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Editorial

Warm greetings!

In this journal, I want to bring in notice a veryimportant issue to make dentists aware of their obligation to adequately inform their patients before providing medical and dental care. Although law in the field of health care is an established concept in developed countries but remains in its infancy in developing countries. Due to global advancements, the situation is now changing because of increased awareness of the patients' rights, and it is just a matter of time before we fall prey rightfully or wrongfully to an ever-evolving legal framework for the health care industry. It is a general legal and ethical principle that one must get valid consent before starting treatment or physical investigation, or providing personal care, for a patient or conducting research involving human participants. In medical terms, informed consent implies to "providing sufficient information for a patient to make an informed and rational choice, the information includes the inherent risks and alternatives that a reasonable doctor would provide having regard to the particular circumstances of the patient." This principle reflects the right of patients to decide what happens to their own bodies and is an essential part of good practice. Without informed consent to treatment, we are vulnerable to criticism on a number of counts. All procedures, from a simple buccal pit restoration to the removal of a complicated, full bony, impacted third molar, require an irreversible change to bodily tissues with the risk of some type of complication or unwanted side effect. Even minor occlusal/incise adjustments can affect the surrounding dentition, cuspid rise, masticatory function, or TMJ (Temporomandibular Joint stability) stability. The mouth is an extremely dynamic environment, subject to the forces of the tongue, lips, cheeks, and teeth. Any change to that environment, even with the best of intentions by the practitioner, may lead to unwanted results, and those possibilities need to be presented to the patient and documented in writing.

situation is now prey rightfully or principle that one for a patient or oviding sufficient and alternatives nciple reflects the

Although "invasive and irreversible" procedures require informed consent, most diagnostic procedures such as general clinical examinations, periodontal probing, and radiographs do not require such formal consent. It is assumed, for the most part, that patients want the doctor to obtain all of the information necessary to make a complete and accurate assessment of the general and oral condition when scheduling for an initial examination or any concerned pain. On occasion, however, patients will specifically state that they wish to forgo diagnostic procedures such as radiographs or periodontal probing. The practitioner's focus must immediately obtain "informed refusal" in these cases. In these days photographic records are incorporated our profession as an adjunct to clinical care, it can be displayed to colleagues, students and other audiences in educational settings, and published in scientific journals or other media as part of dental research. In each case, it is not only prudent, but also necessary for the patients' protection and interest that appropriate consent must be obtained. But in case of minor (if a person is below 18 years of age), person is not eligible to give consent. Generally, a guardian of a child (usually a parent) has the authority to consent to their treatment and procedures, provided that it is in the best interest of the child.

Although this issues is quite vast but I want to summarize by saying that a written and signed informed consent is the only evidence that can save a practitioner frequent visits to the courtroom and large sum of money in legal fees in case of a mishap. Health care practitioners should keep them updated regarding changing laws by consulting their concerned organizations. Happy reading!

Dr. Yogesh Kumar Editor in chief Director Principal Professor & Head Department of Conservative and Endodontics

Surendera Dental College & Research Institute Sriganganagar

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Original Article

VARIATIONS IN MAXILLARY LABIAL FRENUM MORPHOLOGIES IN DIVERSE POPULATION OF PUNJAB & NORTH EAST

Satwant Kaur, Sanjeev Kumar Salaria, Amit Khunger, Manish Sukhija, Navjot Kaur, Isha Sharma

ABSTRACT

A frenulum is a small fold of mucous membrane that connects the lip to the alveolar process. Among all the frena, maxillary labial frenum is the most common which is observed clinically. It is a normal anatomic structure with inherent morphologic variations. The aim of this study is to evaluate the prevalence of frenal variations in a diverse population of Punjab & North East. This study was conducted on 102 subjects of both the sexes within age group 21-30 years (50 Punjab, 52 North east). Intraoral examination was done to evaluate the variations in frenum and photographs were taken. The most common type of Medial maxillary labial frenum observed in both the groups were the simple single frenum (59.80%) followed by frenum with nodule (21.56%) and frenum with appendix (5.88%). Furthermore, other structural variations were also found in the diverse population. Hence, upper labial frenum was found to have diverse morphology and dentist should give due importance for the assessment during oral examination so that patient should be thoroughly educated and motivated regarding the sequel associated with it and if required early surgical intervention taken into consideration to prevent the same.

Keyword: Aberrant frena, frenulum, maxillary labial frenum morphologies.

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INTRODUCTION

Frenum is defined as a "fibrous band of tissue attached to the bone of the maxilla and mandible and is present superficial to muscle attachment.¹The frenii of the oral cavity are categorized into different types: Frenulum linguae, the frenulum labii superioris, the frenulum labii inferioris, and the buccal frena.² Most notably labial frenum and lingual frenum are seen in the oral cavity and the primary function of these frena is to provide stability to the upper lip, lower lip and tongue. The maxillary labial frenum is a fold of mucous membrane found on the underside of the upper lip which connects the midline of the attached gingiva.³According to Mirko

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et al, four types of frenal attachments are found: Mucosal, Gingival, Papillary and papilla penetrating.⁴Most commonly Papillary and Papilla penetrating type of frenal attachments require correction by surgical interventions.

