Forthcoming Meeting

16th Congress of the Balkan Stomatological Society
28 April - 1 May, 2011, Bucharest, Romania

BALKAN STOMATOLOGICAL SOCIETY
&
ROMANIAN DELEGATION OF THE BaSS

Invite you cordially to Bucharest on the occasion of the
16th Congress of the Balkan Stomatological Society

President of the Congress Prof. Norina Forna

Dear colleagues and friends,

On behalf of the Local Organizing Committee, it gives me great pleasure to invite you for the 16th Balkan Stomatological Society Congress (BaSS) to be held in Bucharest, Romania, in April 2011. This event will be organized by the Romania delegation of the BaSS with the support of the Romanian Society of Oral Rehabilitation (ASSRO), The Romania Dental Council (CMDR) and Romanian Association of Oral Implantology and Biomaterials (SRIOB), under the theme “Update in dental medicine”.

The success of the Annual Bass Congress underlines the crucial role of the scientific programme’s quality. In recent years we have not only seen an increase in the number of participants but also the growth and development of what is now an outstanding scientific programme with continuing efforts to elevate Balkan stomatology to a higher level. This certainly could not have been achieved without your valuable support at the BASS congresses and for that we are extremely grateful.

As the Local Organizing Committee, we hope that, in addition to intellectual and professional growth, we can also provide you with a relaxing and enjoyable social experience. The capital of Romania is an attractive tourist destination, which offers the opportunity to all of you to pay a visit to the numerous historical sites and enjoy the extraordinary Romanian scenery.

We look forward to seeing you all in Bucharest.

Kind regards

Professor Norina Forna
President of the Congress

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### Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Author(s)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparative Study of Calcium Hydroxide Extrusion with Different Techniques of Intra-Canal Placement</td>
<td>T. Zarra, T. Lambrianidis, E. Kosti</td>
<td>5</td>
</tr>
<tr>
<td>Efficacy of Computer-Controlled Articaine Delivery for Supplemental Intraoral Anaesthesia</td>
<td>V. Biočanin, M. Milić, D. Brajković, B. Brković, D. Stojić, Lj. Todorović</td>
<td>11</td>
</tr>
<tr>
<td>Caries Experience among Greek Pomak Children Living in Rural North-Eastern Greece. A Cross-Sectional Study</td>
<td>D. Sapourides, V. Topitsoglou, S. Muronidis, N. Kotsanos</td>
<td>15</td>
</tr>
<tr>
<td>Effects of Orbit Sugar-free Chewing Gum for Kids in Overall and Cariogenic Salivary Microflora Reduction</td>
<td>A. Dimkov, N. Panovski, E. Gjorgievsk</td>
<td>24</td>
</tr>
<tr>
<td>Fluoride Released from Orthodontic Bonding Material: An In Vitro Evaluation</td>
<td>E. Zabokova-Bilbilova, A. Sotirovska-Ivkovska, I. Gjorgovski</td>
<td>31</td>
</tr>
<tr>
<td>Variation of Skeletal Cephalometric Variables in Class II Division 2 Patients with Age</td>
<td>N. Topouzelis, A. Zafiriadis, H. Markovitsi</td>
<td>35</td>
</tr>
<tr>
<td>Clinical Oral Manifestation in Gastrointestinal Disorders</td>
<td>M. Popovska, B. Stavrova, A. Atanasovska-Stojanovska, P. Misevska, S. Strezovska, L. Kanurkova, J. Gjurcheski</td>
<td>41</td>
</tr>
<tr>
<td>CR</td>
<td>Authors</td>
<td>Title</td>
</tr>
<tr>
<td>----</td>
<td>---------</td>
<td>-------</td>
</tr>
<tr>
<td>A. Ntomouchtsis, D. Maggoudi, H. Panidou, A. Kondylidou, K. Antoniades</td>
<td>Unusual Penetrating Metallic Foreign Bodies Injured Maxillofacial and Orbital Region with Minimal Damage</td>
<td>52</td>
</tr>
</tbody>
</table>
Comparative Study of Calcium Hydroxide Extrusion with Different Techniques of Intra-Canal Placement

SUMMARY

Introduction: To investigate Ca(OH)₂ extrusion from the apical foramen in relation to the placement mode.

Methods: 200 teeth, prepared with ProTaper files with and without apical patency, were divided in Groups A and B respectively, and filled with Ca(OH)₂ at 1 and 3 mm short of working length, using K-files manually and with mechanical spiral techniques (Pastinject/Lentulo) at 500 and 700rpm. Extrusion was graded as present/absent. Experimental categories were compared using Fisher’s exact test.

Results: Extrusion was observed only in teeth with patency. There was no extrusion with K-files in all cases and with Pastinject and Lentulo inserted at 3 mm short of working length. Speed elevation did not significantly increase the extrusion cases.

Conclusions: K-files tend to be safer than mechanical techniques. Pastinject and Lentulo at 3 mm short of working length prevented Ca(OH)₂ extrusion. Raising speed from 500 to 700 rpm did not significantly increase the extrusion risk.

Keywords: Calcium Hydroxide; K-files; Lentulo; Pastinject; Patency; Rotation Speed

ORIGINAL PAPER (OP)
Balk J Stom, 2011; 15:5-10

Introduction

Calcium hydroxide Ca(OH)₂ is widely used as an intra-canal medicament. A homogenous and sufficient in length, obturation of the root canal space with Ca(OH)₂ is essential in order to benefit from the paste’s antimicrobial effect.

Several techniques and specialized instruments for intra-canal placement of Ca(OH)₂ have been advocated. These can be divided into 3 main categories: (a) spiral techniques, performed with hand endodontic instruments, most commonly with K-files rotated counterclockwise, or by mechanically rotating instruments used in various speeds ranging from as low as 150rpm for Nickel-Titanium instruments, 500rpm to 1000 rpm for the Lentulo paste carrier and the Pastinject (MicroMega, Besancon, France), moderate speed (5,000rpm) for the Gutta-Condensor (Maillefer, Ballaigues, Switzerland) to even higher speed (10,000 rpm) for the McSpadden compactor (Ransom and Randolph, Toledo, Ohio); (b) ultrasonic techniques using specifically designed instruments mounted on an ultrasonic generator, such as K-type ultrasonic files and the Meca-Shaper (Maillefer, Ballaigues, Switzerland); and (c) injection techniques, such as the Messing Root Canal Gun (Dentsply Maillefer, Ballaigues, Switzerland), the Calasept injection system (Scania Dental AB, Sweden) and the Ultracal syringe system (Ultradent, South Jordan, UT, USA). These last techniques use a syringe and a needle to insert the Ca(OH)₂ into the prepared root canals. Although commonly the above techniques are used separately, a combination has also been proposed. Following placement of the paste, condensation can be achieved with files, absorbent paper points and manual pluggers.

The effectiveness of current techniques for Ca(OH)₂ filling of the root canal space varies. Deveaux et al showed that Pastinject and Lentulo provided a better filling in single-rooted teeth compared to Gutta-Condensor, Meca-Shaper and K-type ultrasonic file. Estrela et al concluded that K-files rotated counterclockwise, combined with the use of absorbent paper points and pluggers, achieve better quality of filling with less empty spaces in all thirds of the root canal compared to Mc Spadden compactors, Lentulo spirals...
and syringes. When the Pastinject and the Lentulo were directly compared, Pastinject proved to be more effective for placement of Ca(OH)\(_2\)\(^{7,22}\). Similarly, when comparing Lentulo to an injection technique, the Lentulo provided a denser and up to the desired length filling of the root canal\(^ {30}\). However, it has been suggested that if straight or slightly curved root canals are prepared up to at least size 50, high quality Ca(OH)\(_2\) fillings can be achieved with a syringe\(^ {32}\). There is discrepancy in the literature regarding the effectiveness of different techniques. However, there is a consensus that better filling of the root canal space with Ca(OH)\(_2\) is achieved in root canals that have been adequately instrumented, when compared to those that have been only minimally prepared as is often a case during an emergency appointment\(^ {1,32,34}\).

During root canal treatment, Ca(OH)\(_2\) dressing material might unintentionally escape through the root apex into the periapical tissues\(^ {4,6,35,21}\). Although the effectiveness of various techniques in filling the root canal space has been widely studied\(^ {7,8,30-32}\), there are no reports in the literature on the effectiveness of those techniques in preventing extrusion into the periapical tissues. Only in a pilot study on plastic blocks\(^ {34}\), extrusion was noted in cases of patent blocks with the carrier placed at the working length and therefore, in the main study, this was prevented and thus not studied by placing tape where the canal exited the plastic block. The aim of this study was to investigate the frequency of extrusion of Ca(OH)\(_2\) from the apical foramen in relation to the technique of intra-canal placement, the distance from the apical foramen and rotation speed.

Materials and Methods

200 freshly extracted, fully formed human permanent single-rooted teeth obtained from a pool of teeth were studied. Calculus and conjunctive deposits were removed and teeth were kept in 10% formalin until use. 2 radiographs were taken, 1 from the buccal and 1 from the proximal side of the tooth to verify the existence of a single non-calcified root canal with a curvature of 0-10\(^{9}\) according to Schneider\(^ {28}\). Once the access cavity was prepared, the working length was established radiographically at a distance of 1 mm from the radiographic terminus. The teeth were divided in 2 groups:

**Group A:** The root canals were instrumented with the ProTaper rotary files (Dentsply, Tulsa Dental, Tulsa, OK, USA) according to the manufacturer’s instructions, starting with file S1 up to file F3. Between each file, the root canal was irrigated with 2.5% NaOCl using a 27-gauge needle (Ultradent Products INC, South Jordan, UT, USA) placed passively in the canal at 2-3 mm short of the working length, and a #10 K-file was placed into the root canal and advanced until the tip of the file passed 1 mm from the apical foramen to maintain the patency of the apical constriction.

**Group B:** The instrumentation procedure was identical to that of group A but patency file was not used.

After instrumentation, the root canals were dried with paper points and the teeth were adjusted to holes created through the rubber stoppers of vials and were secured in place using sticky wax. The vials were hand-held. The operator was shielded from seeing the root apex during the filling procedure by a rubber dam that covered the vial.

Pure Ca(OH)\(_2\) powder (Merck K GaA, Darmstadt, Germany) was moistened with saline and mixed to a relatively thick paste (corresponding to a toothpaste consistency). Then, the specimens of each group were randomly divided into 10 experimental groups comprising 10 teeth each. The groups are presented in table 1.

The entire length of a size # 30 Lentulo spiral (Maillefer, Ballaigues, Switzerland) and a size #30 Pastinject (MicroMega, Besancon, France) file were coated with the paste, introduced in the canal at 1 and 3 mm short of the working length and then rotated at 500 and 700 rpm using a handpiece mounted on a speed and torque control machine (X-Smart, Dentsply, Tulsa Dental, Tulsa, OK, USA). A size #30 K-file (Maillefer, Ballaigues, Switzerland) was coated with Ca(OH)\(_2\) and introduced into the canal at 1 and 3 mm short of the working length with a counterclockwise rotation resulting in 20 subgroups (Tab. 1). For all 3 techniques of placement, the paste was condensed with a size #10 plugg (Maillefer, Ballaigues, Switzerland), then dried and compacted with the blunt end of a paper point and the procedure was repeated for a total of 3 times for each tooth.

When the intra-canal placement of Ca(OH)\(_2\) was completed, the tooth-rubber stopper unit was removed from the mouth of the vial and the root ends were viewed under a microscope (OPMI, Carl Zeiss Surgical Inc, Dublin, CA, USA) at x 4.5 magnification. The extrusion of Ca(OH)\(_2\) was recorded as either present or absent by 2 examiners masked on the group and technique examined. Any amount of Ca(OH)\(_2\) that past the apical foramen was considered extrusion (Fig. 1a and 1b.). Only if the 2 examiners agreed upon their answer, the answer considered valid. In case of disagreement, a third examiner was consulted. Cases in which there was no consensus were excluded from the study.

Fisher’s exact test was used to compare the experimental categories, with the level of significance set at p<0.05, to determine statistical significance. All p values were 2-sided. Analysis was performed using SAS software, version 9 (SAS Institute Inc., Cary, NC).
Table 1. 20 experimental sub-groups and the extrusion of Ca(OH)$_2$ in relation to the method of intra-canal placement, distance from the apical foramen and rotation speed (rpm).

<table>
<thead>
<tr>
<th>Group</th>
<th>Technique</th>
<th>Length</th>
<th>Rotation speed (rpm)</th>
<th>Extrusion</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yes (N)</td>
</tr>
<tr>
<td>A (N=100) With patency</td>
<td>LENTULO (N=40)</td>
<td>-1mm</td>
<td>500</td>
<td>0</td>
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<tr>
<td></td>
<td></td>
<td>-1mm</td>
<td>700</td>
<td>1</td>
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<td></td>
<td>-3mm</td>
<td>500</td>
<td>0</td>
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<tr>
<td></td>
<td></td>
<td>-3mm</td>
<td>700</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>PASTINJECT (N=40)</td>
<td>-1mm</td>
<td>500</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-1mm</td>
<td>700</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>K-FILE (N=20)</td>
<td>-1mm</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-3mm</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>B (N=100) Without patency</td>
<td>LENTULO (N=40)</td>
<td>-1mm</td>
<td>500</td>
<td>0</td>
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<tr>
<td></td>
<td></td>
<td>-1mm</td>
<td>700</td>
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<td>PASTINJECT (N=40)</td>
<td>-1mm</td>
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<td>K-FILE (N=20)</td>
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<td></td>
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<td>-3mm</td>
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<td>0</td>
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Results

The number of teeth with extruded Ca(OH)\textsubscript{2} in each group is shown in table 1. Patency of the apical foramen significantly increased Ca(OH)\textsubscript{2} extrusion. In group A, K-files used for intra-canal placement of Ca(OH)\textsubscript{2} prevented extrusion; there were 8 cases of extrusion when mechanical spiral techniques were used; however, there was no statistically significant difference. Insertion of the paste carriers at 3 mm short of the working length constricted the paste inside the root canal more efficiently compared to insertion at 1 mm short of the working length, but the difference between them was not statistically significant. At 500 rpm and at 1 mm short of the working length, Pastinject caused extrusion of Ca(OH)\textsubscript{2} in 3 out of 10 teeth, but the difference was not statistically significant when compared to the Lentulo technique, where no extrusion was detected. Elevating the speed from 500 to 700 rpm did not lead to significantly more cases of extrusion for either Lentulo or Pastinject, although there was a tendency (4 out of 10 cases) for extrusion when using Pastinject at 700 rpm and at 1 mm short of the working length.

Discussion

Although it is suggested that the deliberate extrusion of Ca(OH)\textsubscript{2} into the periapical tissues may have a direct effect on inflamed tissue and epithelial cystic linings and potentially favour periapical healing and encourage osseous repair\textsuperscript{35}, it is not widely recommended. Extensive extrusion of Ca(OH)\textsubscript{2} into the periapical tissues did not appear to compromise ultimate periapical healing\textsuperscript{36,21}; however, in the majority of cases, it seemed to delay it. Moreover, there are reports of immediate flare up induced by extrusion\textsuperscript{6}. Cases with complete healing of the pre-existing periapical lesion even after 3\textsuperscript{21} or 4 years\textsuperscript{16} with incomplete resorption of the extruded paste containing BaSO\textsubscript{4} (used to enhance its radiopacity) have also been reported.

The use of Ca(OH)\textsubscript{2} as an intracanal medicament has been linked with a number of severe side effects. There have been case reports with necrosis of the gingiva and mucosa due to its alkalinity\textsuperscript{3}, severe tissue necrosis after intra-arterial injection\textsuperscript{29}, orbital pain and headache\textsuperscript{16}, severe facial ischemia\textsuperscript{18}, mental or inferior alveolar nerve paraesthesia after penetration of the material into the mandibular canal\textsuperscript{1,24,27}, formation of antroliths following its extrusion into the antrum\textsuperscript{10,12} and foreign body granuloma in the nearby gingival tissues\textsuperscript{15}. In mice, inflammatory responses were reported following inoculation of various Ca(OH)\textsubscript{2} pastes into subcutaneous tissue. The severity of the response varied by the paste type used\textsuperscript{5,20}.

In our study, extrusion of Ca(OH)\textsubscript{2} was recorded as either present or absent. Similarly, previous studies on the extrusion of gutta-percha used the presence and absence of extrusion as a criterion to evaluate the safety of filling techniques in obturating the root canals\textsuperscript{25}. The positive/negative criterion is not sensitive enough to distinguish among techniques. However, the consistency of the extruded calcium hydroxide and its contact with the root surface does not allow measurements as in the cases of debris or irrigant extrusion studied extensively in the literature\textsuperscript{14,17}. The techniques investigated are among the most widely recommended for intra-canal calcium hydroxide placement in clinical practice and they have been thoroughly investigated for their efficacy\textsuperscript{7,8,22,30-32,34}. Thus, it was thought unnecessary to study their filling efficacy. Therefore, this study presents only results of the extrusion of the material, regardless quality of the filling of the root canal in each case, as extrusion in clinical practice is not related to the quality of the filling.

