free metal fillings and mercury copper and silver fillings of the I – III generations are used. Amalgam is an alloy of mercury (Hg) with one or more metals that melts at ambient temperatures. Amalgam takes on a characteristic crystallization, imparting certain properties to the filling when various metals are added to it. An amalgam alloy can contain solid particles of silver (Ag), tin (Sn), copper (Cu), and sometimes zinc (Zn), palladium, indium, and selenium (4).

Mercury and autoimmunity

Several studies have examined the effects of various forms of Hg, including elemental (Hg), inorganic (IHg), and organic (OHg), and their relationship to autoimmunity. In vitro studies using peripheral blood mononuclear cells from healthy individuals have shown that methylmercury (MeHg) causes cell death at lower concentrations than IHg, although exposure to IHg leads to a stronger proinflammatory effect than MeHg. In vivo studies using mouse models susceptible to the development of induced autoimmune disorders have shown that exposure to IHg leads to the lupus-like syndrome, antinuclear and antifibrillin autoantibodies arise, and immunocomplex lupus nephritis is formed, while mice exposed to MeHg develop autoimmune reactions without an immunocomplex component (5). In addition, lower IgE concentrations are found in animals treated with MeHg compared to those treated with IHg. It turned out that OHg harms animal lines with a predisposition to autoimmune pathology (6).

Oral lichen planus (OLP)

Oral Lichen planus is a chronic disease accompanied by an inflammatory component and pathophysiologically manifested by hyperkeratosis (7), and clinically - by the presence of white striae on the oral mucosa (Wickham's striae), which appear in reticular, papular, atrophic, plaque-like, erosive or bullous forms (8).
Additionally, in the development of the disease as a whole and each specific case, separate concomitant factors are distinguished, which, most likely, also play a role in the pathogenesis of the disease. The most significant of them:

- OLP can often be triggered by drugs, such as methyldopa (9), beta-blockers (10), and antiphlogistics (11).

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Received: 24.03.2023 / Accepted: 30.03.2023 / Published: 20.12.2023

- The presence of any concomitant chronic disease of internal organs, in particular, the liver, gastrointestinal tract, and endocrine system (the symptom-complex syndrome of Grinshpan is described, along with OLP, in which diabetes mellitus and hypertensive disease).
- Local traumatic factors of mechanical, physicochemical, chemical, and biological origin, incl. the presence of amalgam fillings in the oral cavity (12).

Diagnosis of Amalgam induced Oral Lichenoid Reactions

Suspicion will be raised regarding the detection of an oral white lesion that is close to a dental amalgam filling. Idiopathic OLP, however, may also manifest in traumatized locations as a result of friction from abrasive restorative materials. Clinicians should also focus on the detection of any lesion that is localized at the lips, skin, nails, and scalp. In the presence of an amalgam-induced OLP, the histological results of the biopsy will be the same as an idiopathic OLP; thus, the clinical examination must be done thoroughly. The same as with idiopathic OLP, immunofluorescence may be used to rule out autoimmune disorders of the mouth. Patients with amalgam-induced OLPs are more likely to test positive for amalgam and inorganic mercury salts than those with idiopathic OLP. As even a negative patch test result will not eliminate the possibility of an amalgam-induced OLP the role of this test in making the diagnosis is not fully diagnostic yet. Biopsy type-independent, the outcomes of the tests cannot diagnose the induction of the amalgam filling for the OLP. The most diagnostically accurate method is to replace the amalgam filling with another restorative material, and routine follow-up of the patient (13-16).

Our study aimed to report cases of lichenoid reactions associated with amalgam, thus supporting the hypothesis that amalgam fillings can cause lichenoid reactions in the oral mucosa, and showing that there is sufficient reason for more comprehensive studies.

Case Report

Case #1: A 47-year-old male patient was referred to our clinic with a burning sensation which is localized at the right lateral border of the tongue and left buccal mucosa. Intraoral examination revealed white lichenoid lesions which are located at the complaint areas. The lesions were associated with amalgam fillings (Figure 1).

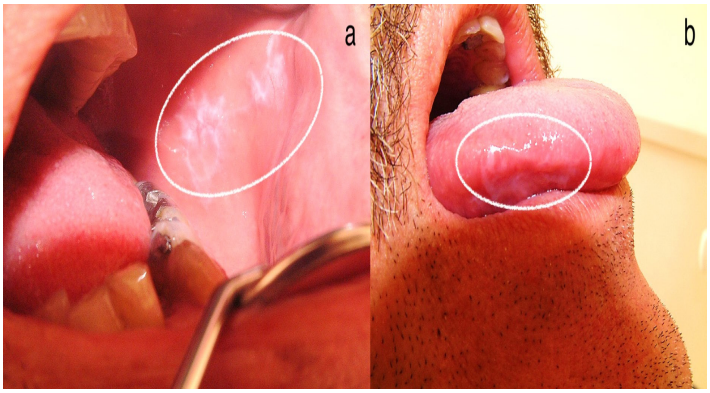

Figure 1: (a) Lichenoid lesion on the left cheek mucosa; (b) Lichenoid reaction due to amalgam filling on the right lateral side of the tongue.