Aberrant frena often cause problems such as loss of papilla, recession, diastema, difficulty in brushing, alignment of teeth, and psychological disturbances.⁵Aberrant frena are detected visually by applying tension over it, to see the movement of papillary tip or blanching produced due to ischemia of the region. An abnormal frenum attachment can lead to frenal pull which may result in distension of gingival Sulcus which in turn encourages plaque accumulation and increase the severity of periodontal pockets.⁶

As the prevalence of frenal variation studies were scarce in the literature. Therefore, the present study was designed to evaluate the prevalence of frenal variations in a diverse adult population of Punjab and North east.

MATERIALAND METHOD

Total 183 students were added in the study protocol out of which only 177 students fulfilled the inclusion & exclusion criteria. All the students were explained about the study with its pros and cons and they were motivated about the preventive and surgical aspects related to abnormal frenal attachments. Only 102 students submitted a written informed consent in favor of the same. Clinical examination of frenum was done using direct visual method by upward distention of upper lip and by using cheek retractor to fully visualize the maxillary labial frenum in all the subjects and frenum morphologies were recorded on the basis of Gundappa's classification and photographs were taken for all the subjects and data obtained thus subjected to statistical analysis.

RESULTS

The study included only the examination of frenum morphologies on the basis Modified Sewerins Typology⁷ as per convenience sampling and following results have been observed in an descending order. The most common type of Medial maxillary labial frenum (MMLF) observed in both the groups were the simple single frenum (59.80%) followed by frenum with nodule (21.56%) and frenum with appendix (5.88%). Among the simple single frena most common was the gingival type (15.68%) as shown in **Table 1**.

Among the frena with nodule, majority of them had the nodule at middle one-third position (13.72%) followed by nodule at alveolar one-third(4.90%) and the least were found with nodule at labial third (1.96%) and in case of frena with appendix, majority of them were found at middle one-third position (5.88%).

Other types of MMLF observed based on the Modified Sewerins Typology⁷ were the simple double frenum (1.96%), simple triple frenum (1.96%) and bifid frenum (0.98%).There were 8 such subjects in which frena were absent and two or more frenal variations were not detected in the study subjects.

S.No.	Frenum Type	Punjab	Group	North East Group		
		Total	%age	Total	%age	
1.	Simple Single Frenum	21	42%	40	76.92%	
2.	Simple Double Frenum	2	4%	-	-	
3.	Simple Triple Frenum	2	4%	-	-	
4.	Simple with Nodule at Labial 1/3	2	4%	-	-	
5.	Simple with Nodule at middle 1/3	10	20%	4	8%	
6.	Simple with Nodule at Alveolar 1/3	5	10%	-	-	
7.	Multiple Nodule	1	2%		-	
8.	Simple with appendix at middle 1/3	6	12%	-	-	
9.	Bifid Frenum	1	2%		-	
10.	Absent	0	-	8	15.38%	
	Total	50	100%	52	100%	

Punjab Group



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Figure 1



Frenum with appendix at middle third

Bifid Frenum



Trifid Frenum

Triple Frenum



Figure 2



Simple Gingival Type

Simple frenum with nodule at middle third



Absent Frenum

Papillary frenal attachment

2

DISCUSSION

Maxillary Labial Frenum appears as a fold of mucous membrane extending from the mucous lining of the mucous membrane of the lips towards the crest of the residual ridge on the labial surface.¹Various conditions of the oral cavity that does not require any treatment include fordyces granules, leukoedema, fissured tongue, retrocuspid papilla, and the inherent morphologies. There are several variations of frenal attachments found in different individuals of different states and to tell them regarding the adverse effects (such as midline diastema, recession, difficulty in speech, mastication, esthetics and maintenance of oral hygiene constituting a periodontal problem have been well documented in the literature)⁸ that may be caused due to abnormal frenal variations. We as professionals need to address them properly during routine dental procedures and diagnose them properly, so that we can guide them regarding their preventive and surgical aspects with their pros and cons in detail.

The present study was conducted on 102 Subjects ageing between 22-30 years in Surendera Dental College, Sriganganagar. 102 subjects were divided into two groups i.e Punjab and North East. There were 50 subjects included in the Punjab group and nearly 52 subjects were included in the North East group and frenal variations were examined as per a modified Sewerin's typology of frenum, due to its practicality, usefulness and easy to use.⁵ The aim of this study was to determine the morphological variations of maxillary labial frenum (MLF) and also to motivate the subjects about preventive and surgical aspects related to abnormal frenal variations.

In both the groups, 11.76 % of the subjects were having different frenal variations other than simple single frenum (60%) and frena with nodule (20.58%) and there were 8 such subjects among the study population found with absence of Maxillary labial frenum which is a very rare occurrence and may be related to developmental abnormalities. The results of this study was in accordance with reports of Mohan et al.⁷

Simple single frenum is found to be a normal condition which do not require any treatment part but if labial frenum is inserted at or near the gingival margin, it interferes with tooth brushing and encourages plaque formation by pulling or averting the gingival margin and it do requires surgical correction.⁹There are cases of frenal attachments with the presence of nodule at middle or labial thirds, which may be because of wrong brushing methods followed by the individuals. There is a study done by Mirko et al, which suggests that different types of frenal attachments influences the periodontal condition with gingival, papillary and papilla penetrating showing lower periodontal resistance in persons with pathologic changes as compared to healthy persons with similar frenal attachment.¹⁰

The variations suggest that diverse variations can occur in general population of two different states and are usually considered developmental in nature.