In the present study, extrusion of Ca(OH)\textsubscript{2} was only recorded in teeth where patency was preserved. Establishing patency of the apical foramen during root canal instrumentation to effectively prevent blockages and loss of working length has been proposed\textsuperscript{2,9,11}. Patency facilitates removal of debris from the entire root canal space, especially in teeth with necrotic pulp tissue and bacteria load\textsuperscript{13} and improves tactile sense during apical shaping and thus reduces the chances of canal transportation and ledge formation\textsuperscript{2}. However, the concept of apical patency is considered controversial due to the differences in the amount of the extruded material found in cases with and without patency filing\textsuperscript{2,19,33}. In this study, a #10 K-file was used as patency file as it was found that more material was extruded apically when diameter of the apical patency increased\textsuperscript{33}.

A wide range of rotation speeds have been used during the spiral filling techniques, ranging from 150 up to 10,000 rpm\textsuperscript{7,8,22,23,30-32,34}. In the present study, elevating rotation speed from 500 to 700 rpm resulted in more cases of Ca(OH)\textsubscript{2} extrusion in teeth with patent apical constriction, but the difference did not reach statistical significance.

In previous studies on the effectiveness of intracanal placement techniques of Ca(OH)\textsubscript{2}\textsuperscript{7,8,30-32,34}, the paste carrier was introduced in the root canal at 0 to 3 mm short of the working length. The most effective delivery of Ca(OH)\textsubscript{2} was achieved when the paste carriers were introduced to working length\textsuperscript{31}. In the other cases, some distance of Ca(OH)\textsubscript{2} from the working length was observed\textsuperscript{22}. In the present study, the extrusion of Ca(OH)\textsubscript{2} from the apical foramen was recorded when the carrier was introduced at 1 and 3 mm short of the working length. The results of this study demonstrated that the distance of 3 mm short of the working length was safe to prevent extrusion, even in teeth with patency and at 700 rpm.
rotation speed with any of the paste delivering techniques evaluated.

Our observations need to be interpreted with caution as ex-vivo experimentation cannot be regarded as directly representative of the clinical situation. Tissue pressure and resistance by the periapical tissues in the in vivo conditions may reduce the occurrence and extent of periapical extrusion of calcium hydroxide, although the exact effect of this variable is difficult to determine\(^3\).

There is a need for more comparative studies on the efficiency of the various Ca(OH)\(_2\) delivering techniques in filling the root canal space in order to educate the clinician how to maximize the antimicrobial properties of Ca(OH)\(_2\), while avoiding the adverse effects caused by its extrusion into the periapical tissues.

References

25. Robinson MJ, McDonald NJ, Mullally PJ. Apical extrusion of thermoplasticized obturating material in canals instrumented with Profile 0.06 or Profile GT. J Endod, 2004; 30:418-421.


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Efficacy of Computer-Controlled Articaine Delivery for Supplemental Intraoral Anaesthesia

SUMMARY

Objective. The aim of this study was to investigate quality and safety of supplemental intraoral anesthesia - periodontal ligament anaesthesia (PDL) and intraseptal anaesthesia (ISA) after computer-controlled articaine delivery.

Method. 54 ASA I volunteers randomly divided into 2 groups participated in this study. 0.4 ml of 4% articaine with 1:100.000 epinephrine were randomly administered with computer-controlled local anaesthetic delivery system on the mesial and distal side of maxillary lateral incisor for ISA or PDL. An electric pulp tester was used to test the pulpal anaesthesia, in 2-minute cycles for 60 minutes. Anaesthesia was considered successful when 2 or more consecutive no-response at 80 readings were obtained. Soft-tissue anaesthesia was measured by pin-prick test.

Results. Success rates for ISA and PDL were 77.8% and 55.6% respectively, but difference was not statistically significant (p>0.05). Duration of complete pulpal anaesthesia was significantly longer (p<0.05) with the ISA in comparison to the PDL. The width of anesthetized field was significantly greater (p<0.05) with the ISA than with the PDL, both for attached gingiva and oral mucosa. No side effects were recorded during the study.

Conclusion. The results of this study indicate that the ISA technique is successful in obtaining complete pulpal anaesthesia of upper lateral incisors and soft-tissue anaesthesia in this area.

Keywords: Intraseptal Anaesthesia; Periodontal Ligament Anaesthesia; Articaine; Computer-controlled local anaesthetic delivery system

Introduction

Achieving adequate anaesthesia of dental pulp and periodontium is imperative in performing most dental procedures. Beside conventional anaesthetic techniques, infiltration and nerve block, some additional anaesthetic techniques may be required. Some recent advances in anaesthetic techniques that provide alternatives to conventional methods include periodontal ligament anaesthesia (PDL) and intraseptal anaesthesia (ISA). PDL is effective for pulpal, osseous and soft tissue anaesthesia. In addition, PDL provides anaesthesia only in the localized area without unpleasant numbness of the lip and facial muscles. However, PDL has some disadvantages, such as possible injury to the periodontal ligament and spread of infection from injection site deeper into the alveolar bone if injection site is inflamed.

In order to overcome disadvantages associated with PDL, intraseptal anaesthesia (ISA) may be used. ISA is an intraoral anaesthetic technique where needle penetrates periosteum in the region of interdental osseous septum and anaesthetic diffuses directly into cancellous bone, reaching apical nerves of teeth. It is a local anaesthetic technique that can provide osseous, soft tissue and pulpal anaesthesia in patients undergoing tooth scaling, periodontal surgery and simple tooth extractions.

Computer-controlled local anaesthetic delivery system (CCLADS) delivers anaesthetic at a constant, slow rate and controlled pressure, regardless of the
tissue resistance. CCLADS provides less painful injections than traditional system. Similarly, this system enables clinicians to perform easier, faster, more reliable and less painful dental anaesthesia and is better accepted by patients than standard method of injection. Traditionally, PDL and ISA have been used with a conventional or high pressure syringe with the possibility to change parameters of the cardiovascular function. However, Nusstein et al reported that PDL used with CCLADS did not cause neither significant nor clinically meaningful increase in heart rate. Evaluation of the anaesthetic parameters showed that duration of complete pulpal anaesthesia using CCLADS with PDL was about 30 minutes in comparison with conventional pressure syringe where duration was 10-15 minutes.

The aim of this study was to investigate quality and safety of the intraoral supplemental anaesthesia (PDL and ISA) after computer-controlled articaine delivery (CCArtD).

Method

54 randomly selected ASA I volunteers participated in this study. All patients were informed of the goals of the study and signed a written consent. The study was approved by the Ethical Committee of the Faculty of Dentistry, University of Belgrade. Persons were randomly divided into 2 groups: (1) the 1st group (27 volunteers) underwent the ISA; (2) the 2nd group (27 volunteers) underwent the PDL. The tested tooth was upper lateral incisor. Previous clinical examination indicated that all the tested teeth were free of caries, large restorations or periodontal disease, and none had a history of trauma or sensitivity.

The local anaesthetic injected was 4% articaine with 1:100 000 epinephrine (Septanest®, Septodont, France). The total dose of anaesthetic solution was 0.4 ml per tooth, both for ISA and PDL. Time of local anaesthetic administering, 0.2 ml mesially and 0.2 ml distally, was approximately 80 seconds (40 seconds at each side). Anaesthetic solution was injected with computer-controlled local anaesthetic delivery system (Anaeject®, Septodont, France) with constant pressure and speed, approximately 0.005 ml per second.

The site of needle insertion for ISA was 2-3 mm above the tip of interdental papilla, with 90° angulation of the needle to the surface of the papilla, until contact with the bone. Blanching of the gingiva overlying bone was indicator that the anaesthetic solution had been properly deposited. The site of needle insertion for PDL was the region of gingival sulcus at 30° to the tooth long axis at buccomesial and buciodistal aspect of the root. We used a 30G short needle (Septodont®, Dental Needle, France), both for ISA and PDL.

Duration and success of pulpal anaesthesia of the upper lateral incisor were evaluated using tooth vitality tester (Vitality Scanner Model 2006®, Sybron Endo). Fluoride gel (Fluorogel forte®, Galenika, Beograd) was used as an electrolyte between the pulp tester probe and the tooth. Before the injections were given, the experimental tooth and control contralateral canine were tested 3 times by means of a Vitality Scanner, Model 2006, to record baseline vitality. After administering anaesthesia, electrical stimulation was repeated every 2 min until the reading became lower than 80 (max). Duration of complete pulpal anaesthesia was period between the first and the last 80 readings on electrical pulp tester. Anaesthesia was considered successful when 2 or more consecutive no response at 80 readings were obtained.

Soft tissue anaesthesia was measured as absence of pain when pin-prick test was used in the region of the attached gingiva. The width of the anaesthetic field, expressed in millimetres, was measured 5 min after the local anaesthetic injection by flexible ruler and pinprick testing in the region of the attached gingiva and oral mucosa. We used 27 gauge needle (Monoject®, Dental Needle, Mansfield, USA) for pin prick testing. Pinprick testing was done directly until contact with the periosteum occurred, immediately after the end of injection, every 5 min during the first 20 min, and after that every 2 min until patient felt blunt pain.

Patients were followed for 5 days to record any local postoperative side-effects, such as postoperative sensitivity to bite, papillary necrosis, postoperative pain or swelling.

Statistical analysis was performed by using statistical software SPSS, version 10.0. The results were analysed by unpaired t-test (2-tailed), Man-Whitney non-parametric test and χ² test.

Results

There were no statistical significant differences (p>0.05) between the groups in respect to the success rate of pulpal anaesthesia achieved by both techniques; ISA being slightly more successful (77.8%) than PDL (55.6%).

Significantly wider area of the anesthetized attached gingiva and oral mucosa at the buccal aspect of the tooth were obtained by ISA in comparison with PDL (Tab. 1).

Duration of complete pulpal anaesthesia (Tab. 2) was significantly longer with ISA than with PDL (p<0.05). Likewise, duration of soft tissue anaesthesia was significantly longer with ISA than with PDL (p<0.05).

No local side effects were recorded during the study.
Table 1. Width of the anaesthetized field obtained by the employed techniques

<table>
<thead>
<tr>
<th>Anaesthetized area (mean ± SD)</th>
<th>Attached gingiva (mm)</th>
<th>Oral mucosa (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISA</td>
<td>20.33 ± 11.09</td>
<td>21.81 ± 9.13</td>
</tr>
<tr>
<td>PDL</td>
<td>7.15 ± 7.81</td>
<td>12.22 ± 8.64</td>
</tr>
<tr>
<td>p</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
</tr>
</tbody>
</table>

Table 2. Duration of anaesthesia after the employed techniques

<table>
<thead>
<tr>
<th>Duration of anaesthesia (mean ± SD)</th>
<th>Pulpal (min)</th>
<th>Soft-tissue (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISA</td>
<td>13.21 ± 4.36</td>
<td>46.48 ± 15.96</td>
</tr>
<tr>
<td>PLA</td>
<td>6.57 ± 4.41</td>
<td>28.77 ± 23.10</td>
</tr>
<tr>
<td>p</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
</tr>
</tbody>
</table>

Discussion

The results of this study showed that CCArtD was reliable producing complete pulpal and soft tissue anaesthesia of the upper lateral incisor after PDL and ISA injection. In our study success rates with both anaesthetic techniques, ISA and PDL, were 77.8% and 55.6% respectively, lower than in previous study, where success rates were 88.6% and 91.4% respectively. The objective reason for lower anaesthetic success was that we used ½ of the anaesthetic dose that Brkovic et al3 had used in their study. Another reason for lower PDL success lies in the fact that in this study, the electric pulp tester - was used to determine complete pulpal anaesthesia. On the other hand, Brkovic et al3 used level of pain during extraction as a criterion for anaesthetic success.

In conclusion, results of the present study showed that ISA provides successful pulpal anaesthesia of upper lateral incisors and adequate soft tissue anaesthesia in the region at least in concentrations of articaine we used.

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References


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Caries Experience among Greek Pomak Children Living in Rural North-Eastern Greece. A Cross-Sectional Study

SUMMARY

Pomaks are a cultural and religious minority living in a rural area of Northeastern Greece, with several factors predisposing them to a very high caries risk. The main aim of the study was to assess caries prevalence of Pomak schoolchildren. A cross-sectional survey was carried out on a total of 700 children 6-12 years old, visually examined in the classroom according to WHO criteria. Generalized Linear Models (GLMs) with Poisson distribution with over dispersion and Binomial models were preferred (SPSS v16).

The SiCDMFT index was 5.64 (SD = 1.86) in 12-year-old Pomaks, while the mean DMFT was 3.85 (95%CI: 3.13; 4.56), almost twice the national average for Greece (2.05, SD 2.50). The proportion of children with severe caries (DMFT≥4) was about 70% at the age of 12. Similarly increased values were found in 6-year-olds [dmft = 5.49 (95%CI: 4.46; 6.51) and SiCdmft = 10.48 (SD 2.74)]. Cavity-free children varied by age between 17% for younger children and 3% for older ones. Despite the high dt and the steeply rising DT values with age, Care indices were extremely low.

In conclusion, Pomak schoolchildren have the worst caries indices in Greece, somewhat similar to the values found in urban children 30 years ago. Thus, oral health promotion policies, using the whole population approach strategy, need to be particularly targeted on the Pomak villages.

Keywords: Caries Prevalence; Children; Cross-Sectional; Rural; Poisson distribution; Pomaks

Introduction

According to the results of a recent Greek national survey of oral health status, the caries experience of children and adolescents in Greece has significantly declined in the last 30 years. For example, the DMFT index for 12 year olds has decreased from 4.30 to 2.05. These favorable data, however, mainly reflect caries decline in the urban population.

Certain parameters e.g. residential area, age, education level and socio-economic status have an impact on caries scores, as previously reported for various countries and specifically for Greece. Additionally, some striking differences have been reported in the oral health of children of ethnic minorities. Most notable inequalities were noted in Australia, where indigenous 5-6 year-old children experienced from 2 to 4 times higher caries scores than their non-indigenous counterparts. It is well documented that, in general, oral health in industrialized countries is associated with improved living conditions and various social factors, oral hygiene, regular use of fluoride and implementation of public health policies. However, preventive strategies may be relatively ineffective, and oral health related needs significantly greater, among poor and disadvantaged groups within these communities.

The dental care system in Greece is largely based on the private sector and utilization of dental services is highly dependent on family income. Primary care for children, however, including the implementation of oral health educational programs, is to a large extent delivered at Public Dental Health centres. In some areas that are remote and isolated areas, or where centres are lacking or difficult to access, high caries scores have been recorded, especially for primary teeth. Western
Thrace, the Northeastern region of mainland Greece, is homeland to about 36,000 Pomaks, who live in racially autonomous communities, mainly in a deprived highland rural area close to the border with Bulgaria. The villages constitute culturally unique Islamic communities, speaking a language with Slavic roots and receiving education in Greek, with Turkish as a foreign language. Educational levels tend to be low, as a considerable proportion of children, especially girls, receive only elementary education. Transport to urban/semi-urban places is complicated, especially during adverse weather conditions, because of the topography and harsh landscape of the highland villages.

There is only limited information available on the oral health status of the Pomak child population and the last national oral health survey did not contain any such data. Consequently, the main aim of the present study was to assess prevalence and treatment needs for caries and, secondly, to record obvious orthodontic problems in the Pomak child population of primary school age.

Methods

This cross-sectional study was conducted within the frames of social and health interests for the mainland border territories of the local Contingent of the Hellenic Armed Forces, the Health Section of which acted as the ethics committee. Invitation for schoolchildren to participate in this oral examination was extended to parents orally by informed school authorities.

Population Sample

Out of the existing 50 Pomak villages, 37 had a state elementary school with a total student population of 1,430. 13 schools were selected on the basis of geographical uniform distribution and population size, and all their students were included in the study. The great variability of student numbers prevented a perfect factorial design. All children present at school on the examination day were examined, comprising a total of 700 children (46% males and 54% females) aged between 6 and 12 years (Tab. 1). Exact ages were calculated according to the formula: (date of examination - date of birth) / 365.

The vast majority of Pomak families have low-income status derived from agricultural work, cattle-raising or manual work. The natural fluoride content of water in the whole region is so low as to be negligible, except for one village called Meses Thermes with 0.65 ppm F and only 4 child inhabitants. There were no data on fluoride toothpaste consumption.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sample distribution n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>74 (10.6)</td>
</tr>
<tr>
<td>7</td>
<td>148 (21.1)</td>
</tr>
<tr>
<td>8</td>
<td>134 (19.1)</td>
</tr>
<tr>
<td>9</td>
<td>131 (18.7)</td>
</tr>
<tr>
<td>10</td>
<td>84 (12.0)</td>
</tr>
<tr>
<td>11</td>
<td>96 (13.7)</td>
</tr>
<tr>
<td>12</td>
<td>33 (4.7)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>321 (45.9)</td>
</tr>
<tr>
<td>Female</td>
<td>379 (54.1)</td>
</tr>
<tr>
<td>Residence (population size)</td>
<td></td>
</tr>
<tr>
<td>&lt;500</td>
<td>214 (30.6)</td>
</tr>
<tr>
<td>500-1000</td>
<td>79 (11.3)</td>
</tr>
<tr>
<td>1,001-2,380</td>
<td>407 (58.1)</td>
</tr>
</tbody>
</table>

Data Collection and Management

The clinical examination was performed by one dentist (DS) from November 2005 to February 2006. Training and calibration on dental caries recording had been performed earlier on 15 high-caries index children at the clinic of the Department of Paediatric Dentistry (k-score = 0.84). Re-examination of Pomak schoolchildren was not possible for reasons of strict military personnel and vehicle traffic schedules.