Case #2: A39-year-old male patient was referred to our clinic with a burning sensation which is localized at the left buccal mucosa. Intraoral examination revealed white lichenoid lesions which are found close to a large amalgam restoration. The patient had a patch test regarding the dental materials and had a positive patch result to dental amalgam which is important in the Oral Lichenoid Lesions diagnosis (Figure 2).

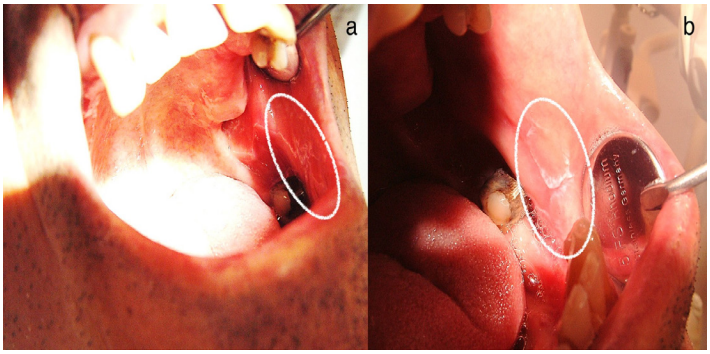

Figure 2: Lichenoid lesion on the left cheek mucosa; (a) Before the filling of tooth 37 is removed; (b) After amalgam filling has been replaced.

Case #3:A 20-year-old male patient was referred to our clinic with a burning sensation that is localized at the right buccal sulcus. Intraoral examination revealed a white lichenoid lesion which is found near the amalgam filling. (Figure 3).

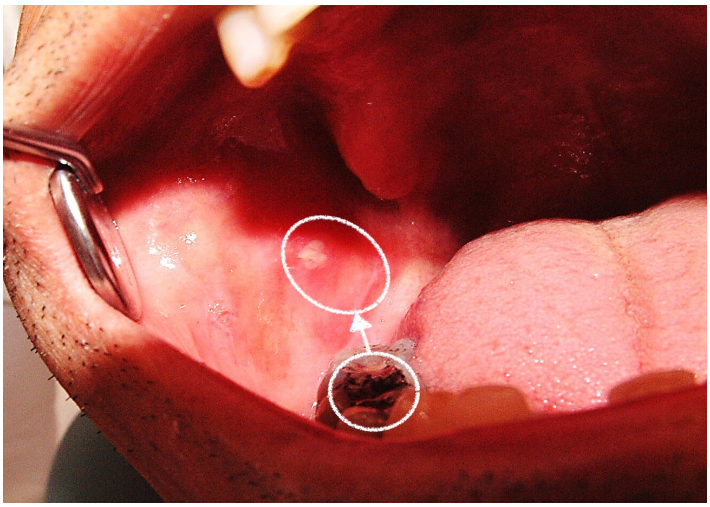

Figure 3: Lichenoid lesion on the right buccal sulcus.

All three of our patients had an autoimmune disease.

Discussion

A 1999 study (17) showed that the metals of dental fillings are associated with the development of immunopathological lesions of the oral mucosa, with Hg (as the main component of amalgam) considered as the main cause. In this study, the frequency of sensitization to metal salts was determined in 194 patients. At the same time, pathological studies of biopsy samples from carriers of positive tests for sensitization to metal salts were additionally carried out and the effect of amalgam removal was investigated to find out whether there would be an improvement from this procedure. The test was conducted using a standard range of dentures and a range of metal salts including gold, Hg, and palladium, as

well as other metals used in dental restorations. Sensitization to Hg has proven to be important, although perhaps not the only cause of oral lichenoid lesions.