However, the presence of abnormal frena have been reported in the literature as a feature of syndromic conditions such as Ehler's-Danlos syndrome (absence of labial and lingual frenum), infantile hypertrophic pyloric stenosis, Holoprosencephaly, Ellis-van Creveld syndrome and oro-facial-digital syndrome.⁹ Upper labial frenum has also been considered to be a modifying factor in denture construction. Abnormal frenal variations with a broad base migrated near the crest of the residual ridge; these require early recognition and surgical removal for a more satisfactory treatment outcome with complete dentures.

As suggested in literature, there are several variations found in upper labial frenum in Punjab Group because they have large jaw sizes but very few variations are found in North East group because of short variations in jaw size and in some cases there is absence of frenal attachments in North east population. However the frenum is found to be absent in Ehler's-Danlos syndrome but in this study this variations are may be due to the developmental abnormalities as there are no such features of Ehler's Danlos syndrome found in study subjects.

There are various studies in the literature suggesting different variations in population on a large scale but all these studies were having large sample size but to the best of our knowledge this is the first study conducted on the variations in upper labial frenum in the diverse population of Punjab and North east in which no significant differences were found between males and females. No reports are available in literature for the other variations reported.

Hence, proper identification of various frenal variations and subsequent modifications of treatment procedures are vital for a successful outcome. The dentist needs to give due importance for frenum assessment during oral examination.

SUMMARY

On the basis of the observations drawn from the study it was summarized that:

• The most common variations were simple frenum followed by frenum with nodule and appendix.

• Punjab group was having maximum frenal variations as compared to people of North East.

• Only the North East subjects were found absent with frenal variations and on the other side

• Punjab group subjects there were found with well projected frenal attachments.

CONCLUSION

It was concluded that dentist should be given due importance to frenal assessment during routine examination as well as during dental treatment, so that early preventive measures and surgical interventions was planned at the earliest before the occurrence of complications associated with abnormal frenal attachments elicit.

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MEDICO-LEGAL FORESIGHT: WHERE ARE WE?

Varun Ahuja, Sachin Ahuja, Seema Gupta, Eenal Bhambri, Baljinder Singh Jaura

ABSTRACT

Aim- To assess the knowledge of orthodontists regarding legal aspects of orthodontic practice.

medical ethics is as fundamental to the practice of medicine as clinical skills.²

Material and methods- A cross-sectional study was conducted with orthodontists registered with Indian orthodontic society by means of questionnaire containing 20 questions pertaining to basic knowledge of COPRA, informed consent, Medico-legal courses and orthodontic documentation. A pilot study was conducted with the 20 subjects to check the validity and reliability of questionnaire. Kappa value was found to be 0.82 which was satisfactory.

Results- A total of 287 professionals were sent the questionnaire by email and facebook. Out of this total, 122 answered and returned the questionnaire. Out of the 122 respondents, almost 75 % of professionals were aware about consent, 44.64 % were not aware about COPRA act, 83 % didn't know about courses regarding medico-legal issues and 22.78 % kept their patient's orthodontic documentation on file throughout their active professional life.

Conclusion- This study revealed that the participants were knowledgeable about informed consent but they lacked knowledge about COPRA act, Medico-legal courses. Some practices have yet to be adopted related to orthodontic records and documentation.

Keywords : Medico legal aspects, orthodontists, professionals

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INTRODUCTION

Dentistry and medicine today are noble professions but there is a level of increased anxiety both within the medical professional and the patients at large knowledge of dentistry and medicine is as much important as knowing law governing their practice.¹ With the increasing use of technology, paradigm shifts in patient's attitude towards the doctor has resulted in making the law an inseparable entity of health care today. Knowledge about The recent increasing trend in litigation against doctors is an issue of paramount concern. The reasons for these are media (electronic and print), professional accountability and decision making. The negativity spread through the media has done further damage to the once considered white collar profession.

Today, the fundamental principles of medicine insist that doctor should be aware about various medico-legal issues, understand the nature of these obligations and fulfil these obligations to best of his ability. This study was designed to identify and analyse the knowledge, attitudes, and awareness of orthodontists regarding legal aspects of orthodontic practice.

MATERIALAND METHODS

This is a cross-sectional and descriptive study. Data was collected from the self-explanatory questionnaire developed specifically for this survey. The questions comprised in the questionnaire were designed to enable the collection of data concerning legal-dental issues. A pilot study was conducted with the 20 subjects to check the validity and reliability of questionnaire. Kappa value was found to be 0.82 which was satisfactory. The population for this study consisted of dentists-specialists in orthodontics-residing in India. The questionnaire contained the following fields COPRA act, Informed consent, orthodontic accessories, oral hygiene, treatment plan, orthodontic documentation and means of communication with the patient.

The orthodontists were identified from the records provided by the members directory of indian orthodontic society. The study was conducted in November-december 2015 and questionnaire built in google forms consisted of 20 questions was sent through email and facebook.

The questionnaires sent were according to following categories COPRA awareness as presented in Table 1, Awareness on consent in Table 2, Awareness on Medico-legal courses in Table 3 and awareness on Orthodontic documentation in Table 4.

The resulting data was statistically analysed using SPSS

version 23.0 and percentages of the responses were calculated.

Table 1 Awareness on COPRA

Q.1 Do you know what COPRA means?