Examination was performed in the classroom using paediatric wooden spatulas, following the WHO (1997) carries diagnostic criteria. To aid diagnosis, teeth were dried with gauze pads. Only teeth with cavities or visual dentinal caries (D3V/d3V threshold) were recorded as carious (DT, dt). Missing (MT, mt) and filled (FT, ft) teeth were recorded only if they were a result of dental caries. No radiographs were taken.

The recordings of malocclusion were based on the presence of visible orthodontic problems, such as anterior or posterior cross-bite, open bite, crowding, ectopic eruption or presence of supernumerary permanent teeth.

Caries prevalence was calculated as DMFT or dmft index. Moreover, care indices (FT/DMFT % and f/dmft %), percentages of caries-free children in primary (% dmft=0), permanent (% DMFT=0) and mixed dentition (% DTMF+dtmf=0), as well as Significant Caries index (SiC) were calculated.
Statistical Analysis

In comparing caries levels with non-normal distribution, the Generalized Linear Models (GLMs) with Poisson distribution with over dispersion was preferred[11,19]. In addition, Binomial models were set up to model the dichotomous outcomes. Data processing was performed with SPSS software program (v16, Chicago, IL, USA). The alpha level in all tests was set at 0.05.

The dependent variables (responses) were: the magnitude of indices DMFT with 13 levels (0-12) and dmft with 20 levels (0-19), the presence of caries 2 levels (Yes, No) and the presence of Orthodontic problem (Yes, No). The independent variables (factors) were Age: 7 levels (6-12 year old), Residence according to population size: 3 levels (<500, 500-1000 and 1001-2380 inhabitants[22], Gender: 2 levels (boys/girls) and Orthodontic problem (whenever not used as a response): 2 levels (Yes, No).

Data analysis was performed using Analysis of Variance in order to select the best model through a stepwise logistical regression. All variables were included in the initial model with all their 2-way interactions. Variables were dropped sequentially, with the variable showing the least evidence of statistically significant association being dropped first. A factor was never dropped if any 2-way interaction with it was present. The analysis was repeated until the only variables demonstrating statistically significant association at the 5% level were those included in the final model. The factors not appearing in any of the 5 models were always tested and found not statistically significant for any 2-way interaction. A standard examination of assumption of equal variances, the residuals, standardized residuals, normalized residuals, etc were performed in all models.

Model-1: A Poisson GLM using as dependent variable the magnitude of DMFT to establish the influence of the factors “Gender”, “Age”, “Residence” and the 2-way interaction of “Age and Residence”.

Model-2: A Negative Binomial GLM using as dependent variable the magnitude of dmft to establish the influence of the factors “Gender”, “Age”, “Residence” and “Orthodontic problem”.

Model-3: A Binomial GLM to establish the influence of the factors “Gender”, “Residence” and “Orthodontic problem” on the transformed new binary variable B-DMFT (presence or absence of caries in permanent teeth).

Model-4: A Binomial GLM to establish the influence of the factors “Gender”, “Age” and “Residence” on the transformed new binary variable b-dmft (presence or absence of caries in primary teeth).

Model-5: A Binomial GLM to establish the influence of the factors “Gender”, “Age” and “Residence” on the binary variable “Orthodontic problem” (presence or absence, used here as dependent variable).

Results

The findings of the ANOVA analysis are summarized in Table 2. All the factors influenced the magnitude of DMFT statistically significantly (Model-1), and the same was found for the presence or absence of caries in the permanent teeth (Model-3), except for factor Age. Although in the Model-3 the ratio “Deviance/dt” was 1.664, slightly outside the acceptable limits (0.5-1.5), it was accepted, because of the significance of the result (a correlation between binary variables orthodontic problem and caries experience).

At the same time, the magnitude of dmft and the presence or absence of caries in the primary dentition (Models-2 & -4, respectively) were both affected statistically significantly (p=0.000) only by the factor “Age”. Residence was found to statistically significantly affect the caries experience in permanent (both magnitude, Model-1 and presence/absence, Model-3), but not in primary dentition. Finally, in Model-5 concerning the presence or absence of orthodontic problem, the factors “Age” and “Residence” were statistically significant, while “Gender” and all the 2-way interactions were not.

The caries levels of all ages in the study are presented in table 3 for permanent dentition and in table 4 for primary dentition. The mean DMFT for 12-year-olds was 3.85 (95%CI: 3.13; 4.56) and the mean dmft for 6-year-olds was 5.49 (95%CI: 4.46; 6.51). Despite the ongoing increase of DT/dt values with increasing age, almost no restorative treatment was evident. As a result, the Care indices were very low, ranging from 0.0 to 3.06% for primary and 0.0 to 10.3% for permanent dentition.

The mean increase in DMFT and SiC index in the permanent teeth was 0.6 units per year. Moreover, for the 4 years following the age of 8, the increase in DMFT ranged from 0.4 to 0.95 units per year. According to figure 1, the SiC index for permanent teeth followed the general increase in DMFT, but remained from about 1 to 2.5 points higher and, likewise the SiC index for primary teeth, followed the general decline of dmft. The maximum value was found in 6-year-olds for the primary (SiCdmft=10.48, SD = 2.74) and in 12-year-olds in the permanent dentition (SiCdmft=5.64, SD = 1.86).

Figure 2 shows the distribution of caries scores per age. It reveals an increase in the proportion of children with severe caries (DMFT≥4) year by year, reaching a figure of over 70% at the age of 12. In the primary dentition, the distribution of dmft values per age (Fig. 3) shows that over 60% of 6-, 7- and 8-year-old children have a dmft≥4. Therefore, the percentage of caries free children was found to be very low in both permanent and primary dentitions separately, and even lower in the mixed dentition (% DMFT+dmft = 0), varying by age between 17% for younger children and 3% for older ones.

Orthodontic problems were found to be higher for the 11- and 12-year-old children (24.2% and 27.1%
respectively) confirming the statistical analysis that “Age” plays an important role in the recognition of orthodontic problems (Model-5).

The DMFT was higher in girls (1.82, 95% CI: 1.63; 2.01) than in boys (1.52, 95% CI: 1.32; 1.71), especially at ages older than 7, and as it was found in Model-1, the factor “gender” statistically significantly affected the magnitude of DMFT. On the other hand, dmft was lower in girls (3.40 CI: 95%, 3.07; 3.72) than in boys (3.84 CI: 95%, 3.45; 4.23), but here the factor “gender” did not significantly affect the magnitude of dmft (Model-2). In boys, as well as in girls, there were no differences in the percentage of caries free children (%DMFT+dmft = 0) and of Care indices (FT/DMFT% and ft/dmft%).

Table 2. Analysis of variance (ANOVA) using generalized linear models (n = 700)

<table>
<thead>
<tr>
<th>Type III analysis</th>
<th>Factors</th>
<th>Degrees of freedom (df)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model-1</td>
<td>Gender</td>
<td>1</td>
<td>0.000</td>
</tr>
<tr>
<td>(influence on DMFT)</td>
<td>Age</td>
<td>6</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Residence</td>
<td>2</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>Age * Residence</td>
<td>12</td>
<td>0.008</td>
</tr>
<tr>
<td>Goodness of fit</td>
<td>Deviance Value =1007.137, df=678, Value/df =1.485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluded stepwise</td>
<td>Factor Orthodontic problem and all the 2-way interactions of Orthodontic problem &amp; Gender p&gt;0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model-2</td>
<td>Gender</td>
<td>1</td>
<td>0.354</td>
</tr>
<tr>
<td>(influence on dmft)</td>
<td>Age</td>
<td>6</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Residence</td>
<td>2</td>
<td>0.126</td>
</tr>
<tr>
<td></td>
<td>Orthodontic problem</td>
<td>1</td>
<td>0.848</td>
</tr>
<tr>
<td>Goodness of fit</td>
<td>Deviance Value =602.651, df=689, Value/df =0.875</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluded stepwise</td>
<td>All the 2-way interactions (p&gt;0.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model-3</td>
<td>Gender</td>
<td>1</td>
<td>0.001</td>
</tr>
<tr>
<td>(influence on DMFT≠0 or =0, Yes/No)</td>
<td>Residence</td>
<td>2</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Orthodontic problem</td>
<td>1</td>
<td>0.007</td>
</tr>
<tr>
<td>Goodness of fit</td>
<td>Deviance Value =11.651, df=7, Value/df =1.664</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluded stepwise</td>
<td>Factor Age and all the 2-way interactions (p&gt;0.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model-4</td>
<td>Gender</td>
<td>1</td>
<td>0.568</td>
</tr>
<tr>
<td>(influence on dmft≠0 or =0, Yes/No)</td>
<td>Age</td>
<td>6</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Residence</td>
<td>2</td>
<td>0.955</td>
</tr>
<tr>
<td>Goodness of fit</td>
<td>Deviance Value =40.421, df=32, Value/df =1.263</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excluded stepwise</td>
<td>Factor Age and all the 2-way interactions (p&gt;0.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model-5</td>
<td>Age</td>
<td>6</td>
<td>0.001</td>
</tr>
<tr>
<td>(influence on Orthodontic problem, Yes/No)</td>
<td>Residence</td>
<td>2</td>
<td>0.017</td>
</tr>
<tr>
<td>Goodness of fit</td>
<td>Deviance Value =40.421, df=32, Value/df =1.263</td>
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<td></td>
</tr>
<tr>
<td>Excluded stepwise</td>
<td>Factor Gender and all the 2-way interactions (p&gt;0.05)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 3. Permanent dentition: Mean DMFT and its components per variable tested

<table>
<thead>
<tr>
<th>Variables</th>
<th>DMFT Mean (95% CI)</th>
<th>DT Mean (95% CI)</th>
<th>MT Mean (95% CI)</th>
<th>FT Mean (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0.46 (0.24;0.68)</td>
<td>0.46 (0.24;0.68)</td>
<td>0.01 (0.00;0.03)</td>
<td>0.07 (0.01;0.13)</td>
</tr>
<tr>
<td>7</td>
<td>0.66 (0.48;0.83)</td>
<td>0.57 (0.41;0.74)</td>
<td>0.01 (0.00;0.03)</td>
<td>0.07 (0.01;0.13)</td>
</tr>
<tr>
<td>8</td>
<td>0.99 (0.79;1.20)</td>
<td>0.91 (0.72;1.10)</td>
<td>0.01 (0.00;0.02)</td>
<td>0.07 (0.01;0.14)</td>
</tr>
<tr>
<td>9</td>
<td>1.87 (1.60;2.14)</td>
<td>1.61 (1.35;1.88)</td>
<td>0.07 (0.02;0.12)</td>
<td>0.19 (0.10;0.28)</td>
</tr>
<tr>
<td>10</td>
<td>2.50 (2.13;2.87)</td>
<td>2.26 (1.90;2.62)</td>
<td>0.12 (-0.03;0.27)</td>
<td>0.12 (0.03;0.21)</td>
</tr>
<tr>
<td>11</td>
<td>3.45 (3.01;3.88)</td>
<td>2.88 (2.43;3.32)</td>
<td>0.28 (0.16;0.40)</td>
<td>0.29 (0.14;0.45)</td>
</tr>
<tr>
<td>12</td>
<td>3.85 (3.13;4.56)</td>
<td>3.27 (2.66;3.89)</td>
<td>0.27 (-0.01;0.56)</td>
<td>0.30 (0.06;0.55)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.52 (1.32;1.71)</td>
<td>1.35 (1.16;1.54)</td>
<td>0.06 (0.03;0.10)</td>
<td>0.11 (0.06;0.15)</td>
</tr>
<tr>
<td>Female</td>
<td>1.82 (1.63;2.01)</td>
<td>1.56 (1.39;1.74)</td>
<td>0.10 (0.05;0.15)</td>
<td>0.16 (0.10;0.21)</td>
</tr>
<tr>
<td><strong>Residence (population size)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;500</td>
<td>2.21 (1.94;2.48)</td>
<td>1.96 (1.71;2.21)</td>
<td>0.07 (0.03;0.12)</td>
<td>0.18 (0.10;0.25)</td>
</tr>
<tr>
<td>500 - 1000</td>
<td>1.92 (1.48;2.37)</td>
<td>1.66 (1.23;2.08)</td>
<td>0.16 (0.04;0.29)</td>
<td>0.10 (0.02;0.18)</td>
</tr>
<tr>
<td>1.001 - 2.380</td>
<td>1.36 (1.19;1.52)</td>
<td>1.17 (1.02;1.32)</td>
<td>0.07 (0.03;0.11)</td>
<td>0.12 (0.07;0.16)</td>
</tr>
<tr>
<td><strong>Orthodontic problem</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>No</td>
<td>1.61 (1.46;1.76)</td>
<td>1.40 (1.26;1.53)</td>
<td>0.09 (0.05;0.12)</td>
<td>0.13 (0.09;0.16)</td>
</tr>
<tr>
<td>Yes</td>
<td>2.10 (1.73;2.46)</td>
<td>1.86 (1.50;2.22)</td>
<td>0.07 (0.01;0.12)</td>
<td>0.17 (0.06;0.28)</td>
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</table>

### Table 4. Primary dentition: Mean dmft and its components per variable tested

<table>
<thead>
<tr>
<th>Variables</th>
<th>dmft Mean (95% CI)</th>
<th>dt Mean (95% CI)</th>
<th>mt Mean (95% CI)</th>
<th>ft Mean (95% CI)</th>
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<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>6</td>
<td>5.49 (4.46;6.51)</td>
<td>5.38 (4.37;6.39)</td>
<td>0.04 (-0.02;0.10)</td>
<td>0.07 (-0.04;0.18)</td>
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<tr>
<td>7</td>
<td>5.32 (4.73;5.91)</td>
<td>5.13 (4.52;5.73)</td>
<td>0.04 (0.00;0.08)</td>
<td>0.15 (0.03;0.27)</td>
</tr>
<tr>
<td>8</td>
<td>4.43 (3.93;4.94)</td>
<td>4.31 (3.81;4.80)</td>
<td>0.08 (0.03;0.14)</td>
<td>0.04 (-0.01;0.10)</td>
</tr>
<tr>
<td>9</td>
<td>2.89 (2.43;3.35)</td>
<td>2.69 (2.25;3.13)</td>
<td>0.16 (0.04;0.28)</td>
<td>0.05 (0.00;0.09)</td>
</tr>
<tr>
<td>10</td>
<td>2.67 (2.14;3.19)</td>
<td>2.61 (2.08;3.13)</td>
<td>0.05 (-0.03;0.12)</td>
<td>0.01 (-0.01;0.04)</td>
</tr>
<tr>
<td>11</td>
<td>1.02 (0.72;1.32)</td>
<td>0.99 (0.69;1.29)</td>
<td>0.05 (-0.03;0.12)</td>
<td>0.03 (-0.01;0.08)</td>
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<tr>
<td>12</td>
<td>1.00 (0.43;1.57)</td>
<td>0.97 (0.41;1.53)</td>
<td>0.03 (-0.03;0.9)</td>
<td>0.03 (-0.01;0.08)</td>
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<tr>
<td><strong>Gender</strong></td>
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<td></td>
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<tr>
<td>Male</td>
<td>3.84 (3.45;4.23)</td>
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<tr>
<td>Female</td>
<td>3.40 (3.07;3.72)</td>
<td>3.28 (2.96;3.61)</td>
<td>0.06 (0.02;0.09)</td>
<td>0.06 (0.02;0.09)</td>
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<td><strong>Residence (population size)</strong></td>
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<td></td>
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<tr>
<td>&lt;500</td>
<td>3.65 (3.17;4.14)</td>
<td>3.43 (2.95;3.91)</td>
<td>0.14 (0.06;0.22)</td>
<td>0.08 (0.03;0.14)</td>
</tr>
<tr>
<td>500 - 1000</td>
<td>3.29 (2.46;4.13)</td>
<td>3.09 (2.29;3.88)</td>
<td>0.14 (0.03;0.25)</td>
<td>0.06 (-0.04;0.17)</td>
</tr>
<tr>
<td>1.001 - 2.380</td>
<td>3.63 (3.32;3.95)</td>
<td>3.57 (3.26;3.89)</td>
<td>0.01 (0.00;0.02)</td>
<td>0.05 (0.01;0.09)</td>
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<tr>
<td><strong>Orthodontic problem</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>3.58 (3.32;3.85)</td>
<td>3.47 (3.20;3.74)</td>
<td>0.06 (0.03;0.09)</td>
<td>0.05 (0.02;0.09)</td>
</tr>
<tr>
<td>Yes</td>
<td>3.70 (2.99;4.40)</td>
<td>3.50 (2.81;4.20)</td>
<td>0.09 (0.02;0.15)</td>
<td>0.10 (0.00;0.21)</td>
</tr>
</tbody>
</table>
of some Muslim populations is reported to be rich in sugar products. Additionally, a study among rural Muslim women in Israel reported that 60% of all postpartum women gave sugar water during the first week of life and another in the USA described that Islamic women are recommended to breast feed their offspring for 2 years, if possible. Both these practices, in the absence of oral hygiene and any fluoride exposure (i.e. through toothpaste or drinking water) may be reasons for early childhood caries, affecting the caries status of the present study population.