In 2016, Romanian authors (18) published research data on the correlation between the corrosion restoration of dental alloys and the development of lichenoid lesions of the oral mucosa. They analyzed the corrosion processes occurring in metal stationary dental fillings in a group of patients with lichenoid lesions, along with their entire electrochemical characteristics. Lichen planus of the oral mucosa is considered a non-infectious chronic immunopathological disorder of unknown etiology that involves the oral mucosa. Similar lesions are typical for the onset of many autoimmune lesions of the oral cavity, in particular discoid lupus and pemphigus, and sometimes occur before neoplasia. The presence of metals in the oral cavity is considered a triggering factor for this form of pathology. The authors analyzed alloys restored after removing some old metal fillings in patients with lichenoid lesions. Their composition was determined using energy-dispersive X-ray spectroscopy. They also measured the electrochemical properties of these materials. Highly alloyed alloys and alloys based on chromium and nickel with different electrochemical behavior were studied. The results showed a correlation between the process of metal corrosion in the oral cavity and the development of lichenoid lesions.

In the literature, experimental and clinical data were published that dental amalgam can induce immunological reactions in genetically susceptible animals and humans. Thus, in genetically susceptible lines of experimental animals, Hg and Ag induce autoimmune reactions. The sera of Hg-sensitive patients were found to have higher autoantibody titers relative to controls. After in vitro stimulation of peripheral blood lymphocytes with HgCl2, the presence of antinuclear SSB / La auto-antibodies was determined. Lymphocytes were obtained from patients with autoimmune thyroiditis and an increased immune response to mercury in vitro. Mononuclear cells were cultured for 6 days with 100 µl HgCl2 solution or with pure medium, and the levels of SSB / La antinuclear autoantibodies were analyzed by enzyme immunoassay. Increased production of SSB / La auto-antibodies after stimulation of peripheral blood lymphocytes with HgCl2 was detected in all cases. Thus, in patients with Hashimoto's thyroiditis and a dental filling with mercury, the production of antinuclear autoantibodies can be stimulated. Thus, it seems that IHg is associated with autoimmune pathology to a greater extent than OHg, although their effect on morbidity in the population is not yet fully understood (19, 20).

Allergy to filling materials may be one of the pathogenetic mechanisms since in all three patients, apart from amalgam fillings, there were no other metal restorations in the oral cavity and there was a complete remission of lesions after amalgam replacement.

Conclusion

Consistent with the works described above, the present report supports the hypothesis that amalgam restorations may be an etiological factor in lichenoid changes in the oral mucosa.

Declarations

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

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

Financial Disclosure: *Authors declared no financial support.*

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T2 Shine-Through Phenomenon in a Plunging Ranula

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ABSTRACT

Aim This case report aims to demonstrate a case of T2 shine-through using MRI and clinical features in a patient with a plunging ranula.
Case Report In this report, a 16-year-old male presented with a left submandibular space expansion and a painless intraoral cystic lesion near the caruncula sublingualis. Clinical signs pointed towards a plunging ranula. MRI revealed a hypointense, well-defined lesion in T1 images and a hyperintense lesion extending from the sublingual gland through musculus mylohyoideus to the submandibular space, featuring a characteristic tail sign in T2 images. Notably, diffusion-weighted (DWI) TRACE images and apparent diffusion coefficient (ADC) images both displayed a hyperintense lesion, indicative of T2 shine-through. The combined evaluation of fine-needle aspiration cytology and imaging led to the diagnosis of a plunging ranula, and the patient was referred for surgical intervention by the oral and maxillofacial surgery department.
Discussion The differential diagnosis of lesions can be aided by DWI and ADC values. T2 shine-through, as seen in this case, manifests as hyperintensity on both DWI-TRACE and ADC images, distinct from diffusion restriction. This phenomenon arises from prolonged T2 decay time in specific tissues. Similar instances have been noted in epidermoid cysts and, as illustrated here, in a plunging ranula.
Conclusion Dentomaxillofacial radiologists should be attuned to the T2 shine-through effect, which can lead to misinterpretation when assessing lesions using DWI-TRACE and ADC sequences. This case underscores the need for accurate differentiation between diffusion restriction and T2 shine-through, enabling informed treatment choices.

Keywords Apparent diffusion coefficient, Diffusion weighted imaging, Magnetic resonance imaging, Plunging ranula, T2 shine-through

Introduction

Ranulas, also known as mucocele, mucus extravasation, or retention cyst, are rare intraoral non-odontogenic cystic lesions that can affect the patient in any decade. Since ranulas lack an epithelium lining like true cysts and instead have a lining formed by connective tissue and granulation, they should be identified as pseudocysts. They form with extravasation of mucus inside a cavity associated with the sublingual gland. There is no gender preference for the lesion. Although the etiology is unclear, the most common reason was reported as trauma to an excretory duct. Two different ranula types are identified as simple ranulas and plunging (deep) ranulas (PR), as they have different clinic features and localizations (1-3). Simple ranulas develop in conjunction with the caruncula sublingualis at the affected side, whereas extravasated mucin in PRs perforates m. mylohyoideus and extends to the neck. Although bilateral ranulas were reported in various case reports in the literature, ranulas are mostly unilateral. Intraoral examination typically reveals a bluish, fluctuant, painless lump that can grow to several centimeters in diameter. The preferred course of therapy is complete excision, which includes removal of the damaged salivary duct as incomplete excision can cause recurrence of the lesion (1-7).