 $Q.2\ \mathrm{Do}\ \mathrm{you}\ \mathrm{know}\ \mathrm{whom}\ \mathrm{to}\ \mathrm{contact}\ \mathrm{in}\ \mathrm{COPRA}\ \mathrm{office}\ \mathrm{when}\ \mathrm{you}\ \mathrm{are}$

booked for any offence?

Q.3 Do you know the legal procedure to tackle COPRA?

Table 2 Awareness on consent taking

Q.4 Main purpose of consent from is to...

Q.5 Before starting the treatment do you inform the patient about

all the treatment options available?

Q.6 Do you take inform consent from every patient?

Q.7 Do you give the success and failure rate of orthodontic treatment you provide?

Q.8 Are you aware about Negligence and Non negligence acts?

Table 3 Awareness of orthodontists on medico-legal programmes and courses

Q.9 Do you know what professional indemnity claim is?

Q.10 Have you taken any insurance coverage to protect yourself against claims?

Q.11 Should medico-legal issues be taught in undergraduate medical science courses?

Q.12 Have you attended any CME/CDE program regarding medico-legal issues ever?

$Table\,4\,Awareness\,of\,orthodontic\,documentation$

Q.13 Do you enter information about damage to orthodontic accessories on dental records and make patient sign a document?Q.14 Do you enter information about poor oral hygiene into dental records?

Q.14 Do you enter information about poor oral hygiene into dental records?

Q.15 Out of the following which method you recommend to improve patient oral hygiene?

Q.16 Do you take signature authorizing implementation of treatment plan?

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Q.17 Do you keep orthodontic documentation on file after treatment?

Q.18 Form(s) of documentation at the orthodontic treatment?

Q.19 In the event of abandonment of treatment do you send communication to your patient?

Q.20 At the end of orthodontic treatment is your patient is "discharged" in writing and you sign the document?

RESULTS

The population of this study consisted of 287 orthodontic professionals members of Indian orthodontic society. Of the 287 questionnaires that were sent out, 122 were returned. The distribution of participants according to their designation is illustrated in Table 5.

Table 5. Distribution Of Participants

Table 6 Percentage of response

6 110		NT1
S.NO.	Designation	Number
1.	Senior Lecturer	34
2.	Reader	56
3.	Professor	22

The results of the questionnaire were subjected to descriptive analysis in SPSS software and percentages were determined. Percentages showed that 44.64 % were not aware about the COPRA act, 75% of professionals were aware about the consent, 83% don't know about courses regarding the medico-legal issues and 19.78% kept their patient's orthodontic documentation on file throughout their active professional life. (Table 6)

<u>S.No</u> .	Category of questionnaire	Percentage of	Percentage of NO			
		YES				
1.	Awareness about COPRA act	55.36	44.64			
2.	Awareness about the consent	75	25			
3.	Awareness about courses	17	83			
4.	Awareness about orthodontic	19.78	80.22			
	documentation					

7

and encouraging insight into awareness of medico legal issues. It also stresses about the need to improve their knowledge, awareness and practices regarding medico legal issues. In the present study, 44.64% of orthodontists were not aware about consumer protection act which is similar to study conducted by Singh et al in Udaipur where 50.4% medical professionals and 49.6% of dental professionals were not aware about Consumer Protection Act.² In the present study, 83% of orthodontists didn't know about the courses regarding medico legal issues. This is similar to study conducted by Dr. Senthilkumar et al in Tamilnadu where 85.7% of medical college health professionals and 92.4% of dental college health professionals were not aware of medicolegal programmes/courses.³

In the present study, almost 75% of orthodontists were aware about informed consent which was similar to study conducted by Dr. Rai in Vodadara where almost 90% of the respondents were aware of informed consent.⁴ This is also similar to study conducted by O.C. Osmie et al in Berlin where 74.6% of health professionals had awareness about informed consent.⁵ There is also similarity to study conducted by Dr. Senthil kumar et al in Tamilnadu where 87.4% of medical college health professionals were aware of informed consent; whereas 76.1% of dental college health professionals were aware about informed consent.³

In the current study, almost 19.78% of othodontists were in habit of keeping their patient's orthodontic documentation on file throughout their active professional life. In a study conducted by Machen, he showed that the most glaring weakness displayed by orthodontists was their inefficiency to keep records of the following facts: oral hygiene, damage to orthodontic accessories, tooth decay, damaged restorations and cancellation of or missed appointments.6 In a study conducted by Pueyo, the professionals agreed that there is a need to record all events that occur daily in the care of their patients.7 Silva in 1997 told that pre-appointed evidence consists of all dental documentation developed throughout clinical practice. Therefore, documentation of all phases of professional activity is of utmost importance.⁸

CONCLUSION

Dentistry has reached a new stage in terms of

professional liability. The study was a genuine endeavor to assess the knowledge of orthodontists about COPRA, informed consent and medico legal issues. This study revealed that the participants were knowledgeable about informed consent but they lacked knowledge about COPRA act, Medico-legal courses. Some practices have yet to be adopted related to orthodontic records and documentation.