The caries experience of 12-year-old Pomak schoolchildren (DMFT = 3.85, SD ± 2.02) of the present study was much higher than that of Christian Orthodox children of the same age from either the greater rural Thrace area, recorded ten years earlier (DMFT = 2.51, SD ± 1.96), or from the nearby rural lowland county (DMFT = 1.81, SD ± 2,12) and the national rural average (DMFT = 2.23).

The average 6-year-old Pomak had 6 carious teeth, 5.5 primary and 0.5 permanent teeth. The presence of severe caries (dmft≥4) by age 7 in 71% of the Pomaks disappointing and indicative of a very early onset of the disease, and this is not related to population size of community of residence (Model-2). By the ages of 8, 9 and 10, about half of children had 1 to 3 carious permanent teeth. Furthermore, it is alarming that one third of the 6-year-olds had almost twice the mean value for that age (SiCdmft=10.48 SD ± 2.74). Such a severe carious status vindicates the adequacy of visual tooth examination.

Differences of at least this magnitude in carious indices have relatively recently been reported in Australia. Indigenous 5 to 6-year-olds from South Australia had on average 3.2 carious primary teeth, while the equivalent Australian mean was 1.44. Even more strikingly, indigenous children from a Northern Territory of Australia at age 5 years had almost 4 times the dmft and at age 10 years had almost 5 times the DMFT of their non-indigenous counterparts. The authors considered it more appropriate that, from a health policy perspective, correcting this inequality would require a public health and clinical effort aimed at the indigenous children as a whole.

It can be seen in table 2 that factor Age was significant for the magnitude of DMFT (Model-1), but it did not have any significant influence on whether a child did or did not have caries (Model-3). Subsequently, it shows that children who have caries activity acquire more and more affected teeth, as time (in this instance “Age”) has a cumulative effect. For this reason it is clear why it is necessary to use statistical models that study the outcome of caries experience as a binary variable in combination with models that study the complete DMFT or dmft scale as a whole.

Discussion

This survey documents the markedly low level of dental health of Greek Pomak children living in remote communities in a deprived highland region of Northeastern Greece. Apart from the unfavourable educational, socioeconomic and geographical parameters already described, dietary or cultural factors may exacerbate the problem. Pomaks are Muslims and the diet of some Muslim populations is reported to be rich in sugar products. Additionally, a study among rural Muslim women in Israel reported that 60% of all postpartum women gave sugar water during the first week of life and another in the USA described that Islamic women are recommended to breast feed their offspring for 2 years, if possible. Both these practices, in the absence of oral hygiene and any fluoride exposure (i.e. through toothpaste or drinking water) may be reasons for early childhood caries, affecting the caries status of the present study population.

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The next striking consequence of the high caries indices is the very high level of treatment need, as DT and DMFT or dt and dmft differed very little (Tabs. 3 and 4). While the national mean Care index for permanent teeth in 12-year-old children was 55.3% and in the greater rural Thrace 47.5%, Pomak 12-year-olds had a mere 7.9%.

Regarding the quarter of 11 to 12-year-old Pomak children with orthodontic problems, none were currently undergoing treatment. This somewhat low prevalence of malocclusion can be explained mainly by the fact that antero-posterior molar relationship was not recorded. Mesial drift, as a result of frequent space loss due to the extensive carious lesions of primary molars makes diagnosis of true Class II malocclusions difficult in field studies where such high caries indices are prevalent. However, similar malocclusion figures, and even lower, have been recorded, e.g. in India in 12-15 year olds using the DAI index.

In general, children residing in rural areas of the USA tended to have less access to, and utilization of dental care compared to children residing in urban areas. In Greece, utilization of private dental services is highly dependent on family income and, as a result, children from more deprived areas have a significantly lower mean Care index. This situation probably also affects Pomaks who could, however, visit the Public Health Centre, located in the largest village of our study area, or the dental departments of the civic or military hospitals, located at a distance of 20-50 km away in the province capital and receive basic treatment for free. However, access to health care except for an urban-rural dimension seems to have one of cultural/religious isolation. The minimal dental care of Pomaks is characterized by a problem-oriented dental visiting pattern similar to that reported for the remote lands of Australia, containing elements of a visible appearance visiting pattern reported for carious teeth of Mexican immigrants’ children in a small US city.

According to the proposals made by Bratthall, the SIC index for 12-year-olds should be less than 3 by the year 2015 and Pomak 12-year-olds had almost double that figure (SIC_{DMFT}=5.64, SD ± 1.86). To achieve this goal in time needs careful planning by both the health and the transport authorities. A person’s environment is the most important caries-promoting factor and, fortunately, the factor more amenable to change than, for example, genetic factors. Facilitating the transportation of the children to Public Health Centre, providing oral health education and specific target treatment measures (e.g. fluoride treatment and placement of fissure sealants on every posterior erupting tooth) together with regular recalls, are among measures necessary to be taken for timely improvements. In this, the Muslim culture (tradition, diet, rules and habits) of our study area is worth additional consideration. Oral health education especially for girls, who frequently become mothers at an early age, could significantly increase brushing with fluoridated toothpaste for themselves and their children. This study identified one pocket of rural Greek population - of a diverse religious and cultural background - exhibiting extreme caries indices and care needs, as it has been reported for non-immigrant small population sections elsewere. Inequalities in oral health care constitute an ethical problem and these reports increase awareness for the underprivileged in the making of political decisions for planning oral care. Furthermore to alleviating dental pain and discomfort for these children, a particular country’s attempt to improve caries indices of child population is benefited when preventing dental disease in high-risk groups.

Possible limitations of the present study could be those related to the adopted field study examination protocol. Recording dental plaque deposits, periodontal status, oral hygiene and dietary habits would allow better clinical view of the oral situation of those children. Further studies could also investigate and compare the oral health status of Pomak children residing in even greater numbers in neighbouring communities in Bulgaria.

Conclusions

It is remarkable that Pomak schoolchildren have the highest caries indices in Greece today, and these indices are similar to the values found in urban locations in Greece 30 years ago. Health promotion policies, using the whole population approach strategy, as opposed to high-risk, need to be particularly targeted on this geographically and socially isolated community of Pomaks.

Acknowledgements. This survey was performed while the prime author was serving his duty in the Hellenic Armed Forces as a dental officer. The authors wish to thank Prof. I. Antoniou of the School of Mathematics, Aristotle University of Thessaloniki, for supporting interdepartmental cooperation and Ch. Chatzipolichronis, DDS and K. Manthos, DDS for assistance during clinical examinations.

References


33. Theocharidis P. Pomaks - the Muslims of Rodopi. History, origin, language, religion, traditions. Cultural Centre of Thrace, Xanthi, 1995. (in Greek)

34. Topitsoglou V. Fluoride chart of Greece and Cyprus. Natural fluoride content of drinking water. Monograph, Thessaloniki, 2004. (in Greek)


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Effects of Orbit Sugar-free Chewing Gum for Kids in Overall and Cariogenic Salivary Microflora Reduction

SUMMARY

The effects of Orbit sugar-free chewing gum in plaque acid attack neutralisation, food debris removal, and saliva secretion rate stimulation, have already been clinically proven. Sugar alcohols, which have since recently been considered to have a direct impact on bacterial cells, are among the ingredients of this chewing gum. The objective of this study was to gain knowledge of the effects of Orbit sugar free chewing gum for kids with calcium addition in overall salivary flora reduction, and particularly in the reduction of the cariogenic oral microorganisms, as direct factors leading to dental decay.

The research included a group of 24 healthy schoolchildren of both gender at the age between 8 and 13. All participants had good oral health, similar hygiene and diet regimens, and similar DMF indices. In order to obtain higher precision and accuracy, the same group was also used as a control group, so that saliva samples were taken twice: once before and once 20 minutes after Orbit chewing gum had been chewed. The microbiological analyses were performed at the Institute of Microbiology and Parasitology of Skopje Medical Faculty. The counts of Streptococcus mutans (SM) and Lactobacillus species (LB) were determined by commercially available CRT bacteria strips, whereas the total count of saliva microbials was determined by standard microbiological methods.

Significant reductions in salivary SM and LB levels, and declines in the total count of aerobe and anaerobe bacteria, and Candida albicans as well, were observed in all cases.

Keywords: Chewing Gum; Cariogenic Microorganisms; Salivary Microorganisms; Streptococcus mutans; Lactobacillus species

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Balk J Stom, 2011; 15:24-30

Introduction

The fact that microorganisms are one of the most essential factors in dental disease etiology arouses the question of how to eliminate or reduce them to minimal values. Because of that, the major prerequisite is typological and numerical verification of the microorganisms. On the other hand, the key factor of the “struggle” against them is proper maintenance of oral hygiene.

In spite of a considerable number of substances and methods for oral hygiene, since recently sugar-free chewing gums have gained strong influence, particularly among the young population. Sugar-free chewing gum has a positive benefit for dental health by increasing salivary flow during chewing, which helps to dilute and neutralise plaque acidity. There is general scientific agreement now that chewing sugar-free gum, amongst other things, can help to protect teeth against decay.

Over the last 25 years there has been considerable clinical research into the effect of salivary stimulation and the role of saliva in oral health. Clinical evidence suggests that sugar-free gum not only will not decay teeth, but that it will reduce the acidic effects caused by other foods, if chewed after meals and snacks.

Both the chewing action and the taste of sugar-free gum stimulate the production of extra saliva by up to 10 times the normal rate. Stimulation of salivary flow changes its composition and increase concentration of bicarbonate, which enhance its ability to neutralise plaque...
acid. Also, as salivary flow increases, the availability of minerals is increased, helping to repair early tooth decay.

There are many indications that dissolved calcium can inhibit demineralisation of the enamel, serving as a substrate for remineralisation of the teeth. Most children love sweets and are very fond of eating between meals. Because after each snack or drink that is rich in carbohydrates the pH of the plaque rapidly becomes acid. This has the effect of drawing off calcium ions and other mineral ions from the tooth enamel (Fig. 1). If such demineralisation happens repeatedly in the course of a day, or if it lasts for an extended period, than caries can develop. This process can happen very quickly in children because the enamel cap of a milk tooth is only half as thick as that of permanent teeth. For this reason children’s teeth need special protection.

Patients with dry mouth are more susceptible to tooth decay as their flow rate, pH level and buffering capacity is lowered. Patients are often recommended to chew sugar-free gum to relieve the symptoms of dry mouth and also to help encourage the function of the salivary gland. Wrigley’s Orbit sugar-free chewing gums have become the first products given recognition by the World Dental Federation for providing a significant contribution to oral health. Sugar-free chewing gums consist mainly of sugar alcohols, which are a combination of hexitols and pentitols. Xylitol and Sorbitol are the most frequent sugar alcohols, whereas Manitol is less frequent. Sugar alcohols, primarily Sorbitol and Xylitol, have a direct effect on the bacterial cell. The ways of action of polyols on bacteria is illustrated in figure 2.

After the uptake of Xylitol, the substance is phosphorylated to Xylitol-5-P. Since most cells lack xylitol-5-P dehydrogenase, it results in its intra-cellular accumulation. Dephosphorilation of X-5-P takes place eventually and Xylitol is then emitted from the bacteria. The consequence of the cycle is a futile PEP/energy - consumption leading to an inhibition of the glycolysis and none acid attack on the enamel. The bacterial uptake of the hexitols results in a phosphorylation to sorbitol-6-P and mannitol-6-P. 2 separate dehydrogenases transform the phosphorelated hexitols to fructose-6-P, which participates in glycolysis. Ethanol, formic and lactic acids are the end products in sorbitol and manniol metabolism.

Orbit sugar-free chewing gums are the most popular chewing gums in FYROM, which was proven by the results of the poll conducted in 2002, according to which 75% of the participants use Orbit chewing gum at least once a day (Figs. 3 and 4).

GTF – Glycosyltransferase
PMF – Protonotiveforce
PTS – Phosphotransferase system
G-6-P – Glucose-6-Phosphate
F-6-P – Fructose-6-Phosphate
F-1,6P2 – Fructose 1, 6-bisphosphate
3-PGA – 3-Phosphoglycerate
DHAP – Dihydroxyacetonephosphate
3 PG – 3-Phosphoglycerate
2 PG – 2-Phosphoglycerate
PEP – Phosphoenolpyruvate
PYR – Pyruvate
E1 – Enzyme 1
HPPr – Histidine protein heat resistant
E2 – Enzyme 2

Figure 1. The way of remineralization after the use of Orbit chewing gum

Figure 2. Ways of action of polyols
There are various types of Orbit chewing gums, differing from each other as follows:
- The type of the sugar alcohols and their proportion;
- Addition of mineral ions (e.g. calcium) to enhance the effects of remineralisation;
- Addition of sodium carbonate to maintain teeth whiteness by activating the natural protective mechanisms of the saliva;
- Addition of different aromas;
- Menthol additions for stronger mouth freshness.

In our investigation we used Orbit sugar-free chewing gum for kids because it contains both xylitol and sorbitol sugar alcohols, as well as calcium, and is produced in one of 2 fruit flavours that makes it more attractive to kids. By investigating the effects of Orbit sugar-free chewing gum on cariogenic microorganisms and on the whole number of salivary micro-flora, we wanted to see whether we can add yet another benefit of Orbit sugar-free chewing gum to the already well-known benefits mentioned earlier in this text. The aim of this study was: (1) to estimate the salivary levels of Streptococcus mutans (SM) and Lactobacillus species (LB) before and after chewing Orbit sugar-free chewing gum for kids with calcium; (2) to compare the number of whole salivary flora by saliva analyses before and after chewing Orbit sugar-free chewing gum for kids with calcium.

Materials and Methods

The group consisted of 24 healthy schoolchildren aged 9-13 of both gender. The participants had good oral health, similar hygiene and normal dietary regimen and similar DMF indices. In order to obtain higher precision and accuracy, the same group was used as a control group, too. Saliva samples were taken before and 20 minutes after, chewing Orbit gum, early in the morning, after at least 12 hours without oral hygiene. The study subjects were selected at the Faculty of Stomatology, Department of Pediatric Dentistry - Skopje. The microbiological analyses were carried out at the Institute of Microbiology and Parasitology, Medical Faculty in Skopje.

In our study we used the Orbit sugar-free chewing gum for kids with calcium (Wrigley, USA). Its ingredients are:
- Xylitol
- Sorbitol
- Manitol
- Acesuflam
- Aspartam
- Calcium Lactate
- Gum base
- Flavors

Collecting Saliva Samples

Patients refrained from oral hygiene for at least 12 hours before the treatment.

First saliva sample was taken without any prior food consumption, mouth rinsing or saliva stimulation.

Chewing the Orbit sugar free chewing gum for kids with Calcium (Wrigley, USA), for approximately 20 minutes.

After chewing gum has been chewed, the mouth was rinsed with 200 ml of water for about 15 sec.

The second saliva sample was taken following a 20 min. intermission.

Quantitative Evaluation of SM, LB and Total Number of Salivary Microorganisms

In order to determine the total number of salivary microorganisms, saliva samples were taken by spitting approximately 3-5 ml of saliva before and after chewing the Orbit sugar-free chewing gum for kids with calcium into special sterile containers made particularly for this purpose (Fig. 5). The specimens used to determine the counts of SM and LB in the saliva were taken with CRT bacteria-commercially available strips (Ivoclar-Vivadent, Schaan, Liechtenstein). These strips have selective...
culture media for determination of the SM count in saliva or plaque on the blue agar surface and for determination of the LB count in saliva on the bright agar surface. The first step of the procedure was to remove the agar carrier from the test vial. After that, a NaHCO$_3$-tablet was placed at the bottom of the vial. The protective foils were carefully removed from 2 agar surfaces, taking care not to touch the agar. Both agar surfaces are thoroughly moistened with saliva using a pipette, allowing the excess saliva to drip off. Finally, the agar carrier was slid back into the vial, the vial was closed tightly and it was then sent to the Institute of Microbiology (Fig. 6).

**Microbiological Processing of Samples**

Planting was performed simultaneously with sampling. After an incubation period of 48 hours at 35-37°C, the grown colonies (colony forming units - CFU) were counted, provided their number was small, or were compared with the chart supplied by the manufacturer when their number was excessive, and were then interpreted as 10,000; 10,000-100,000; 100,000-1,000,000 and > 1,000,000 CFUs. The SM colonies were translucent on the blue agar surface, while LB colonies were grey-white on the green agar surface. By counting the colonies only the approximate number of bacteria could be determined, because of the notion that 1 bacterial cell causes the growth of 1 colony, and is thus being designated as “a colony forming unit (CFU)” (Fig. 7). After drying up, strips can be stored in a refrigerator at 2-8°C, where, being protected from light and temperature fluctuations, they can last for years, and be used for comparison purposes at any time.
Figure 7. Colony forming units-CFU for SM and LB (standard according to manufacturer’s instructions)

Figure 8. Growth density sectors
Semi quantitative determination of whole salivary microbial counts was performed with a 4 mm diameter calibrated eza. On each of the 3 bases, 50 saliva microliters were spread in the usual manner (routine processing). In order to obtain isolated colonies by dilution, the material was transplanted up to the half of the Petry dish (sector 1) on 3 sectors of the Petry dish (Fig. 8). Then the eza was sterilized by heating, and the materials from the 2 lines of sector 1 were transplanted onto the quarter in the lower side of the Petry dish (sector 2). At the end, the eza was again sterilized by heating and the material from the last 2 lines of sector 2 was transplanted onto the last quarter of the Petry dish (sector 3).