Magnetic Resonance Imaging (MRI) is known for its superiority in revealing the extension and the internal structure of the lesions of the head and neck region with fruitful information about the affected surrounding structures (8). As MRI can distinguish the characteristic radiographic features of PRs with a specific sign described as the "tail sign", those lesions can be examined without exposing the patient to any ionizing radiation. T2 sequences of MRI can easily highlight the solid lesion's non-solid fragments and the cystic lesions' whole internal structure, leading to precise radiographic evaluations for the radiologists (9, 10).

MRI is becoming a standard imaging method for evaluating both odontogenic and non-odontogenic cystic lesions and tumours of the head and neck region, and diffusion-weighted imaging (DWI) is shown to be beneficial for differentiating those lesions such as odontogenic keratocyst and ameloblastomas (11, 12). As there is a confusing similarity between the early unicystic ameloblastomas and odontogenic keratocysts, the differential diagnosis may become tricky, which makes it harder for the oral and maxillofacial surgeons to plan the appropriate treatment. DWI is valuable in evaluating the cyst and tumour according to their apparent diffusion coefficients (ADCs). If a lesion demonstrates significantly lower ADC values, it shows that the lesion has a diffusion restriction which suggests a solid lesion (13, 14).

In some cases, both ADC and isotropic diffusion mapping reveal a hyperintense lesion which is known as T2 shine-through. T2 Shine-through occurs when a high signal on isotropic diffusion mapping is not due to diffusion restriction but rather to a higher signal in the T2 sequence. This mainly happens as some tissues have a long T2 decay time (15). This phenomenon can be seen in lesions such as epidermoid cysts, and in our case, it was also seen in a plunging ranula case; thus, this case report aims to demonstrate a case of T2 shine-through with a PR's MRI and clinical features.

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Received: 21.03.2023 / Accepted: 30.03.2023 / Published: 20.12.2023

Case Report

A 16-year-old male patient was referred to our clinic with an expansion at the left submandibular space and a painless intraoral cystic lesion that is localized at caruncula sublingualis that occurred around a month ago (Figure 1). Due to its characteristic localization and clinical features, PR was considered in the differential diagnosis. In order to see the exact extension and morphology of the lesion, MRI was planned.

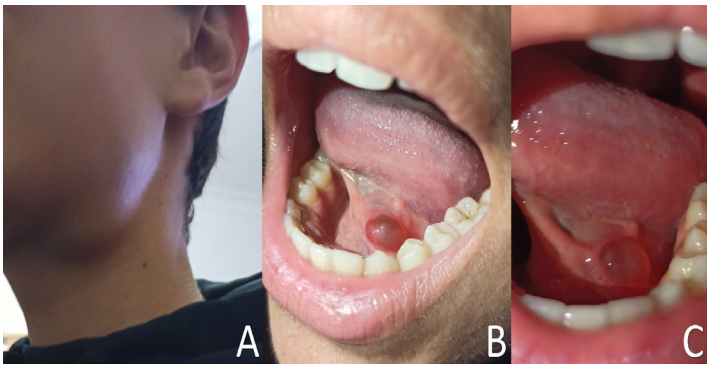

Figure 1: Extraoral image of the patient that caused expansion at the left submandibular space (A), Intraoral image of the cystic lesion at caruncula sublingualis. Note the fluid appearance in the lesion (B-C).

Axial (Figure 2) and sagittal (Figure 3) MRI slices revealed a hypointense, well-defined lesion in T1-Turbo Spin Echo (TSE) images (TR:617, TE:9.90) and a hyperintense, well-defined lesion that extends from the sublingual gland and herniates through musculus mylohyoideus to the submandibular space with a characteristic tail sign in T2-TSE (TR:839, TE:2164) and T2-TSE Fat-Saturated images (TR:814, TE:1798). The lesion had even higher signal intensity in T2-TSE Fat-Saturated images. Diffusion-weighted (DWI) TRACE images at b=1000s mm-2 (TR:5000, TE:101) and apparent diffusion coefficient (ADC) images (TR:5000, TE:101) both showed a hyperintense lesion that suggests the presence of a T2 Shine-Through case (Figure 4).