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9

Review Articles

CLINICAL UPDATES IN MANAGEMENT OF AVULSED PERMANENT TOOTH WITH IMMATURE APICES -A REVIEW

Shruthi Chandrashekar Katti, Madhu Pujar, Hemant Vagarali, Veerendra Uppin, Venkateswarlu Modem

ABSTRACT

The regeneration of avulsed permanent teeth with open apices following trauma could be beneficial to reduce the risk of fracture. The goal of regenerative procedures in endodontics is the use of biological procedures to arrest the progress of the disease, prevent its recurrence and favoring repair or replacement of damaged structures of pulp-dentin complex. Alternative to apexification, the newer treatment protocol is regenerative endodontic procedure which includes revascularization, and apexogenesis. Cells from the pulp, periodontium, vascular, and immune system helps in regeneration.

The purpose of this article is to review the recent updates in management of avulsed permanent teeth with open apices. The selection criteria for regenerative and conventional procedures is based on the type of tooth injury, fracture type, periodontal status, presence of periapical lesions, stage of tooth development, vitality status, and patient age will be reviewed. Procedure like apexogenesis, apexification, or partial pulpotomy treatments have already been attempted and have less success rate as reported in the literature. Regenerative treatment procedure is an alternate treatment modality for non-vital teeth with immature apices with a higher success rates.

Keywords : Avulsion, open Apex, regenerative procedures To download this article-www.surendera dental college.com/journal

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INTRODUCTION

Avulsion is a relatively uncommon type of traumatic injury to the permanent dentition.¹⁻² The maxillary central incisors was the most frequently injured teeth in all studies for both the primary and secondary dentitions. The second most frequently injured teeth were maxillary lateral incisors in all studies except that by Forsberg and Tedestam³whereas mandibular central incisors were the second most frequently injured teeth. Prevalence rates in the primary dentition peaked at age 10-24 months in a Brazilian study,⁴ while the frequency of trauma to the permanent dentition in school age children peaked in the age group 9-15 years.^{5,6,7,8.} Treatment for avulsed or traumatized teeth with an exposed pulp differs. Some dentists debride the pulp tissues and obturate the root canal with gutta-percha,9,10 composite resin, calcium hydroxide.¹¹or mineral trioxide aggregate (MTA).¹² Very few dentists will attempt regenerative endodontic procedures to maintain or restore the vitality of a tooth. A regenerative Journal of Updates in Dentistry, Jul-Dec 2017; 8(2) : 10-13

endodontic procedure; which includes revascularization, and apexogenesis, pulp capping and partial pulpotomy, and even stem cell therapy and tissue engineering. The goal of modern restorative dentistry is to functionally and cosmetically restore the tooth structure. Natural dental hard tissues, i.e. dentin, enamel and cementum exhibit little or no regenerative capability.13Regenerative endodontic procedures can be defined as biologically based procedures designed to predictably replace damaged, diseased, or missing structures, including dentin and root structures as well as cells of the pulp-dentin complex, with live viable tissues, preferably of the same origin, that restore the normal physiologic functions of the pulp-dentin complex.14

OBJECTIVES

To regenerate pulp-like tissue, ideally, the pulp dentine complex; regenerate damaged coronal dentine, such as following a carious exposure; and regenerate resorbed root, cervical or apical dentine. These potential approaches include root canal revascularization, postnatal (adult) stem cell therapy, pulp implantation, scaffold implantation, threedimensional cell printing, injectable scaffolds and gene therapy.13

REGENERATIVE ENDODONTIC TREATMENT RECOMMENDATIONS

Regenerative endodontic procedures need guidelines which are required to ensure to be used on teeth, which are most likely to benefit patients. In 2010, the American Dental Association (ADA) provided the first treatment codes for regenerative endodontic procedures. The codes for apexification / recalcification are D3351-D3354. The formal acknowledgement by the AAE and ADA and collection of cases to analyze success rates marks a milestone in the growing acceptance of regenerative endodontic procedures into more main stream dental practice. The terminology used to describe regenerative endodontic procedures includes direct pulp capping, revascularization, apexogenesis, apexification, and even dental pulp constructs.¹⁵The first review article to group these terms into the field of regenerative endodontics was published in 2007.16

COMMON FEATURES OF REGENERATIVE ENDODONTIC PROCEDURES FOR THE TREATMENT OF IMMATURE TEETH WITH PULPAL **NECROSIS**

3 main components are:

- 1. Disinfection
- 2. Recruitment of mesenchymal stem cells (MSCs) and establishment of a scaffold
- 3. Placement of a coronal barrier and restoration

DISINFECTION

Eradication of microbial biofilms is of utmost important in regenerative procedure. Disinfection plays a role in stem cell-conducive environment.¹⁷ Undifferentiated mesenchymal stem cells from periapical tissues like apical papilla and periodontal ligament cells are present and are used to mediate the regenerative processes. Many factors affect the survival of these cells, so it is very important to pay attention to the newer disinfecting materials that are used in eradication of biofilms.

The current American Association of Endodontist(AAE) and European Endodontic Society (ESE)¹⁸ guidelines recommend minimal to no instrumentation of root canal to preserve remaining dentin thickness. Regenerative procedure completely relies on chemical disinfection for eradication of microbial biofilms. Commonly used disinfectants are sodium hypochlorite, EDTA, chlorhexidine and intracanal medicaments like calcium hydroxide,triple antibiotic paste .^{17,19,20} Extensive research has shown these irrigants and medicaments have detrimental effects on survival of stem cells required for regeneration, but EDTA is used as a final irrigant before recruitment of stem cells from periapical tissues because EDTA – induces release of growth factors from dentin and are capable of stem cell chemotaxis, angiogenesis and neurogenesis.²¹⁻²²

RECRUITMENT OF MESENCHYMAL STEM CELLS (MSCS) AND ESTABLISHMENT OF A SCAFFOLD

Inducing bleeding in regenerative endodontic procedure (revascularization) was based on work done by Dr Nyggard-Ostby.²³ Formation of a fibrin network in blood clot acts as a scaffold for appropriate organization of stem cells during regenerative procedure in a 3-dimensional matrix.²⁴Scaffolding matrices, such as platelet rich plasma plasma (PRP),²⁵ platelet rich fibrin(PRF),²⁶ have been used in regenerative procedure. PRP induces ingrowth of vascularized connective tissue in endodontically disinfected tooth.