The results were read out in a semi quantitative way, i.e. the density of growth was marked with the capitals A, B and C. The capital A was used to mark the growth density in the first sector, B was used for the second sector and C for the third one. The sector marked with A presented a sector with such high density of growth of colonies that they could not be counted (A > 100 colonies within the sector), B - a growth of 20 to 100 colonies, C - 5 to 20, and 0 - 0 to 5 colonies. With the aim to present the results in a more convenient way, we have split the growth density sectors in accordance with the number of colonies into high growth density sectors (AAA, AAB, and AAC), medium growth density sectors (ABB, ABC, ABO, and ACO), and into sectors of low or no growth density (BBO, BCO, and OOO). The sectors of the first group were labelled with ++, those of the second group with +, and the sectors of the third group with +-.

### Table 1. Growth density of salivary aerobic and anaerobic bacteria before and after use of Orbit sugar-free chewing gum for kids with calcium

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<th>Growth density</th>
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<td></td>
<td>Before</td>
<td>After</td>
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<tr>
<td>AAA</td>
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<td>/</td>
</tr>
<tr>
<td>++</td>
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<td>4</td>
</tr>
<tr>
<td>AAS</td>
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<td>3</td>
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<tr>
<td>AVV</td>
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<td>VVO</td>
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<tr>
<td>+</td>
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<td>10</td>
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<tr>
<td>VSO</td>
<td>/</td>
<td>/</td>
</tr>
<tr>
<td>OOO</td>
<td>/</td>
<td>/</td>
</tr>
</tbody>
</table>

\[ c_2 - p > 0.05 \quad c_2 - p < 0.05 \]

\[(p = 0.09) \quad (p = 0.0047)\]

### Results

The results of this investigation are presented in tables 1-3 and diagram 1. As it can be seen, the effects of chewing a sugar-free chewing gum with calcium were more pronounced on the counts of anaerobic bacteria and \textit{Candida albicans} than on the aerobic bacteria (Tab. 1 and Diagram 1). The effect of chewing was more pronounced on SM than on LB (Tabs. 3 and 4).

### Table 2. Number of subjects with CFU (colony forming units) of SM and LB in 1 ml saliva before and after use of sugar-free chewing gum with calcium

<table>
<thead>
<tr>
<th></th>
<th>Streptococcus mutans CFU/ml</th>
<th>Lactobacillus species CFU/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before</td>
<td>After</td>
</tr>
<tr>
<td>Without growth</td>
<td>(3)</td>
<td>4</td>
</tr>
<tr>
<td>102-3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>103-4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>104-5</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>105-6</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>106-7</td>
<td>6</td>
<td>/</td>
</tr>
<tr>
<td>N</td>
<td>21</td>
<td>21</td>
</tr>
</tbody>
</table>

### Table 3. Effects of sugar-free chewing gum with calcium on the reduction of cariogenic salivary micro flora counts (number of subjects with logarithmic reduction factor - log RF)

<table>
<thead>
<tr>
<th>log RF</th>
<th>Streptococcus mutans</th>
<th>Lactobacillus species</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>/</td>
</tr>
<tr>
<td>3-4</td>
<td>2</td>
<td>/</td>
</tr>
<tr>
<td>N</td>
<td>21</td>
<td>22</td>
</tr>
</tbody>
</table>
Discussion

Using the semi quantitative determination method for total microbial salivary counts, aerobic and anaerobic microorganisms were separately processed. There has been a redistribution of the counts of aerobic and anaerobic microorganism colonies from sectors with high and medium growth density (++ and +) before chewing, to sectors with low or without any growth density (+ and +) after chewing. However, statistical analysis ($\chi^2$ test) has shown no statistical significance in the case of aerobic microorganisms after chewing Orbit chewing gum ($p = 0.09$). Statistical analysis conducted for anaerobic microorganisms have shown significant reduction after chewing Orbit chewing gum ($p = 0.0047$). However, when one considers duration of chewing, which was limited to 20 minutes, it becomes apparent that the decrease in growth density after chewing Orbit sugar-free gum depends to a certain extent also on the mechanical function of the saliva during mastication.

Orbit sugar-free chewing gum performed very effectively in the reduction of Candida albicans yeasts colonies. Namely, only 1 of 7 participants, in which a total of 34 colonies had been isolated before chewing Orbit chewing gum, exhibited a growth density of only 1 colony after chewing. The total number of colonies was reduced by 34 times on the average.

Over the last few years, numerous studies have been aimed toward research of the influence of the use of sugar-free chewing gum in dental caries prevention. By reducing the principal amount of cariogenic micro-flora, mainly the salivary SM, the incorporation of bacteria into the plaque is avoided, and their fermentable properties at low pH-values are suppressed as well, which prevents the start of the demineralisation process. In our investigation we obtained a significant difference in the number of cariogenic microorganisms’ colonies before and after chewing Orbit sugar-free chewing gum. The reduction was higher in SM than in LB counts, expressed by the number of subjects with logarithmic reduction factor of cariogenic micro-flora. The number of subjects with log RF = 0 for SM was 2, while it was 6 for LB. 2 subjects had a logarithmic reduction factor of 4 (log RF $\geq$ 4) for SM, and there were no subjects with this reduction factor for LB.

At the end of the discussion, we would like to emphasize that until now no research of the effects of Orbit sugar-free chewing gum on the bacterial cell have been carried out, so that the results that were discussed can be considered as the results of a pioneer experiment in this direction. However, considering the action of sugar alcohols reported in literature, we can conclude that our results are in accordance with the research of Birkhed, Edgar, Edgar and Gedds, Mäkinen et al and Szöke et al.

Conclusion

Significant reductions in salivary MS and LB levels, and declines in the total count of aerobic and anaerobe bacteria and Candida albicans as well, were observed in all cases. Therefore, we can conclude that Orbit sugar-free chewing gum influenced very effectively in the reduction of cariogenic microorganisms.

References


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Fluoride Released from Orthodontic Bonding Material: An *In Vitro* Evaluation

**SUMMARY**

Enamel demineralization is an undesirable but common complication of orthodontic fixed appliances therapy. The purpose of this study was to test long-term benefits of resin-modified glass ionomer cement (GC Fuji OrthoTM LC) for the prevention of demineralization in patients receiving orthodontic treatment with fixed bonded appliances. 90 healthy extracted premolars without any clinical signs of decalcification were selected. All teeth were cleaned and cut in half buccolingually with a diamond disc. Thus, the control and test specimens were obtained from the same teeth. Orthodontic brackets were bonded with a resin-modified glass ionomer cement. The teeth were divided in 3 groups according to the period of monitoring (1, 3 and 6 months). They were stored in artificial saliva until analyzing. Determination of the fluoride in enamel was done by spectrophotometer. The amount of fluoride in enamel 1 month after the brackets application was significantly higher; after 3 months it was even higher; and after 6 months it was still statistically significantly higher compared to initial values, but lower than the previous 2 time intervals (and remained on a constant level). The results of this in vitro study clearly indicate that fluoride-releasing material used in fixed orthodontic treatment inhibits demineralization of enamel around orthodontic appliances.

**Keywords:** Enamel; Brackets; Glass-ionomer Cements; Demineralization; Remineralization

**Introduction**

Orthodontists are still challenged by an “old problem” in their practices: enamel demineralization around orthodontic appliances. Patients undergoing orthodontic therapy are exposed to a higher risk of enamel demineralization1. Appliances are directly attached to tooth surface, increasing the difficulty of achieving adequate oral hygiene. Some of commonly used accessories, such as hooks, posts, elastic chains and springs, can also undermine dental bio-film removal. Thus, the incidence of white spot lesions can be significantly higher among orthodontic patients with poor oral hygiene8.

Enamel demineralization is an undesirable but common complication of orthodontic fixed appliances therapy. Several studies have reported a significant increase in the prevalence and severity of demineralization after orthodontic therapy compared with controls, and the overall prevalence amongst orthodontic patients ranges from 2 to 96%17,19. The teeth most commonly affected are molars, maxillary lateral incisors, mandibular canines and premolars15.

The potential risk of enamel surface decalcification during orthodontic treatment can be reduced by using glass ionomer cements (GIC) for bonding the brackets2-4. GIC have been showed to consistently release fluoride over time. They also have ability to take up and re-release fluoride after application of a topical fluorides source. Although the property of fluoride releasing would appear to make GIC an ideal bonding agent for orthodontic brackets, the adequacy of strength for successful clinical bonding9,12,24 is less. Recently, Fuji OrthoTM LC developed the GIC for bonding brackets to teeth. The manufacturer claims it can be applied in a wet field and is not as technique-sensitive as composite resins.

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**ORIGINAL PAPER (OP)**

Balk J Stom, 2011; 15:31-34
Specifically, it requires no etching of the enamel surface and should be applied in wet environment. Another attribute of glass ionomers is that they release fluoride, which is known to reduce the incidence of caries. The process of fluoride release is by way of polyacid attack on the alumino-silicate glass. As the glass network breaks down, the \( \text{Al}^{3+}, \text{Ca}^{2+}, \text{and F}^- \) ions are released.

The capacity of glass ionomers to absorb fluoride from rinses and tooth paste in essence allows the glass ionomer to reconstitute itself and continuously release fluoride. This should aid in the decreased incidence of decalcification and unsightly white spots around the brackets. The advantages proposed to be gained by the operator and patients are substantial. If all these factors were true for the new Fuji Ortho™ LC product, it would be more beneficial clinically than composite resin alone. Because of these possible improvements over composite resin, a test of Fuji Ortho™ LC effectiveness in lowering bracket failure rate and incidence of decalcification seemed in order.

Cook compared the \textit{in vivo} bond strength of GIC Ketac (ESPE Premier Denbol Products), with a composite resin bonding agent. The result of his evaluation indicated that the bond strength of that GIC was not nearly as good as that of the composite resin. Cook stated that thorough drying of the teeth before GIC use was not necessary, but that cotton rolls should be used to isolate the field of operation. He also suggested that the surface of the teeth to be bonded should be wiped off before bracket placement and stressed that acid etching was not necessary. The 40 cases studied showed a 12% failure rate, which is considered too great for routine orthodontic practice.

Fajen et al evaluated the bond strength of 3 different GIC against a composite resin \textit{in vitro}, and like Cook, found the bond strength of the GIC to be "significantly less". The fluoride release is a result of 2 processes: the short-term release is associated with a leakage of relatively loosely bound fluoride from the cement matrix. The long-term release is a result of diffusion controlled phenomena where the concentration gradient is the moving force for the release.

The purpose of this study was to test the long-term benefits of resin-modified GIC (GC Fuji Ortho™ LC) for prevention of demineralization in patients receiving orthodontic treatment with fixed bonded appliances.

### Material and Method

In this study, 90 healthy extracted premolars without any clinical signs of decalcification were selected. All teeth were cleaned and cut in half bucco-lingually with a diamond disc. Thus, the control and test specimens were obtained from the same teeth. Orthodontic brackets were bonded with GC Fuji Ortho™ LC, resin-modified GIC. The teeth were divided in 3 groups according to the period of monitoring (1, 3 and 6 months). They were stored in artificial saliva (20 mmol/l NaHCO₃, 3 mmol/l NaH₂PO₄ and 1 mmol/l CaCl₂, neutral pH) until analyzing. Determination of the fluoride in enamel was done by spectrophotometer. Determination started with distillation, and then 50ml of the distillate was mixed with 10ml SPADNS and acidic circonyl. The absorbance was read on the spectrophotometer. Than the results were calculated by the formula: \( F \text{ ppm} = \frac{50A}{V} \), where \( A \) is ppm of fluoride measured by the spectrophotometer, and \( V \) ml of the sample.

For statistical evaluation, a one-way analysis of variance (ANOVA) was initially used to see if there was a significant difference between groups.

### Results

Table 1 shows the value of \( F \) in enamel in the experimental group of teeth 1 month after brackets were bonded. Average value of \( F \) in the examined group of teeth was 844,044 ppm, and in the control group of teeth the average value of \( F \) was 614,230 ppm. For this time period, a statistically significant difference was found between values of \( F \) in the examined groups of teeth.

<table>
<thead>
<tr>
<th>group</th>
<th>( N )</th>
<th>( \bar{X} )</th>
<th>SD</th>
<th>( t )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>test</td>
<td>30</td>
<td>844,044</td>
<td>314,130</td>
<td>3,490</td>
<td>0,00085*</td>
</tr>
<tr>
<td>control</td>
<td>30</td>
<td>614,230</td>
<td>177,159</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows the values of \( F \) in enamel in the group of examined and control teeth 3 months after bonding of brackets. Again, a statistically significant difference was found between values of \( F \) in the examined and control group of teeth, respectively.

<table>
<thead>
<tr>
<th>group</th>
<th>( n )</th>
<th>( \bar{X} )</th>
<th>SD</th>
<th>( t )</th>
<th>( p )</th>
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</thead>
<tbody>
<tr>
<td>test</td>
<td>30</td>
<td>946,260</td>
<td>449,995</td>
<td>2,462</td>
<td>0,01672*</td>
</tr>
<tr>
<td>control</td>
<td>30</td>
<td>684,072</td>
<td>370,822</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows the values of \( F \) in enamel in the group of examined and control teeth 3 months after bonding of brackets. Again, a statistically significant difference of the values was found (946,260 ppm and 684,072 ppm of \( F \) in the examined and control group of teeth, respectively).
Values of the F in enamel of the examined and control group of teeth 6 months after bonding brackets are presented in Table 3. The result was similar to the previous. After treatment of 1, 3 and 6 months, statistically significant difference occurred in the average values of fluoride in enamel between the experimental and control groups. The differences were greater after 1 month and smaller after 6 months (Tab. 4).

Table 3. Values of F (ppm) in enamel 6 months after bonding brackets

<table>
<thead>
<tr>
<th>group</th>
<th>n</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>test</td>
<td>30</td>
<td>557,398</td>
<td>198,477</td>
<td>2,076</td>
<td>0,04438*</td>
</tr>
<tr>
<td>control</td>
<td>30</td>
<td>454,539</td>
<td>185,117</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Comparative display of F values in enamel at the test and control group

<table>
<thead>
<tr>
<th>group</th>
<th>n</th>
<th>time/months</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>test</td>
<td>30</td>
<td>1</td>
<td>844,044</td>
<td>314,130</td>
<td>3,490</td>
<td>0,00085*</td>
</tr>
<tr>
<td>control</td>
<td>30</td>
<td></td>
<td>614,230</td>
<td>177,159</td>
<td></td>
<td></td>
</tr>
<tr>
<td>test</td>
<td>30</td>
<td>3</td>
<td>946,260</td>
<td>449,995</td>
<td>2,462</td>
<td>0,01672*</td>
</tr>
<tr>
<td>control</td>
<td>30</td>
<td></td>
<td>684,072</td>
<td>370,822</td>
<td></td>
<td></td>
</tr>
<tr>
<td>test</td>
<td>30</td>
<td>6</td>
<td>557,398</td>
<td>198,477</td>
<td>2,076</td>
<td>0,04438*</td>
</tr>
<tr>
<td>control</td>
<td>30</td>
<td></td>
<td>454,539</td>
<td>185,117</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Discussion

After completing the fixed orthodontic treatment, and as a reason that ideal oral hygiene usually is not achieved, demineralised zones are spotted. They are more noticed in the gingival part of labial surface of the teeth, where plaque accumulation is significantly higher. Such demineralised zone appears as early as 4 weeks after orthodontic brackets and bands placement. It is known that these demineralised zones are able to remineralise and to restore the damaged apatite crystals. The process of remineralisation in the oral cavity is favoured by fluoride. This effect is one of the reasons why application of fluoride is recommended every time to prevent, neutralise or restore demineralised enamel (with good oral hygiene). Its crystals are larger than the original ones, which is linked to the reducing possibility of dissolving. This explains the positive cariostatic effect of materials containing fluoride used for bonding the brackets. Around some brackets bonded with such materials, due to the released fluoride, a weaker demineralization of enamel appears than in cases where they are bonded with materials which do not release fluoride.

Results of this study clearly show that the content of fluoride in enamel significantly increased after application of GIC containing fluoride. Thus, the amount of fluoride in enamel before fixing the brackets was 614,230 ppm; after 1 month of their bonding, the amount of fluoride in enamel was 844,044 ppm, which is statistically significantly higher of the initial coverage of fluoride in enamel. After 3 months, the value of fluoride in enamel in the examined group was even higher (946,260 ppm). After 6 months decrease the amount of fluoride (557,398 ppm) was noticed, although still significantly higher compared to the control group.

In our study enamel demineralization in vitro was inhibited to a certain degree. Similar prevention of decalcification was reported by many authors for other fluoride-releasing materials. Besides the positive impact on local fluoride-released cement used for bonding the brackets in inhibiting demineralisation of the enamel around orthodontic brackets and bands, the release of fluoride from GICs provides continuous presence of low concentrations of fluoride in the oral medium, which also influence with inhibition on demineralised enamel around orthodontic brackets and bands.