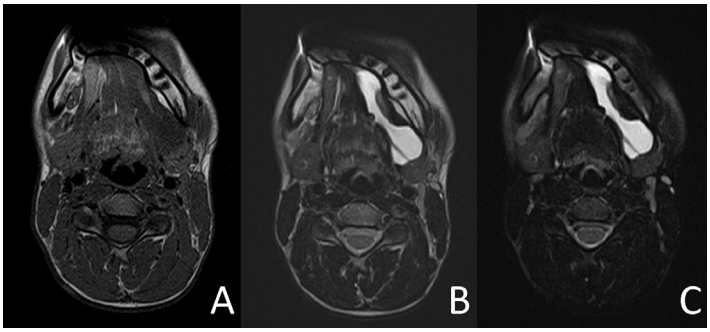

Figure 2: Hypointense, well-defined lesion is seen in T1W-TSE (TR:617, TE:9.90) axial slice (A), Hyperintense well-defined lesion that extends from the sublingual gland to the submandibular space is seen in T2W-TSE (TR:839, TE:2164) and T2-TSE-FATSAT (TR:814, TE:1798) images. Note that this appearance is known as the tail-sign appearance (B-C).

Fine-needle aspiration cytology and imaging characteristics of the lesion were evaluated together, and the lesion was defined as a plunging ranula. The patient was referred to Oral and Maxillofacial Surgery for surgical treatment.

Discussion

A diffusion tensor is an array of numbers in a 3x3 matrix that represents the various diffusion coefficients of anisotropic biological tissues. TRACE term, as in DWI-TRACE, represents the sum of diagonal elements of such an array and the average of this TRACE value. The intensity of the signal of each voxel in DWI-TRACE images has an inverse relationship with the Apparent Diffusion Coefficient (ADC) value. In the presence of the diffusion restriction, such as in abscesses and malignant lymph nodes, DWI-TRACE images reveal hyperintense areas, and ADC images reveal hypointense areas. On the other hand, in the absence of diffusion restriction, such as in CSF, DWI-TRACE images reveal hypointense areas while ADC images reveal hyperintense areas. As DWI-TRACE images also involve significant T2W, lesions with very long T2 values may appear hyperintense as they appear in ADC images. This condition is known as "T2 Shine-Through" and when present, both T2 and ADC images should be examined to check for conformation (15-20). Colagrande et al. suggested that T2 shine-through effect can be lowered by using greater b values (21).

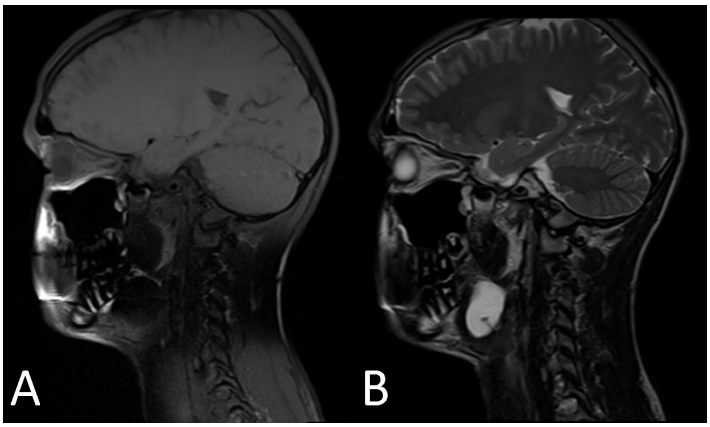

Figure 3: Hypointense, well-defined lesion is seen in T1W-TSE (TR:617, TE:9.90) axial slice (A), Hyperintense well-defined lesion that extends from the sublingual gland to the submandibular space is seen in T2W-TSE (TR:839, TE:2164) image. Note that this appearance is known as the tail-sign appearance (B).

In order to discuss the significance of this phenomenon, both for the pitfalls and differential diagnosis, a brief review of the literature was performed. Thirty-nine articles were found in the PubMed database; however, only two described T2 Shine-Through in the head and neck region. The majority of the cases were about lesions and ischemic strokes of the brain and the tumours of the liver. The articles that presented cases in the head and neck regions were published by Hibino et al. (22) in 2017 and Chawla et al. (15) in 2009.

Hibino et al. reported an 18-year-old patient who referred to them with a four-day history of neck pain and fever (40.2^{O} C). The patient had an incomplete Kawasaki Disease, and he had oral and pharyngeal mucositis with bilateral cervical lymphadenopathy. They performed an MRI and reported a hyperintense area in T2W, ADC, and DWI-TRACE sequences in the retropharyngeal region that was suggesting retropharyngeal edema which was mimicking a retropharyngeal abscess. They discussed that the hyperintense appearance on DWI-TRACE sequences was not caused by restrict-

ed diffusion but by a high T2 signal that is commonly observed in vasogenic edema (22).