Revascularization Of Avulsed And Replanted Teeth

Avulsed intact teeth without root fracture can be washed with

water, saline, or chlorhexidine to remove any debris present and be replanted immediately.²⁷ The removal of coagulum and cleaning of the socket is not regarded as being beneficial.²⁸ If an extra-oral dry time of 60 min or more, replantation is usually not recommended.²⁷ Teeth with an open apex heals more rapidly.²⁹ Revascularization after replantation of an avulsed tooth is influenced by the extra-oral time and the stage of root development, which is influenced by the diameter of the apical foramen. An open foramen >1.1 mm is beneficial, with natural revascularization occurring in approximately 18% to 34% of teeth with immature roots.^{30,31} Successful periodontal healing can be improved if the pulp is extirpated within 14 days.³²

PLACEMENT OF A CORONAL BARRIER AND RESTORATION

Bioceramic materials like MTA and biodentine are used as coronal barrier. These materials help in differentiation of stem cells into odontoblast phenotype. They provide a safe-zone barrier to the restorative material which is used to seal pulp chamber. Coronal placement of these materials helps in hard tissue deposition which can potentially increase fracture resistance.^{33,34}

CONCLUSION

Regenerative endodontic procedures should encompass both immature permanent teeth and adult permanent teeth especially in consideration of cell homing and cell transplantation for pulp and/or dentin regeneration. Multiple therapeutic approaches should be developed for infected dental pulp of immature and mature permanent teeth.

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Review Articles

CHITOSAN: A NEW NATURALLY OCCURRING ROOT CANAL IRRIGANT

Khanchandani D, Pujar M, Modem V, JamadarA ,Mamadapur V S

ABSTRACT :

Root canal instrumentation produce a layer of organic and inorganic material called the smear layer that may also contain bacteria and their by-products. This layer covers the instrumented walls and may prevent the penetration of intracanal medicaments into the dentinal tubules and interfere with the close adaptation of root filling materials to canal walls. For several years, various root canal chelating agents have been used to remove the smear layer amongst which ethylene diamine tetraacetic acid (EDTA) is the most commonly used. EDTA has proven to be effective in removing the smear layer but it is derived synthetically and has various disadvantages therefore to overcome the drawbacks of EDTA, search for biocompatible substances continues and Chitosan is one such biocompatible material which occurs naturally in the environment and is also biodegradable. Due to its abundance in nature and low cost production, chitosan has become ecologically interesting for various applications.

Keywords: Chitosan, EDTA, root canal treatment

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Source of Support: Nil Conflict of Interest: Nil INTRODUCTION

For a successful endodontic treatment, the smear layer formed after instrumentation should be completely removed from the surface of the root canal wall as it can provide an avenue for leakage. It may also harbor micro-organisms by forming biofilms.¹ Various root canal chelating agents have been used to remove the smear layer amongst which ethylene diamine tetraacetic acid (EDTA) is the most commonly used(Marques et al. 2006, Estrela et al. 2007, Spano' et al. 2009).² Chelating agents primarily act on the inorganic component of smear layer, aiding in itsremoval.¹ EDTA has proven to be effective in removing the smear layer but it is derived synthetically and has various disadvantages. Materials derived from the nature have several advantages over the synthetic ones such as unlimited availability, low cost of production, not harmful to the environment. One such naturally occurring biomaterial that is being recently used in the field of Endodontics is Chitosan.

DISADVANTAGES OF EDTA

EDTA acts on the inorganic portion of the smear layer and favour its removal. Crompton et al reported that application of 1 ml of 17% EDTA for 1min is very effective for smear layer removal.³However, EDTA has several disadvantages and therefore many materials are being tested and introduced to replace EDTA. According to various studies, application of EDTA for more than 1 min or when it is applied in volumes greater than 1 ml causes erosion of the root canal wall.^{4,5}Sayin et al reported that EDTA alone or in combination with NaOCl can cause reduction in the micro hardness of the root dentin.⁶There are various concerns regarding the use of EDTA as it may cause damage to the periapical tissues.⁷ There are many environmental concerns with the EDTA as the concentration of EDTA as considerably increased in rivers and lakes due its overuse. EDTA is not found originally in nature therefore it is considered a pollutant.²Therefore, to overcome the drawbacks of EDTA, search for biocompatible substances continues and Chitosan is one such biocompatible material which occurs naturally in the environment and is also biodegradable. Due to its abundance in nature and low cost production, chitosan has become ecologically interesting for various applications .2EDTA has proven to be an effective irrigant at a concentration of 17% whereas according to various studies, Chitosan at a low concentration of only 0.2% removes smear layer similar to EDTA. Therefore, Chitosan could be a feasible alternative of EDTA.