Conclusions

The fluorides contribute to inhibition of demineralization process around the brackets and bands during fixed orthodontic treatment. The amount of fluoride in enamel after 1 month after the brackets application was significantly higher, after 3 months it was higher, and after 6 months it was still statistically significantly higher compared to initial values; yet it is still lower than the previous 2 time intervals (and remains on a constant level).

The results of this in vitro study clearly indicate that fluoride-releasing materials used in fixed orthodontic treatment inhibit demineralization of enamel around orthodontic appliances.

References


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Variation of Skeletal Cephalometric Variables in Class II Division 2 Patients with Age

SUMMARY

Apart from the dental and maxillofacial features, an important consideration in the treatment of Angle Class II division 2 malocclusions is facial growth, particularly if the case requires not only tooth movement but changing maxillo-mandibular relation as well. The purpose of this study was to determine the effect of chronological age on certain skeletal features of Angle Class II division 2 patients. The material of the study included 96 lateral cephalometric X-rays of patients with Angle Class II division 2 malocclusion, ranging in age from 7 to 35 years; on each cephalometric imaging, 8 cephalometric measurements were performed. Statistical data processing included analyses of 1 variable and correlation of 2 variables.

In patients with Angle Class II division 2 malocclusion the facial profile was convex and did not change significantly with age, the anteroposterior position of the chin in the children’s group approximated ‘normal’, while there was a tendency for mandibular retrusion among adult patients. Mandibular morphology changed and became more “square” among older patients.

Key words: Class II/2; Skeletal Features; Cephalometric Analysis; Age

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Introduction

During growth and in the period between deciduous and permanent dentition, the features of Angle Class II division 2 malocclusion exacerbate due to increasing incisor over-occlusion, which leads to differential growth between the maxilla and the mandible, and consequently, to maxillary protrusion. There was a view that Angle Class II division 2 malocclusion exacerbates with time not due to a change in the growth pattern but due to increasing anterior rotation of the mandible, which results from the particular effect of the masseter muscles.

Under conditions of normal mandibular growth and development, one would expect a lower incidence of mandibular retrusion among adults, as compared to minors. However, this is not so in cases of Angle Class II division 2 malocclusion, probably due to palatal inclination of maxillary incisors and increased incisor overjet, which result in stunting mandibular growth. This finding is confirmed by observation that in these cases, mandibular alveolar development, as assessed by the S-N-B angle, was more restricted than the development of osseous base of the mandible, as assessed by the S-N-Pog angle.

The range of views related to dental, skeletal and facial features of Angle Class II division 2 malocclusion make it necessary to further study such cases and follow their particular development through time, which is important not only for clinical orthodontists’ needs, but also for accurate determination of the case description. The aim of the study was: (a) to examine possible differences of skeletal cephalometric measurements among 3 age groups of Angle Class II division 2 malocclusion patients, and (b) to investigate possible correlations between patients’ age and those cephalometric measurements examined.

Subjects and Methods

Research material included 96 lateral cephalometric X-rays of Angle Class II division 2 malocclusion patients who had never had any type of orthodontic treatment. Their selection was based on the basis of dental occlusion...
relations and patients’ ages, out of a total number of 174 cases of Angle Class II division 2 malocclusion patients who asked for orthodontic treatment. The X-rays of patients selected were divided into 3 groups.

The first group, “a children group”, included 33 X-rays. 13 patients were boys and 20 were girls. Their mean age was 9.5 years; the youngest was 7 and the oldest 11 years old. Their dentition was mixed and there was no case of having lost a deciduous tooth early or missing some permanent tooth.

The second group, “an adolescent group”, included 31 X-rays. 13 patients were boys and 18 were girls. Their mean age was 14 years; the youngest was 13 and the oldest 15.5 years old. Their dentition was permanent and there was no tooth missing in any of the cases.

The third group, “an adults group” included 32 X-rays. 11 patients were men and 21 women. Their mean age was 21 years; the youngest was 17 and the oldest 35 years old. Their dentition was permanent and there was no tooth missing in any of the cases.

Cephalometric Variables

On every lateral cephalometric X-ray, 8 cephalometric measurements were performed, concerning both sagittal and vertical dimensions of the facial skeletal structures. Cephalometric measurements used were the following (Figs. 1 and 2): (1) Facial angle (Po-Or/Na-Pog); (2) Facial Axis Angle (Pt-Gn/Ba-Na); (3) Mandibular Plane Angle (Po-Or/Go-Me); (4) Mandibular Arc Angle (Dc-Xi-Pm); (5) Facial Convexity (AàNa-Pog); (6) Mandibular Corpus Axis (XiàPm); (7) Cranial Base Length (BaàNa); and (8) Anterior Cranial Base Length (CCàNa).

Method Error

In order to determine the experimental method error for each variable used, 20 X-rays were selected at random. These were traced and re-measured by the same researcher 20 days after their initial analysis. T-test was used to determine method error; the significance level was α=0.05. No statistically significant differences were found for the 8 variables used in the 2 measurements performed.

Statistical Analysis

Data processing included analyses of 1 variable and correlations of 2 variables. All continuous variables were checked using the Kolmogorov-Smirnov test. The results were analyzed with ANOVA and the Duncan test, whereas Pearson’s correlation coefficient was used to determine whether there was a statistically significant correlation between age and other quantitative variables or not.

Results

Descriptive statistics for 8 cephalometric measurements used concerned both sagittal and vertical dimensions of facial skeletal structures are presented in Tables 1 to 8. ANOVA showed that there was no statistically significant difference in the mean values of facial angle (Tab. 1), facial axis angle (Tab. 2) or facial convexity (Tab. 5) in the 3 age groups. In the adult group, the mean value presented statistically significant differences (p<0.01 - ANOVA and Duncan test) for the mandibular angle (Tab. 3) and the mandibular arc angle (Tab. 4), when compared to the other 2 groups, which did not present statistically significant differences when compared to each other. Mean value differences (ANOVA and Duncan test) for mandibular corpus axis appeared to be statistically significant (p<0.001) for all 3 age groups (Tab. 6). The statistically significant difference appearing in cranial base length mean values (BaàNa - ANOVA and Duncan test) indicated that in minors mean value for this length was significantly reduced (p<0.001) when compared to the other 2 age groups, which showed no statistically significant difference when compared to each other (Tab. 7). The statistically significant difference appearing in cranial base length mean values indicated that in minors mean value for this variable was significantly reduced (p<0.05) when compared to the adult group, while in the group of adolescents, Duncan test did not show any statistical difference with either or both other groups (Tab. 8).

Figure 1. A. Facial angle (Po-Or/Na-Pog), B. Facial Axis Angle (Pt-Gn/Ba-Na), C. Mandibular Plane Angle (Po-Or/Go-Me), D) Mandibular Arc Angle (Dc-Xi-Pm)
### Table 1. Statistical parameters of Po-Or/Na-Pog Angle

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Mean Value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 – 11</td>
<td>33</td>
<td>86.5</td>
<td>2.8</td>
<td>81</td>
<td>91</td>
</tr>
<tr>
<td>13 – 15</td>
<td>31</td>
<td>87.5</td>
<td>3.2</td>
<td>80</td>
<td>93</td>
</tr>
<tr>
<td>17 – 35</td>
<td>32</td>
<td>88.4</td>
<td>3.8</td>
<td>79</td>
<td>95</td>
</tr>
</tbody>
</table>

\[ F = 2.960, \text{p} = 0.057 \]

### Table 2. Statistical parameters of Pt-Gn/Ba-Na Angle

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Mean Value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum</th>
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<tbody>
<tr>
<td>7 – 11</td>
<td>33</td>
<td>89.7</td>
<td>3.1</td>
<td>82</td>
<td>95</td>
</tr>
<tr>
<td>13 – 15</td>
<td>31</td>
<td>89.7</td>
<td>4.5</td>
<td>80</td>
<td>98</td>
</tr>
<tr>
<td>17 – 35</td>
<td>32</td>
<td>91.5</td>
<td>4.2</td>
<td>83</td>
<td>100</td>
</tr>
</tbody>
</table>

\[ F = 2.193, \text{p} = 0.117 \]

### Table 3. Statistical parameters of Po-Or/Go-Me Angle

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Mean Value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 – 11</td>
<td>33</td>
<td>20.9 (1)</td>
<td>4.2</td>
<td>13</td>
<td>30</td>
</tr>
<tr>
<td>13 – 15</td>
<td>31</td>
<td>20.8 (1)</td>
<td>5.6</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td>17 – 35</td>
<td>32</td>
<td>16.8 (2)</td>
<td>6.9</td>
<td>2</td>
<td>30</td>
</tr>
</tbody>
</table>

ANOVA(1) (2) Mean value differences appeared in 2 sub-groups (Duncan test)

\[ F = 5.549, \text{p} = 0.005<0.01 \]

### Table 4. Statistical parameters of Dc-Xi-Pm Angle

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Mean Value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 – 11</td>
<td>33</td>
<td>32.5 (1)</td>
<td>5.9</td>
<td>21</td>
<td>45</td>
</tr>
<tr>
<td>13 – 15</td>
<td>31</td>
<td>35.4 (1)</td>
<td>4.9</td>
<td>26</td>
<td>47</td>
</tr>
<tr>
<td>17 – 35</td>
<td>32</td>
<td>40.4 (2)</td>
<td>6.7</td>
<td>29</td>
<td>57</td>
</tr>
</tbody>
</table>

ANOVA(1) (2) Mean value differences appeared in 2 sub-groups (Duncan test)

\[ F = 14.802, \text{p} = 0.000<0.001 \]

### Table 5. Statistical parameters of facial convexity AàNa-Pog

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Mean Value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 – 11</td>
<td>33</td>
<td>4.1</td>
<td>2.3</td>
<td>-2</td>
<td>9</td>
</tr>
<tr>
<td>13 – 15</td>
<td>31</td>
<td>3.4</td>
<td>3.2</td>
<td>-2</td>
<td>12</td>
</tr>
<tr>
<td>17 – 35</td>
<td>32</td>
<td>3.0</td>
<td>3.8</td>
<td>-7</td>
<td>9</td>
</tr>
</tbody>
</table>

\[ F = 0.904, \text{p} = 0.408 \]

---

\[ NS \]
Table 6. Statistical parameters of Mandibular corpus axis XiàPm

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Mean Value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 – 11</td>
<td>33</td>
<td>64.3 (1)</td>
<td>3.6</td>
<td>58</td>
<td>73</td>
</tr>
<tr>
<td>13 – 15</td>
<td>31</td>
<td>69.1 (2)</td>
<td>3.5</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>17 – 35</td>
<td>32</td>
<td>71.9 (3)</td>
<td>5.7</td>
<td>59</td>
<td>88</td>
</tr>
</tbody>
</table>

ANOVA (1) (2) (3) Mean value differences appeared in 3 sub-groups (Duncan test)

Table 7. Statistical parameters of cranial base length BaàNa

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Mean Value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 – 11</td>
<td>33</td>
<td>107.4 (1)</td>
<td>4.2</td>
<td>100</td>
<td>115</td>
</tr>
<tr>
<td>13 – 15</td>
<td>31</td>
<td>110.9 (2)</td>
<td>6.0</td>
<td>102</td>
<td>128</td>
</tr>
<tr>
<td>17 – 35</td>
<td>32</td>
<td>113.4 (2)</td>
<td>6.5</td>
<td>100</td>
<td>127</td>
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</tbody>
</table>

ANOVA(1) (2) Mean value differences appeared in 2 sub-groups (Duncan test)

Table 8. Statistical parameters of anterior cranial base length CCàNa

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Mean Value</th>
<th>Standard deviation</th>
<th>Minimum value</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 - 11</td>
<td>33</td>
<td>59.7 (1)</td>
<td>2.7</td>
<td>55</td>
<td>69</td>
</tr>
<tr>
<td>13 - 15</td>
<td>31</td>
<td>61.3 61.3</td>
<td>3.6</td>
<td>52</td>
<td>70</td>
</tr>
<tr>
<td>17 - 35</td>
<td>32</td>
<td>62.4 (2)</td>
<td>4.4</td>
<td>53</td>
<td>70</td>
</tr>
</tbody>
</table>

ANOVA(1) (2) Mean value differences appeared in 2 sub-groups (Duncan test)

Investigation into the presence of a statistically significant correlation between all patients’ age (when considered as a continuous variable) and the variables measured (measurements performed) used a Pearson’s correlation coefficient. This coefficient was calculated between the age and every variable for the total number of patients examined. From the results presented in table 9, the following may be concluded: skeletal variables that presented a pronounced positive correlation (p<0.001) and increased with age were: mandibular arc angle (Dc-Xi-Pm, r=0.535, N=96), mandibular corpus axis (XiàPm, r=0.552, N=96) and cranial base length (BaàNa, r=0.355, N=96). A pronounced negative correlation of 1% (p<0.01) was found for the mandibular base angle (Po-Or/Go-Me, r = -0.280, N = 96), which reduced with age. A positive correlation of 5% significance level (p<0.05) was found for facial angle (Po-Or/Na-Pog, r = 0.255 N = 96), which increased with age.

Table 9. Correlation of variables with age

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>r</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Po-Or/Na-Pog</td>
<td>96</td>
<td>0.255</td>
<td>0.012 &lt; 0.05</td>
</tr>
<tr>
<td>Po-Or/Go-Me</td>
<td>96</td>
<td>-0.280</td>
<td>0.006 &lt; 0.01</td>
</tr>
<tr>
<td>Dc-Xi-Pm</td>
<td>96</td>
<td>0.535</td>
<td>0.000 &lt; 0.001</td>
</tr>
<tr>
<td>Xi Ò Pm</td>
<td>96</td>
<td>0.552</td>
<td>0.000 &lt; 0.001</td>
</tr>
<tr>
<td>Ba Ò Na</td>
<td>96</td>
<td>0.355</td>
<td>0.000 &lt; 0.001</td>
</tr>
<tr>
<td>CC Ò Na</td>
<td>96</td>
<td>0.247</td>
<td>0.015 &lt; 0.05</td>
</tr>
</tbody>
</table>

Discussion

Cephalometry is the main means for describing and assessing craniofacial growth. Similarly to all types of
X-ray imaging, cephalometric X-rays should also be restricted to those absolutely necessary and performed only for diagnostic purposes. Therefore, when too many X-ray examinations are performed on the same person for research purposes, this is criticized due to the increased radiation the person is exposed to, which is unacceptable. This ethical reasoning has meant fewer X-ray examinations for research purposes, which resulted in avoiding longitudinal growth assessment and repeated X-ray imaging of the same person.

This paper aimed at studying Angle Class II division 2 malocclusion cases and determining the improvement or exacerbation of facial skeletal structure relationships at various ages. Due to ethical considerations mentioned above, the material of the study comprised initial lateral cephalometric X-rays of cases with Angle Class II division 2 malocclusion who asked for treatment; these patients ranged in age from 7 to 35 years.

Initially, 8 cephalometric measurements were performed to determine Angle Class II division 2 malocclusion in 3 patient groups - a children’s group, an adolescents’ group and an adults’ group - and differences were later identified among these 3 groups. Furthermore, it was investigated whether these measurements are affected by age in all the patients examined.

Facial angle, which determines chin position along the anterior-posterior axis, was used to assess the position of the mandible along the sagittal axis. Facial angle (Po-Or/Go-Me) showed no significant increase in the adolescents’ and adults’ groups, although it was found to increase with patient’s age. Facial angle increase with age was attributed mainly to the significant increase of the length of the mandibular corpus axis. Values found for the facial angle indicate a “normal” mandibular position of the mandible in children. On the contrary, there is a tendency for slight mandibular retraction among adults, which seems to agree with similar findings by numerous authors. Besides, the difference in mandibular position between children and adult patients tends to support the view that Angle Class II division 2 malocclusion is not a primary skeletal syndrome, but a deformation, which numerous authors attribute mainly to the pronounced palatal inclination of maxillary central incisors, which results in stunting mandibular growth.

Mandibular corpus axis length (Xi àPm) appeared significantly increased in adults as compared to that of children and adolescents. Furthermore, all patients examined showed significant differences since this length increased with patient age.

Skeletal facial convexity was found increased in all 3 groups examined. Furthermore, it was not significantly different in all the groups and showed no negative correlation with age, although it appeared decreased in the adolescents’ and adults’ groups. Skeletal facial convexity development is caused by the significant increase found in mandibular corpus axis length and cranial base length with age, in particular, the increased anterior cranial base length. Cranial base length (BaàNa) presented significant increase among adolescents and adults as compared to the children’s group, while the difference between adolescents and adults was not significant. On the contrary, cranial base length showed a particularly significant positive correlation with age, which was expected.

Anterior cranial base (CCàNa) was found to be significantly longer among the adults’ group as compared to that of the children, while it was not different in the adolescents’ group when compared to the other 2 groups. Similar to “normal” individuals, all patients examined showed positive correlation of anterior cranial base length with age.

The face, in all 3 groups of patients examined, showed a “normal” direction of increase, since mean values of facial angle (Pt-Gn/Ba-Na) in minors and adolescents showed no difference from what was proposed as “normal”. Facial angle did not show significant differences among all groups examined, nor any correlation with age. Brezniak et al used Downs’ axis and Ricketts’ facial axis, and found that Angle Class II division 2 malocclusion patients presented a more horizontal type of increase in comparison to “normal” individuals.