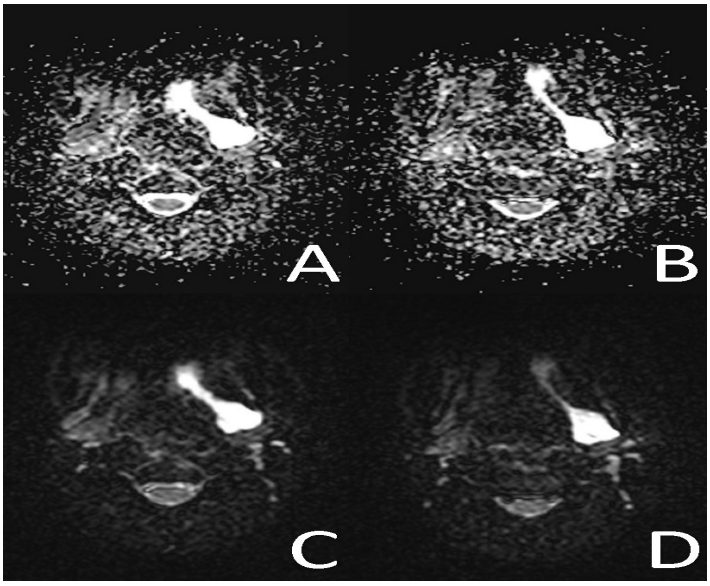

Figure 4: DWI-TRACE images at b=1000s mm-2 (TR:5000, TE:101) (A-B), and ADC images (TR:5000, TE:101) both revelead a lesion with a high signal as it was in T2W sequence (C-D).

Chawla et al. conducted a review in order to evaluate the utility of DWI in the diagnosis, prognosis, and monitoring of the treatment responses in the head and neck region. They stated that DWI images should be interpreted with attentiveness and should be evaluated with ADC maps as T2 shine-through effect may cause misdiagnoses and mimic another pathology (15).

To the best of our knowledge, this case report presents the first instance of the T2 shine-through phenomenon observed in an intraoral lesion. Dentomaxillofacial radiologists should be more familiar with the concepts and glossary of MRI terms to avoid pitfalls and enhance differential diagnosis.

Conclusion

T2 Shine-Through phenomenon can be seen in lesions such as epidermoid cysts in maxillofacial region. In the present case, this phenomenon was also seen in a plunging ranula; thus, dentomaxillofacial radiologist should be aware of this finding as it may cause confusion since DWI-TRACE and DWI-ADC sequences will both present the lesion as hyperintense.

Declarations

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

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

Financial Disclosure: *Authors declared no financial support.*

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Treacher-Collins Syndrome: Case Series

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ABSTRACT

Aim The aim of our report is to describe the most common features and some of the associated complications of TCS and to report the involved genetic mutations that lead to this disorder.

Case Report Patients typically present with downslanting palpebral fissures, lower eyelid colobomas, microtia, malar and mandibular hypoplasia which could lead to respiratory distress. Care for these patients requires a multidisciplinary team from birth through adulthood. Proper planning, counseling and surgical techniques are essential for optimizing patient outcomes. Moreover, TCS patients may require additional psychological care to avoid being rejected by society.

Discussion Treacher Collins syndrome (TCS) is one of the rare genetic disorders characterized by symmetrical craniofacial malformation without affecting the growth or neurological development. This autosomal dominant disorder has a variable degree of phenotypic expression.

Conclusion PTreacher Collins syndrome is rare and a complex congenital disorder with a variable degree of craniofacial deformity. It does not associate neurodevelopmental impairment. Patients usually suffer from social distancing and failure to integrate properly with the socitey due to their physical appearance. Taking care of these patients requires a multidisciplinary team and a reconstructive treatment is important for their social and psychological wellbeing.

Keywords Dentistry, Franceschetti-Zwahlen-Klein Syndromegenetic syndrome, Mandibulofacial dysostosis, Syndromes, Treacher Collins syndrome

Introduction

Mandibulofacial dysostosis (Treacher - Collins syndrome or Franceschetti - Zwahlen - Klein Syndrome) is a rare genetic disorder that commonly leads to craniofacial dysmorphism. It is an autosomal dominant disorder with a variable degree of phenotypic expression (1). TCS is generally characterized by external and middle ear anomalies, antimongoloid obliquity of the eyelids, ocular hypertelorism, coloboma of the lower eyelids, absence of eyelashes, hypoplasia of the pinna and outer auditory canal, and hypoplasia of the mandible (2).