The chelating effect of Chitosan has drawn attention of various researchers because it has high affinity towards various metal ions under acidic conditions.8Previous studies have shown that chitosan causes the demineralization of dentin in as efficiently as EDTA and demonstrates a capacity for cleaning the dentin walls equivalent to that of citric acid and EDTA.^{9,10}

STRUCTURE OF CHITOSAN AND ITS DERIVATION

Chitosan (1-4, 2-amino-2-deoxi-b-D-glucana) is a straight chain, cationic polysaccharide. Chitosan is naturally found in the cell wall of fungi, mainly in the order Mucorales , insects' exoskeletons, crustaceans' shells.¹¹ Chitosan was discovered in 1859 by Rouget by subjecting chitin to hot potassium hydroxide solution treatment. In 1894, Gilson confirmed that glucosamine is present in chitin and the was named chitosan was coined by Hopper-Seyler.¹²

Schematic representation of the primary structures of (a) Chitin and (b) Chitosan.¹³

It is derived from Chitin through the process of deacetylation in an alkaline environment. Chitin is the second most commonly occurring polymerized carbon found in nature after cellulose.¹⁴



Schematic representation of N- deacetylation of chitin into chitosan through hydrolisis by sodium hydroxide.¹¹

APPLICATIONS OF CHITOSAN

Chitosan has been used in many industries like food as (iron and calcium absorption

A c c e l e r a t o r, fiber sour c e), biomedical and pharmaceuticals(antibacterial and anti-tumour agent, drug carrier, wound healing accelerator) biotechnology (enzyme and cell carrier, chromatography resin), environment (water treatment), agriculture (seed preparation), and in cosmetics by Jeon et al. 2000.It has an acidic pH and therefore shows remarkable chelating capacity for different metal ions, hence it is used in various industries for recovery of metals.²

In dentistry, the antifungal effect of a 2% chitosan gel containing0.1% chlorhexidine against Candida albicanshas been demonstrated, and its addition to calcium hydroxide paste as an intracanal medication has been shown to promote prolonged calcium ion release.² Recently, Chitosan is gaining popularity as a root canal irrigant. Chitosan is gaining popularity in dentistry due to its various favorable properties. It is biocompatible, non-toxic, highly bioactive, biodegradable, and selectively permeable, has a polyelectrolyte action, antimicrobial activity, ability to form gel and film, has good chelation ability and absorptive capacity.¹¹

ANTIMICROBIAL ACTIVITY OF CHITOSAN

Candida albicans and Enterococcus faecalisare the most commonly found species in the root canal failure cases, ¹⁵these are the most resistant species of fungi and bacteria. C. albicans has a collagenolytic activity and it uses dentin as a nutrient source and promotes colonization and therefore it exhibit high virulence.¹⁶

Therefore an ideal root canal irrigant must be effective against both bacteria and fungi. Chitosan has broad spectrum antimicrobial activity which includes bacteria as well as fungi.¹ The antimicrobial activity of chitosan regarding gram-positive and gram-negative bacteria ranges from 100 up to 100,000 mg l-1 and 100 up to 1,250 mg l-1 for gram-negative and gram-positive bacteria, respectively.¹¹The mechanism of antimicrobial activity of the chitosan is not yet fully understood. There are many mechanisms of action of chitosan suggested in literature by various authors. According to some authors, in the presence of physiologic fluids, the amino groups of Chitosan get protonated and they bind to anionic groups of the microorganisms and this leads to agglutination of the microbial cells and inhibition of their growth.^{17,18}Another mechanism was proposed by Yadav, Bhise in the year 2004. He suggested that Chitosan interacts with the bacteria cell wall and promotes displacement of Ca++ of the anionic site resulting in cell damage.¹⁹ Another postulate is that the positive load of the chitosan interacts with the negative load of the microbial cell wall and this leads to rupture of the microbialcell wall.²⁰It is also postulated that Chitosan forms of an external barrier, chelating metals and causes suppression of essential nutrients required for microbial growth.²¹According to Kong et al reported that antimicrobial resistance of chitosan has not occurred.²² Tsai and Su²³and Zheng and Zhu²⁴ have verified that the antimicrobial activity of the chitosan is directly related with the absorption chitosan to the bacterium, which causes changes in the cell wall and in the permeability of the cellular membrane. Ballalet al conducted a study to compare the antibacterial efficacy of chlorhexidine and 2% chitosan gel and their combination and he concluded that the latter had maximal antibacterial efficacy.²⁵

CHELATION ACTION OF CHITOSAN

Although there is not much literature on the chelating effect of chitosan for endodontic applications, this property has been used by industry for the recovery of various metal ions for wastewater treatment and for purification of drinking water by Onsøyen & Skaugrud 1990.