Mandibular angle (Po-Or/Go-Me) and mandibular arc angle (Dc-Xi-Pm) mean values measured support the view that patients with Angle Class II division 2 malocclusion tend to have a “strong” and “square” mandible with a “strong” muscular system, a small mandibular angle and a large mandibular arc angle.

Mandibular angle mean values in children and adolescents showed no differences, while in the group of adult patients this angle was significantly lower than in the other 2 groups. In all the patients examined, the mandibular angle presented a statistically significant difference, since it reduced with age. The reduction of mandibular angle with age might be due to the anterior mandibular rotation during its growth, a fact which mainly appears in cases with insufficient incisor support.

Mandibular arc angle increases with normal growth as a result of increased adaptive changes occurring in the mandible. In the children’s and adolescents’ groups, it showed no significant difference, while it was significantly increased in adult patients in comparison to the other 2 groups. In all the patients examined, mandibular arc angle showed particularly significant differences with growth since it increased with age.

Assessment of findings of this research led to the conclusion that in patients with Angle Class II division 2 malocclusion facial profile was convex and did not significantly change with age, whereas anteroposterior position of the mandible showed significant differences in the 3 groups examined: in the children’s group it might be considered “normal”, while among adolescent and adult patients it showed a tendency for retraction. Mandibular
Conclusions

The cephalometric study and assessment of findings of this study suggest that:
1) Anteroposterior chin position in children approximated “normal”, while adult patients showed a tendency for retrusion;
2) Facial profile was convex and showed no significant differences among the groups of children, adolescents and adults and no change with age;
3) Mandibular morphology was found to vary significantly at various ages: it changed and became more “square” with age;
4) During orthodontic treatment of patients with Angle Class II division 2 malocclusion, it is necessary to consider and activate in time those mechanisms that inhibit the stunting of mandibular growth in the anteroposterior and vertical dimensions.

References


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Clinical Oral Manifestation in Gastrointestinal Disorders

SUMMARY

Aim: to evidence extraoral and intraoral, subjective and objective, symptoms by patients with Crohn's disease and ulcerative colitis, depending of the disease’s phase.

Material and Method: to realize the established aim, 12 patients (8 with Crohn's disease and 4 with ulcerative colitis) were followed at the Clinic for gastrointestinal diseases. All patients went through exceptional anamnesis and clinical control (inspection and palpation). All examinees were examined in both phases - exacerbation and remission.

Results: As extraoral symptoms, arthralgia, sarcoidosis, thrombophlebitis, anaemia, oedema of the face and mouth were pointed out. The anaemia is mostly present in patients with Crohn’s disease (63%) and ulcerative colitis (75%). After that, on the patients oedema of the mouth is evidenced in 38% of patients with Crohn’s disease and 25% of patients with ulcerative colitis. From the subjective symptoms, symptoms such as illness, firing/fry, and glow were indicated; at the phase of exacerbation, these symptoms were indicated by all 8 patients with Crohn’s disease. Also by all patients with clinical diagnosis of ulcerative colitis, illness was present and only 3 out of 4 had an indication of firing and glow. From intraoral dental symptoms in both diseases, aphthous stomatitis and glositis were often present. In the exacerbation phase, in patients with Crohn’s disease, aphthous stomatitis was always present, and glositis in 88% of patients. In the remission phases, the subjective dental symptoms evidently decreased. Considering ulcerative colitis, the findings were identical, aphthous stomatitis and glositis were present in all 4 examinees. Piostomatitis vegetans was present by 63% of patients with Crohn’s disease, and of patients with ulcerative colitis.

Conclusion: the profound clinical manifestation in examinees in the exacerbation phase is due to pathogenetical activities in the gastrointestinal tract. The oral cavity as a beginning part of the gastrointestinal tract, a similar histological changes and disruptions are shown. For that reason, the most important role of the dentist is to diagnose gastrointestinal disruptions.

Keyword: Crohn’s disease; Colitis, ulcerative; Gastrointestinal Disruptions

Introduction

Dentists and gastroenterohepatologists put their effort and attention for diagnosis and treatment of certain diseases of digestive system. Contrary to gastroenterohepatologists, dentists take care of the oral cavity as the initial part of digestive system. Although, each one is diagnosing and threat different pathology, their points of view and focuses correlate very often in the clinical practice. Digestive system is a long muscular tube which initial part is the oral cavity, through which food and secretions are transmitted toward rectum. Histological analogy, familiarity and correlation of oral cavity and other parts of the digestive system determinate certain gastrointestinal disorders to give repercussions in the oral cavity.

Having that in mind, dentists should recognize, diagnose and treat oral lesions and infections that are
related with digestive diseases. In fact, the role of the dentist is quite heterogeneous: from disease detection which is not diagnosed yet, to adjusting dental treatment with medical treatment that impacts oral health.

Gastrointestinal diseases that mostly affect oral cavity are: ulcerative colitis and Crohn’s disease. There are many articles in medical and dental literature that describe extra abdominal and oral expression of Crohn’s disease and ulcerative colitis. Well-known and in practice often found oral expressions in relation with inflammation of the large intestine are: vegetative pyostomatitis, aphthous ulcers, cobbled look of oral epithelium, epithelium shrinks granulomatous inflammation of small salivary glands, candidiasis and angular cheilitis.  

Ficarra at al were examining the connection between Crohn’s disease and vegetative pyostomatitis of oral mucosa, which is the marker of intestinal inflammation. The authors describe a 45-year-old woman with diarrhoea present around 6 months and persistent painful oral ulceration. The tongue was striated and in the area of oral commissurare pustules were present from which Staphylococcus simulans was isolated.

It is well known that changes in the oral cavity may appear year or more before the first signs of inflammation in the bowel has been registered. However, Crohn’s disease and ulcerative colitis are of special interest to dentist due to accompanying changes in the mouth and the influence of the medical therapy over the dentist treatment.

Clinical course of these diseases is characterized by episodes of acute attacks (phases of exacerbation) and phases of remission. This results in patient’s long time suffering due to difficulties and slow treatment. Nowadays, dental literature presents data that indicate the presence of antimicrobial proteins in saliva, as well as bacterial and fungal infection in patients with Crohn’s disease and ulcerative colitis having oral changes.

The aim of the study was to find out extra abdominal changes in patients with Crohn’s disease and ulcerative colitis and to evidence subjective symptoms and objective changes in the oral cavity in both stages of the diseases (exacerbation and remission), as well as to register intraoral similarities and differences in patient with these 2 diseases.

Material and Method

For realization of the established aim, 12 patients (8 with Crohn’s disease and 4 with ulcerative colitis) were followed at the Clinic for gastrointestinal diseases (Faculty of Medicine) and the Department of periodontology and oral disease (Faculty of Dentistry) in Skopje. Exceptional medical history data (epidemiological characteristics of the disease - gender, age, duration of disease) and subjective symptoms (pain, glow, burning) were collected from all the patients.

With clinical evaluation we noted extraoral and intraoral symptoms. Extraoral signs were: arthralgia, sarcoidosis, thrombophlebitis, anaemia, face oedema, lips swelling. Intraoral signs were: aphthous stomatitis, vegetative pyostomatitis, deep linear ulceration, angular cheilitis, indurative polyloid formation, glossitis, pale mucosa, oral hairy leuokplakia. All examinees were examined in both phases of exacerbation and remission.

Results

The results of our research are presented in tables and charts. Charts 1 and 2 present gender and age of patients with Crohn’s disease and ulcerative colitis. Of the total number of patient suffering from Crohn’s disease, 50% were women and 50% were men. 1 male patient (25%) had ulcerative colitis and 3 women (75%). Both diseases were found in population older than 20 years, mostly at the age 31-50 years.

Table 1 presents extraoral characteristics of patients with Crohn’s disease and ulcerative colitis in phases of exacerbation and remission. In the phase of exacerbation, in patients with Crohn’s disease anaemia was most frequent, in 5 of 8 patients (63%). In the phase of remission, anaemia was present only in 2 of 8 patients in phase of exacerbation or remission. In patients with ulcerative colitis, in the phase of exacerbation, anaemia was also the most frequent (3 out of 4 patients) and other conditions (arthralgia, sarcoidosis, thrombophlebitis lip oedema) were less frequent. Some intraoral consequences of the anaemia in patients with Crohn’s disease and ulcerative colitis are presented in figures 1 and 2.

Subjective symptoms (pain, burning and glowing) in patient with Crohn’s disease and ulcerative colitis, in both phases of the diseases (exacerbation and remission) are presented in table 2. In the phase of exacerbation, all 8 patients with Crohn’s disease (100%) had subjective hardship of pain and burning; however, in the phase of remission, only 2 of these patients (25%) felt pain in the oral cavity, while one patient (13%) felt burning. In the phase of exacerbation, all 4 patients with ulcerative colitis had subjective hardship of pain, while burning was present in 3 patients (75%). In the phase of remission, subjective hardship was less prominent.

Intraoral characteristics among patients with Crohn’s disease and ulcerative colitis, in phases of exacerbation and remission are presented in table 3. Among intraoral signs, we have noticed aphthous stomatitis, Pyostomatitis vegetans, indurated polyoid formation, deep linear ulcers, pale mucosa, oral hairy leukoplakia, glossitis, and angular cheilitis. Some of these signs are presented in figures 3-6.

Charts 3 and 4 present a comparative view of intraoral signs among patients with Crohn’s disease and ulcerative colitis in both phases of the diseases.
Table 1. Extraoral characteristics of patients with Crohn’s disease and ulcerative colitis in phases of exacerbation and remission

<table>
<thead>
<tr>
<th>Extraoral characteristics</th>
<th>Crohn’s disease (n=8)</th>
<th>Ulcerative colitis (n=4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase of exacerbation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arthralgia</td>
<td>2 25</td>
<td>1 25</td>
</tr>
<tr>
<td>Sarcoidosis</td>
<td>1 13</td>
<td>1 25</td>
</tr>
<tr>
<td>Thrombophlebitis</td>
<td>1 13</td>
<td>1 25</td>
</tr>
<tr>
<td>Anaemia</td>
<td>5 63</td>
<td>3 75</td>
</tr>
<tr>
<td>Facial oedema</td>
<td>0 0</td>
<td>0 0</td>
</tr>
<tr>
<td>Lips oedema</td>
<td>3 38</td>
<td>1 25</td>
</tr>
</tbody>
</table>

| Phase of remission        |                        |                        |
| Arthralgia                | 1 13                   | 1 25                   |
| Sarcoidosis               | 1 13                   | 0 0                    |
| Thrombophlebitis          | 1 13                   | 0 0                    |
| Anaemia                   | 2 25                   | 1 25                   |
| Facial oedema             | 0 0                    | 0 0                    |
| Lips oedema               | 2 25                   | 1 25                   |

Figure 1. Oedema of the lip in the patient with: (A) ulcerative colitis, and (B) Crohn’s disease

Figure 2. Consequences of anaemia present in patients with Crohn’s disease: (A) angular cheilitis; (B) cheilitis exfoliativa
Table 2. Subjective symptoms in patients with Crohn’s disease and ulcerative colitis in phases of exacerbation and remission

<table>
<thead>
<tr>
<th>Subjective symptoms</th>
<th>Crohn’s disease</th>
<th>Ulcerative colitis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number</td>
<td>%</td>
</tr>
<tr>
<td>Phase of exacerbation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pain</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>fry and glow</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>Phase of remission</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pain</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>fry and glow</td>
<td>1</td>
<td>13</td>
</tr>
</tbody>
</table>

Table 3. Intraoral signs of Crohn’s disease and ulcerative colitis in both phases of the disease (in patients with oral symptoms)

<table>
<thead>
<tr>
<th>Phases of the disease</th>
<th>Intraoral signs</th>
<th>Crohn’s disease</th>
<th>Ulcerative colitis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number</td>
<td>%</td>
<td>number</td>
</tr>
<tr>
<td>Exacerbation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aphthous stomatitis</td>
<td>8</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>Pyostomatitis vegetans</td>
<td>5</td>
<td>63</td>
<td>2</td>
</tr>
<tr>
<td>Indurated pylipoid formation</td>
<td>2</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Deep linear ulcers</td>
<td>2</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Angular cheilitis</td>
<td>4</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>Pale mucosa</td>
<td>2</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Glossitis</td>
<td>7</td>
<td>88</td>
<td>4</td>
</tr>
<tr>
<td>Oral chairy leukoplakia</td>
<td>1</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Aphthous stomatitis</td>
<td>3</td>
<td>38</td>
<td>1</td>
</tr>
<tr>
<td>Pyostomatitis vegetans</td>
<td>2</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Indurated pylipoid formation</td>
<td>1</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Remission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep linear ulcers</td>
<td>1</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Angular cheilitis</td>
<td>2</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Pale mucosa</td>
<td>2</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Glossitis</td>
<td>2</td>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>Oral chairy leukoplakia</td>
<td>1</td>
<td>13</td>
<td>1</td>
</tr>
</tbody>
</table>
Figure 3. Cobbled look of the buccal mucosa in patient with Crohn’s disease

Figure 4. Pyostomatitis vegetans in patients with Crohn’s disease

Figure 5. Hyperemia in oral epithelium in the patient with ulcerative colitis

Chart 3. Comparison of intraoral characteristics among Morbus Crohn in a phase of exacerbation and remission

Chart 4. Comparison of intraoral characteristics among Colitis ulcerative in a phase of exacerbation and remission

Figure 6. Aphthous stomatitis in patient with ulcerative colitis: (A) buccal mucosa; (B) apex of the tongue
Discussion

Ulcerative colitis and Crohn’s disease are 2 of the most frequent intestine irritations in the group of idiopathic inflammations. Ulcerative colitis affects mucosa and submucosa of the large intestine and Crohn’s disease is actually regional enteritis, inflammatory condition that affects all layers of the intestine. Nevertheless, these 2 diseases share many common features, including an unknown etiology and not so clear pathogenesis. Both diseases are of crucial interest to dentist because of the associated changes in the mouth and the consequences arising from therapy (especially the use of corticosteroids). Therefore, many editorials in medical and dental literature are devoted to extra-abdominal and oral signs of intestine inflammations, or to oral cavity findings.

From epidemiological aspects of view, both diseases demonstrate 3 well-known peaks of incidence. The first, which is the highest, in the period between 20 and 24 years of age, the second between 40 and 44 years of age, and the third between 60 and 64 year. After 60 years of age, the incidence of ulcerative colitis far exceeds the incidence of Crohn’s disease. Women from England and Northern Europe have 30% higher risk for development of ulcerative colitis and Crohn’s disease. They often affect whites and Jewish people, particularly those originating from Central Europe: Russia and Poland.

Our results are somehow contradictory to the findings obtained from the literature: the biggest incidence was registered in the period between 30 and 50 years of age. This study went through the subjective and objective extraoral and intraoral changes in phase of exacerbation and remission. In phase of exacerbation, of the extraoral findings found in patients with ulcerative colitis and Crohn’s disease, anaemia was dominantly present. We believe that pernicious anaemia arises as a result of blood and iron loss, which is more emphasized in the active phase of both diseases. Inflammatory bowel mucosa can distort absorption of vital nutrients, such as Ca, Fe, or folates, which are absorbed in the small intestine. Therefore, the reduced absorption due to inflammation results in lack of the previously mentioned nutrients, which is more noticeable in patients with Crohn’s disease than in patients with ulcerative colitis. Diarrhoea is a major cause for dysfunctional balance of electrolytes and low level of albumin. Lack of iron and folates reflect the occurrence of anaemia. In the phase of remission symptoms are less prominent. Anaemia is also present as a main extraoral symptom, but only in the half of the respondents. The applied treatment corrects abdominal findings and decreases the number of patients with anaemia, which explains the obtained findings of our study. Concerning other extraoral signs, oedema of lips was noticed more often in patients with ulcerative colitis, which was also noticed by Ming and Yamada.

Among intraoral objective findings in patients with ulcerative colitis in the phase of exacerbation, aphthous stomatitis was the most prominent symptom, followed by glossitis, pyostomatitis vegetans and angular cheilitis. We presume that aphthae are the consequence of the lack of iron, folic acid, Vitamin B12, intestinal absorption dysfunction and loss of blood. Aphthae were still present, although in a smaller number, even in the phase of remission of the disease. We believe that their persistence is due to the effect of the applied therapy (treatment with sulfasalizine, salofalk and other drugs results in occurrence of new ulcers or longer persistence of already existing aphthae - these drugs are excreted through saliva and they irritate oral mucosa). The new eruptions in these patients are often a forerunner of a new surge of the disease. Question which needs to be answered is the following: are aphthae a typical sign of the disease, disease forerunner, only a random clinical finding, or the consequence of the present anaemia?

By frequency of presence, at these patients intraoral Pyostomatitis vegetans (deep proliferative lesions) is present. Their appearance in the oral cavity is related to the impact of circulating human immune complexes, whose creation shall encourage the intestine antigen or damaged lining of the colon. The other very often present sign of the Crohn’s is a cobbled mucous look. This morphological change is a reflection of granulomatous changes that represent the main reason of Crohn’s disease. The consequences of dysfunctional absorption are visible through other present signs: pale mucosa, angular cheilitis and glossitis. These signs are more prominent among undiagnosed cases, in the acute phase of the disease, or when the disease is poorly controlled.