The disease was first described by Franceschetti and Zwahlen as a congenital deformation of the jaw and facial bones. There is no chromosomal anomaly in this disease, but the anomaly is potential at the gene level (3). Some researchers have concluded that this disease is caused by poor blood conduction in the area of the internal carotid artery, up to the stapedial artery. The researchers reported that poor blood conduction inhibits (limits) the normal growth and development of the fetus during the fetal development stage. The degree of this inhibition may also extend to include tissue parts originating from the first and second Branchial arches (4).

More extensive research has been done on this disorder by Poswillo and Roa (5, 6). In severe cases, hypoplasia of the orbit or aplasia of the bone edge of the orbit may be seen. In the majority of cases, the nose is disproportionately large or there may be no nasal bone. Poor bone development often results in malocclusion. Due to hypoplasia of the mandible, compression and crowding may occur in the lower teeth. The prognathic upper jaw causes an open bite in the area of incisors. Although cleft lip was not documented, cleft palate was detected in 1/3 of the cases. Macrostomy is prevalent in these cases, and the patient's appearance resembles a fish in profile (7).

The severity of the disease varies. In some cases, the manifestations are minimal and barely noticeable. In this case, it is difficult to distinguish the affected individuals from healthy ones. In some families, miscarriage and early postnatal deaths are common. However, sometimes such a situation may not occur and the syndrome is transmitted from generation to generation. Due to the syndrome's autosomal dominant transmission, the disorder is definitely seen in the next generation. This does not definitely mean that all the siblings are going to be affected by the disorder. In his research on animal specimens showing similar orofacial syndrome pathogenesis, Postwillo observed that preotic neural crest ectomezenchymal cells migrating to the face and primitive ear were destroyed (5). The researcher has shown that these are the cells that affect the development of the skeleton, mandible and the lower part of the face. There is no apparent cure for this disease. However, a number of surgical interventions are applied for aesthetic and reconstructive purposes.

The rarity of this syndrome alongside with its transmission from generation to generation causing chin and facial defor-

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Received: 23.03.2023 / Accepted: 30.03.2023 / Published: 20.12.2023

mities as what we encountered in two siblings and in a single child of a family with no previous history of such a syndrome constitute the subject of our article.

Case Report

Our first two cases were two siblings who applied for dental crowding and pre-surgical orthodontic treatment. The older sibling was a 19-year-old male, and the younger was an 18-year-old female. In the anamnesis, it was understood that the patients who were born with normal delivery had a different appearance from the time of birth, but the family did not seek any treatment for a long time. Family history of the patients, revealed that such cases were also encountered in previous generations. A family tree was prepared based on the information obtained from the patients.

When the family tree was made, it was determined that besides our cases, mothers, grandmothers and fathers of their grandmothers were also affected by this disease. Among the diseased individuals in the family, only the mother and her two children are alive. Our cases represent two of the six siblings in the family who were affected. The other four are healthy. The disease is transmitted from generation to generation by carrying an autosomal dominant character.

Our first case was an 18-year-old woman with a face shape that had the characteristic features of the disease. Palpebral fissures were prominent. Antimongoloid obliqueness and coloboma on the lower eyelids were detected in the eyes of the patient, and the eyelashes were missing. The eyes were hyperteloric and the nose disproportionately large. A mild deformity was detected in the auricle of our case. Ears were relatively low and the patient had hearing difficulties. Very stiff hairs were obvious, starting just in front of the upper edge of the auricle and continuing as a band to the middle of the cheek. The patient had a fish-like appearance when viewed in profile, due to micrognathia in the lower jaw and anterior thrust in the upper jaw (Figure 1).

Figure 1: Right profile view of the patient

In the oral examination, although the condition of the teeth was quite good, it was observed that the gums were edematous. This is related to the patient's inability to close his lips and mouth-breathing as a result of the open bite caused by the incompatibility of the jaws. Our patient had a crowding in the lower teeth and remaining root belonging to tooth number 25. During the examination, it was decided to remove this root.

Our second case was a 19-year-old male patient, who had the characteristic features of the disease, but was mildly affected by it. Eyes were hyperteloric and palpebral fissures were prominent. There was no deformity in the ears, but they were relatively low (inferiorly positioned). The patient also had mild hearing impairment. This patient does not have the hair growth seen in his sister. Similar to the first case, due to micrognathia in the lower jaw and prognathia in the upper jaw, there was a fish-like appearance when viewed from a face profile (lateral profile) (Figure 2). Oral examination revealed good oral hygiene. There was no need for orthodontic treatment before surgery for the patient's tooth crowding. No additional pathology was detected in the radiographic examination. Dentally, it was decided to perform endodontic treatment for tooth no. 16, which was diagnosed with deep dentin caries, and extraction of remaining roots of teeth no. 36 and 46.

Figure 2: Front view of the patient

Our third case was a 9-year-old female. Our patient showed all the features of this syndrome like the antimongoloid obliqueness, coloboma in the eyelids and no eyelashes in the lower eyelid were observed. In addition, the ear deformity in our patient was advanced and there was a hearing loss of 40%. Our patient, who stated that she had been using a hearing aids since the age of four, also had micrognathia in the lower jaw and the patient's profile was fish-like.

Oral examination showed good oral hygiene. It was observed that she was a mouth breather due to malocclusion and as a result the patient suffered from periodontal problems. There was a crowding in the teeth. Periapical lesions caused by caries in teeth 36-46 were seen in periapical and panoramic radiographs.

Submandibular lymphadenopathies were detected on both sides due to decayed teeth. It is interesting that there were no abnormal features in the family history of our patient. Although the syndrome is known to be autosomal dominant. İt was not previously encountered in our patient's family, and it was encountered for the first time in our case which means that a patient may suffered from a sudden mutation at the gene level. It is also worth mentioning that the other siblings of our patient did not have such an anomaly.

In the medical history taken, it was learned that our patient was born by Caesarean section and was exposed to cord entanglement. The patient was admitted to extract the decayed teeth and to treat the restorable ones under general anesthesia. However, the patient could not tolerate general anesthesia and treatment could not be continued due to tachycardia. Later on the patient applied to our faculty and was advised to have her decayed and unrestorable teeth extracted with local anesthesia, get her periodontal problems solved and undergo the recommended orthodontic treatment required prior to the surgical intervention planned to correct the jaw deformities after the age of 18.

Discussion

Treacher-Collins syndrome is a disease characterized by antimongoloid obliqueness of the eyelids, ocular hypertelorism, coloboma and absence of eyelashes of the lower eyelids, ear anomalies and hypoplasia of the mandible. The face is quite remarkable. All three of our cases have all the features of this syndrome and a bird's face appearance is dominant. There is micrognathia in the lower jaw, anterior thrust and open bite in the upper jaw.

Even though a minimal ear deformity was noticeable in the first case there was no ear deformity in the second case. However, in both cases, the ears were inferiorly positioned. In our third case, the ear deformity was severe and the airway was found to be obstructed. Hearing impairment is an important feature in such cases. All three of our cases have hearing impairment. Especially in our third case, the hearing difficulty was more severe and it was learned that the patient had been using hearing aids since the age of 4. TCS affected patients must have audiological testing and an early hearing abilities check must be carried out by a specialist as soon as possible. Speech therapy, bone conduction amplification and hearing aids are useful means to help aquire new communicational skills. Unfortunately, external ear and auditory canal reconstruction surgeries rarely help in hearing improvement. (8).

The disease has a familial course due to its autosomal dominant transmission (9, 10). There is familial transmission in our first two cases. The syndrome is passed on from generation to generation. On the maternal side of our cases, at least one patient is encountered in each generation. However, in our third case, this syndrome is seen for the first time in the family. The cause of this event is attributed to mutation.

Since it is autosomal dominant, it is likely to be seen in future generations in the family. In the literature, cleft palate was found in 1/3 of the cases (2). In our cases, however, such a situation was not observed. On the other hand, as seen in many cases, the profiles of our patients took on a fish-like appearance. The severity of the disease varies (11). In some cases, the disorder's effect is barely noticeable. Although the features in our cases were the defining characteristics of the disease, the male patient was less affected than his sister. The mothers of the patients are the least affected individuals. In our third case, the characteristic face shapes and severe ear deformity were remarkable.

Miscarriage and early postnatal deaths are common in some families (12). It was learned that there was no miscarriage or early postnatal death in the family of our first two cases, therefore the disease was passed on from generation to generation. The disease does not necessarily affect all individuals in a generation. As seen in our cases, only two of the six siblings were affected. It was stated that there was no miscarriage or early postnatal death in the family of our last case, and that such an anomaly was encountered for the first time. There is no mental retardation in Treacher - Collins syndrome, but the affected persons are usually shy due to their physical characteristics (4). It was obvious that our patients were shy because of their physical features and were in need for psychological counseling as soon as possible.

Conclusion

Treacher Collins syndrome is rare and a complex congenital disorder with a variable degree of craniofacial deformity. It does not associate neurodevelopmental impairment. Patients usually suffer from social distancing and failure to integrate properly with the socitey due to their physical appearance. Taking care of these patients requires a multidisciplinary team and a reconstructive treatment is important for their social and psychological well-being.

Declarations

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

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

Financial Disclosure: *Authors declared no financial support.*

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