In a phase of remission, intraoral clinical signs in patients with Crohn’s disease could still be present, but in a fewer number of patients. We believe that the improved absorption in the intestine has a positive effect on the patients’ oral status.

Subjective symptoms in a phase of exacerbation, as pain, burning and glowing, are due to the presence of eroded or ulcerated areas. In the phase of remission, there is a gradual normalization of the regulatory mechanisms and a decrease of subjective symptoms in patients with ulcerative colitis and Crohn’s disease.

Finally, it might be concluded that clinical symptoms among most of the respondents in the phase of exacerbation where the consequence of the events in the gastrointestinal tract. The oral cavity, as mirror of general health status of each individual, especially reflects disorders of the digestive system. Therefore, the important role of the dentist is to recognize oral changes, diagnose them and treat the consequences of ulcerative colitis and Crohn’s disease. From this point of view, the inter-departmental clinical and technical cooperation with the colleagues from gastroenteropatology departments is of particular importance. We hope that it would facilitate treatment and increase the quality of life of this category of patients.
References


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Atypical fibroxanthoma is an uncommon mesenchymal tumour, which usually has a benign clinical course and an excellent prognosis. Treatment of choice is wide surgical incision since the possibility of recurrence is highly correlated to positive tumour margins.

We report a case of atypical fibroxanthoma in a female patient suffering from scleroderma. Despite the aggressive treatment, the tumour recurred several times. This is the first documented case of atypical fibroxanthoma occurring a patient with a collagen disorder.

**Keywords:** Fibroxanthoma, atypical; Scleroderma

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**Case Report**

A 57-year-old Caucasian woman presented to our department of Oral and Maxillofacial Surgery with an 8-month history of a painless ulcerative pre-auricular tumour measuring 3x3cm. She reported the appearance of a small nodule 8 months ago which had grown rapidly and become ulcerated. The lesion was fragile and asymptomatic, but due to its cosmetic appearance the patient had to cover it with a piece of gauze. The rest of the examination was unremarkable with no palpable cervical adenopathy. The chest film was free of metastatic lesions, although there was an extended pulmonary fibrosis due to scleroderma. The patient had a smaller lesion resected from the same area one year ago. The histological examination of this tumour revealed a keratoacanthoma.

The patient suffered from scleroderma diagnosed 10 years ago, being controlled with Prezolon 5 mg (1x3) and Cyclophosphamide 50 mg (1x3). Despite the aggressive immunosuppressive therapy, she had developed pulmonary hypertension due to the disease, but she had no gastrointestinal symptoms. Her medical history also revealed moderate hypertension and coronal disease.

A punch biopsy of the pre-auricular tumour was performed and the patient was initially treated with radiotherapy due to her compromised medical status. The radiotherapy started immediately because the tumour was...
growing fast and was clinically diagnosed as a squamous cell carcinoma.

The biopsy showed an atypical spindle cell neoplasm, which did not stain with cytokeratin, S-100 protein, HMB-45, MelanA and SMA. The tumour was histologically characterized as sarcoma. Radiotherapy was subsequently abandoned. Under general anesthesia a wide excision of the tumour was performed. Part of the superficial temporal fascia and part of the zygomatic arch were also excised (Figs. 1 and 2). The defect was covered with free skin grafts because the duration of the surgery should be kept to a minimum due to compromised medical status of the patient.

The biopsy specimen demonstrated a well-circumscribed, non-encapsulated tumour localized in the dermis, contiguous with the ulcerated epidermis. The cells were large, pleomorphic, longitudinal and spindle-shaped with an abundant eosinophilic cytoplasm and frequent mitotic figures (Fig. 3). The margins of the specimen were not infiltrated and the nearest distance from the margins of the tumour was 1cm. Immunohistochemical staining of proliferative cells was strongly positive for vimentin, S-100 (Fig. 4) and CD68, but much more weakly positive for cytokeratin 8/18 and smooth muscle actin (SMA). Tumour cells did not show any reactivity with HMB 45, MelanA, KerAE1/AE3, Ker LMW, KerHMW, Ker7, Ker20, EMA and CD34. The diagnosis of atypical fibroxanthoma was established.

2 months later the patient presented to our department with 2 nodules located at the margins of the skin graft. Excision of one nodule under local anesthesia was performed. The histological examination of the specimen revealed a recurrence of the primary tumour. The next month the patient underwent a wide excision of the nodules under general anesthesia and the defect was again reconstructed with free skin grafts (Figs. 5 and 6). Once again biopsy was indicative of an atypical fibroxanthoma. The patient has been closely followed for 18 months and she has shown no evidence of a recurrence or distant metastasis. The patient eventually died from the systemic disease.
Atypical fibroxanthoma was first reported by Helwig in 1963. He described a solitary spindle cell neoplasm arising on the sun damaged skin of an elderly patient. Atypical fibroxanthoma begins as a small, firm and solitary nodule, which may be ulcerated (36%) or bleeding (26%)\(^7\). It usually grows rapidly, but remains asymptomatic. Some nodules have a pigmented appearance due to hemosiderin deposits. In this case, differential diagnosis from melanomas may be difficult. Atypical fibroxanthoma usually appears on the head and neck of elderly people with a mean age of 71-86 years\(^5\), and less often on the trunk and extremities of younger people. Very rarely it can affect the eye\(^8\). Our patient was 57 years old and presented with a large painless ulcer on the pre-auricular region.

The pathogenesis of atypical fibroxanthoma is still unknown, although many predisposing factors have been reported. Ultraviolet radiation seems to play a major role by inducing p53 mutations at dipyrimidine sites\(^9\). Other predisposing factors include trauma, burns, radiotherapy, post-cardiac and post-renal transplantation and immunosuppressive therapy\(^10,11\). A high incidence of cutaneous malignancies has been reported in transplant recipients, which is attributed to the need of lifelong maintenance immunosuppressive therapy\(^12\). Immunosuppressive therapy impairs the tumour surveillance mechanism of lymphocytes, disrupting the balance between tumourigenesis and tumourilysis\(^13\). Immunosuppressive therapy and perhaps the initial radiation therapy may have contributed to the presence of multiple recurrences in our patient despite wide surgical excision.

The diagnosis of atypical fibroxanthoma is based on histological examination and immunohistochemistry, since its clinical course and appearance leads to a variety of preoperative diagnosis, such as squamous cell carcinoma, basal cell carcinoma, pyogenic granuloma, melanoma, dermatosarcoma, cutaneous lymphoma and malignant fibrous histiocytoma\(^5,10\).

Immunohistochemical studies are helpful in establishing the diagnosis and in differentiating atypical fibroxanthoma from other cutaneous malignancies. Atypical fibroxanthoma stains positively with vimentin only, and shows variable reaction with a1-antitrypsin, factor XII and smooth muscle actin (SMA)\(^13,14\). Squamous and spindle cell carcinoma stain positively with cytokeratin and epithelial membrane antigen, whereas atypical fibroxanthoma does not stain with these markers\(^15\). Moreover, atypical fibroxanthoma does not stain with S-100 protein and HMB-45, which are usually positive in melanomas\(^16\). However, the absence of positive reaction with these markers cannot confirm the diagnosis of atypical fibroxanthoma, because in some cases spindle cell carcinomas may not stain with cytokeratin and melanomas may not stain with S-100 protein\(^5\). In our case, the tumour stained with vimentin and there was a mild reactivity with SMA, which has been reported before\(^5\). Interestingly, in our case, there was a strong reaction with S-100 protein, which has not been reported before. It seems that reactivity with S-100 protein cannot exclude the diagnosis of atypical fibroxanthoma.

Immunohistochemical studies are also used in order to differentiate atypical fibroxanthoma from its malignant counterpart, namely malignant fibrous histiocytoma. LN-2 is a 35kDa protein mainly expressed on the nuclear membrane of B-lymphocytes. This protein has been consistently identified in malignant fibrous histiocytomas but not in atypical fibroxanthomas\(^17\). It seems that LN-2 is a reliable marker in distinguishing between the 2 lesions.
The treatment of choice is wide surgical excision with at least 1 cm margin\textsuperscript{18}. We absolutely agree with Gonzalez-Garcia et al\textsuperscript{7} that curettage and cryosurgery are never indicated since they can lead to a remarkably higher recurrence rate. Mohs microsurgery is a conservative approach that should only be reserved for tumours adjacent to important anatomic structures. Radiotherapy is advocated by some authors, but some others suggest that following radiotherapy the tumour may show a more aggressive clinical course\textsuperscript{7,19}. We chose to treat our patient with wide surgical excision despite her compromised medical status.

Atypical fibroxanthomas are known to recur in about 12\% of cases\textsuperscript{20}, with a mean time of 2 years between surgery and recurrence. Recurrences are usually a consequence of inadequate surgical margins\textsuperscript{7,21}. However, multiple recurrences occurred in our patient despite the wide excision of the primary tumour, suggesting that immunosuppressive therapy and radiotherapy might also play an important role in clinical course of the tumour. The existence of occasional recurrences advocates for a close follow-up of the patient, at least for the first 2 years following surgery.

Although extremely uncommon, metastatic spread has been described by some authors\textsuperscript{6,22}. Metastasis is usually associated with large tumours with deep vascular invasion and with immunocompromised hosts. According to Helwig\textsuperscript{6}, metastasis usually occurs within 12 to 18 months. Metastasis from atypical fibroxanthoma is not always fatal, since surgical control or even cure may also happen.

References


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Unusual Penetrating Metallic Foreign Bodies Injured Maxillofacial and Orbital Region with Minimal Damage

SUMMARY
Penetrating injuries during work accidents represent a rare but complex variety of craniofacial trauma. Generally, the penetrating material is stiff enough to cross through different anatomic structures and can cause an impressive problem for the patient. On the arrival at the emergency department, clinical situation of the patient must be evaluated to decide the type of examination. Functional and cosmetic problems must be taken under consideration and an immediate decision must be taken by the specialists for a rapid surgical treatment. The surgical approach depends on the position of a foreign body.

2 penetrating head injuries during work accident are presented, the pre- and intra-operative approach described and the particularities of these cases are pointed out.

Keywords: Penetrating Trauma; Metallic Foreign Body

Introduction
According to Agrillo et al1, a good cosmetic and functional outcome of penetrating injuries depend on 4 main factors: (1) the extent of the traumatic injury; (2) clinical condition and age of the patient; (3) diagnostic accuracy; and (4) the amount of time that has passed between trauma and operation. First aid for trauma patients requires their transportation to an emergency department by qualified personnel. After this, a multidisciplinary approach is recommended, taking into account all the anatomic structures involved and planning the most suitable surgical strategy1.

In order to assess the exact extent of the maxillofacial injuries, it is necessary to perform some examinations, such as standard skull radiographs in 4 projections, 2-dimensional computed tomography (CT) scans in axial and coronal projections, or 3-dimensional CT scans of the maxillofacial area2. Preoperative knowledge of the shape of the foreign body and its relationship to the surrounding structures using appropriate imaging modalities is imperative3.

Report of Cases
Case A
A 52-year-old farmer sustained an injury of his left eye during outdoor activity. After the injury, he was examined in the nearby hospital of his town and then referred to Papanikolaou Hospital of Thessaloniki nearly 48 hours after being injured, under broad-spectrum antibiotic coverage and anti-tetanus prophylaxis.

At the time of examination, he had hypophagia, slight oedema around the left orbit, blepharoptosis and a dermal injury of the left upper eyelid. On further examination by ophthalmologists, the left eye had peri-bulbar oedema, hyphema, intravitreous haemorrhage and reduction of visual acuity to counting fingers at 1 m. The IOP was 15 mmHg. A slit lamps examination disclosed iridoschesis at 6 o’clock. ENT examination revealed no abnormality of the nasal cavity. There was no systemic involvement.

X-rays at the time of the injury and the requested posttraumatic computer tomography revealed a metal body with intra- and extra-conal extension, in immediate contact to the left frontal, ethmoidal and nasal bones. The
distal part of the foreign body ended in the left superior concha. The optic nerve appeared normal. There were no signs of any injuries of the globe or any fractures or intracranial involvement (Figs.1-3).

It was decided to explore the wound under general anaesthesia. Through the entry wound the metallic body was found to be embedded in the medial wall of the orbit. On manipulation, the body showed slight movement and appeared to be fixed to deeper structures. In order to avoid further injuries of the orbital contents, with mild manoeuvres and under direct visual contact, the entry wound was extending and the foreign body removed (Fig. 4).

The patient recovered uneventfully. 3 months later the ptosis improved. New ophthalmologic examination revealed visual acuity of 3/10 and IOP of 9 mmHg. Fundus examination showed small hemorrhage near the optic disc.

Case B
A 57-old man was brought to the emergency department after a work accident. He was slightly confused, but able to answer to some questions. He had a metal foreign body of irregular shape embedded in his left mid-face, in the area of the left sinus. He presented soft tissue injuries of the lips and the chin, dermal loss at the tip of the nose, 3 broken teeth in the front of the mandible and burning injuries on the neck, the cheek and the forehead (Figs. 5 and 6). After the evaluation by specialists of other disciplines and since there were no signs of any injury of vital anatomic structures,
radiographs (Figs. 7-9) and no computer tomography, were taken to estimate the exact position of the metal body, because time was more critical in view of the patient distress.

The patient was transferred directly to surgery in the operating room for careful removal under general anaesthesia, with all facilities available in the event of any complication. A metal body of irregular shape and size 8 cm x 5 cm was removed from the left side of the patient’s face (Fig. 10), along with a high number of small pieces of plastic which were also embedded in the trauma area and seemed to have caused the burning injuries of the face. There was no intra operative haemorrhage or other complications.

The front wall of the left sinus, along with the zygomaticomaxillary buttress was completely destroyed and there was no possibility of reconstruction. An antro-rhinostoma was performed at the meatus inferior. A primary plastic closure of the face injuries was achieved. Antibiotic cover with cephalosporine second generation, intra- and post-operatively, for 14 days was recommended. Our patient recovered uneventfully and had no recurrent maxillary sinusitis or nasal obstruction.
Discussion

Foreign bodies can cause injuries of the orbit and extensive damage to the surrounding structures\(^4\). They may give rise to severe orbital complications and usually inorganic foreign bodies cause visual loss or orbital complications from direct trauma\(^5\)\(^-\)\(^8\). A retained metallic orbital foreign body may cause a variety of signs, symptoms, and clinical findings, based on its size, location and composition\(^9\)\(^,\)\(^10\). There have been described cases with pyogenic infection, periostitis and fistula formation. There may also be a risk of gas gangrene formation, development of tetanus, chronic sinusitis, when a sinus is involved, meningeal infection or cerebral abscess formation if cranial cavity is involved\(^11\). Even sight-threatening complications have been described\(^12\). Complications can appear long time after the injury\(^13\). In the case A, the 24-month follow-up period was uneventful.

CT scan is the standard diagnostic test, because it demonstrates most foreign bodies and it is safe in the presence of metallic bodies\(^14\)\(^,\)\(^15\). Recent reports have shown helical CT scans to be as accurate as conventional CT scans, while reducing the radiation exposure for the patient\(^16\)\(^,\)\(^17\).

The surgical approach used, depend on the position of the foreign body. Most commonly, this is through the entry wound. Posteriorly located foreign bodies have an increased risk of motility disturbances or optic neuropathy after surgical removal\(^18\), whereas anteriorly placed foreign bodies are more easily removed\(^19\)\(^,\)\(^22\).

In the case B, the examination was performed with simple radiographs, because of the metallic nature of the foreign body and the possible artefacts in other imaging procedures\(^23\), the urgency of the situation and because it was thought that any other method, like CT, would not add anything important for the planned surgical intervention.

The proposed algorithms for the approach of penetrating injuries of the face\(^24\)\(^,\)\(^25\), after the exclusion of any life threatening situation for the patient and with no complication from the orbital area, had no importance in the case A, because of the unique shape and size of the embedded foreign body. In the second case, the foreign body lost kinetic energy during the impact with the maxillary region, saving, in this way, the orbital structures and the brain. Since there was no possibility of osteosynthesis in the maxilla because of the extensive destruction of the bone structures of the area, we decided a double approach from intraoral and through the face trauma that left behind the metal body. A Caldwell- Luc operation was unnecessary. The metallic object was carefully removed because of the danger of a major haemorrhage and to avoid secondary iatrogenic injury during removal.

Injury to the paranasal sinuses should be appropriately treated to decrease the risk of recurrent sinusitis and mucocele formation. Wound tracts should be thoroughly irrigated and devitalized tissue debrided. Intraoral wounds should be closed early when possible. Prophylactic antibiotic coverage and tetanus toxoid booster should be given. Long term follow-up is recommended. Sometimes further imaging studies are necessary to evaluate delayed traumatic injuries to cranial nerves and paranasal sinuses\(^26\).

Although seldom fatal, the treatment of penetrating craniofacial injuries requires a methodical approach because of the possible immediate complications that may follow the removal of the foreign body. The therapeutic record should be based on a multidisciplinary approach to obtain the best aesthetic and functional results. It must be emphasised that the prognosis of every injury by a foreign body is strongly influenced by the nature and the location of the injury and the extent of initial damage.

References


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