Chitosan removes the smear layer by acting on the inorganic

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portion of the smear layer. The chelation action of Chitosan is due the formation of complexes between chitosan and metal ions which is most probably is due to the mechanisms of adsorption, ion exchange and chelation.²⁶Currently, there are two theories to explain the process of chelation of chitosan. The first theory is called the model of the bridge. It states that two or more amino groups of one chitosan chain bind to the same metallic ion.²⁷According to the second theory, only one amino group of the structure is involved in binding, which is the metal ion "anchored" to the amino group.²⁸The chitosan polymer is formed by a chain composed of several dimers of chitin. Similar to the EDTA molecule, the chitin dimer shows two nitrogen atoms with pairs of free electrons responsible for the ionic interaction between the metal and the chelating agent. In an acidic medium, the amino groups present in the bipolymer are protonated, resulting in an overall position charge (-NH3+). This form is responsible for the attraction to other molecules in order for adsorption to occur.²⁹Pimenta et al conducted a study and concluded that 0.2% chitosan solution reduced dentin micro hardness similar to of 15% EDTA.30

Apart from possessing good chelating capacity and broad spectrum antimicrobial activity, Chitosan also has other favorable effects on dentin. Chitosan induces remineralization of the exposed and demineralized dentin as itsits functional phosphate groups binds to calcium ions to form a favorable surface for crystal nucleation, resulting in the formation of a calcium phosphate layer.³¹

CONCLUSION

An ideal root canal irrigant should exhibit tissue dissolving property, remove smear layer and have antibacterial activity. At present there is no single irrigant that possesses all the ideal characteristics even when used at a lower pH, increased temperature or with surfactants to increase their wetting efficacy. For several years, a combination of NaOCl and EDTA solutions is recommended for the efficient removal of the smear layer from the surface of the root canal wall. However, this combined irrigation regimen has several disadvantages as mentioned in the present article, therefore clinicians must consider replacing EDTA with irrigants which are equally effective and are biodegradable and biocompatible like Chitosan.

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Review Articles

PERACETIC ACID - A POWERFUL BACTERICIDAL WEAPON. A REVIEW

Urvashi Sukhija, Navneet Kukreja, Abhishek Bansal, Jyoti Bansal

ABSTRACT: With the steadily growing frequency of AIDS, many dental researchers and clinicians have become more interested in disinfection and sterilization procedures. The need for appropriate disinfection and sterilization has been emphasized by numerous articles documenting infection after improper reprocessing of patient care items. Because it is unnecessary to sterilize all patient care items, hospital policies must identify whether disinfection or sterilization is indicated on the basis of each item's intended use.

Keywords : low temperature disinfectant, peracetic acid, sterilization

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INTRODUCTION

Microorganisms are ubiquitous. Since they cause contamination, infection & decay, it becomes necessary to remove or destroy them from materials or from areas. Infections that can occur in dental clinics are similar to hospital infections.¹

Dental practice involves several risks of contamination due to the frequent contact with blood and saliva. Extracorporeal survival of microorganisms may range from a few minutes to a few weeks, and infectious diseases such as syphilis, gonorrhea, tuberculosis, diphtheria, measles, viral parotiditis, rubella, influenza, herpes, varicella, cytomegalo virus infection, viral hepatitis and acquired human immunodeficiency syndrome, may be transmitted during dental treatment Given this reality, matters related to the control of infections and biosafety regulations have taken on a new focus.¹

Sterilization process includes the elimination of all viable organisms, including spores. However, it should be highlighted that certain instruments cannot be sterilized by heat; one of the most commonly employed methods in dentistry. In these cases, sterilization using chemical agents is required for materials like plastics, resins, wooden handled items, waxes, rubber, and cloth materials in prosthodontics. Sterilization of these items is not necessary in many cases; however, disinfection is required to minimize cross-transfer of potentially infections microorganisms from patient to patient. Prosthodontic articles that are contaminated only by handling, which contact skin surfaces only or that have minimal contact with oral fluids can be disinfected with an EPA-approved tuberculociadal disinfectant.^{1,2}

Therefore, chemical disinfectants or Low-temperature

sterilization is required for temperature- and moisture-sensitive critical dental devices and supplies. Ethylene oxide has been the most widely used low-temperature sterilization process. Health care facilities are currently considering alternative processes to ethylene because ethylene oxide is a probable carcinogen and is flammable; ethylene oxide's longer required aeration time at the end of the sterilization cycle to vent the gas.3

Alternative technologies to ethylene oxide include vaporized hydrogen peroxide, gas plasmas, ozone, peracetic acid, and chlorine dioxide. Some of these new technologies have been cleared by the Food and Drug Administration (FDA) and are commercially available, including peracetic acid plasma sterilization.

IDEAL PROPERTIES OF LOW TEMPERATURE DISINFECTANT:⁴

- high efficacy
- rapid activity
- strong penetrability
- material compatibility
- nontoxicity
- ability to withstand an organic load
- and cost-effectiveness

Although 1% sodium hypochlorite and 2% glutaraldehyde have been widely recommended for disinfection, these chemical agents are not the ideal for this purpose. Sodium hypochlorite is a bleaching agent and may interfere with the esthetics of the prostheses. Glutaraldehyde releases toxic vapors, irritants and allergens, which cause eye, nose and throat irritation, allergy, contact dermatitis, asthma and rhinitis. In addition, it should be used in well-ventilated places and requires the use of masks, gloves and eyeglasses. Items immersed in glutaraldehyde, must be well thoroughly washed in running water to avoid the release of toxic product residues.

Table 1: oxidation capacity of various disinfectants

Disinfection	EV (elektronic volts)
Ozone	2,07
Peracetic acid	1,81
Chlorine dioxide	1,57
Sodium hypochlorite	1,36

PERACETIC OR PEROXYACETIC ACID (PAA)

Peracetic or peroxyacetic acid (PAA) is a strong oxidizing agent

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used for high level disinfection and sterilization at low temperatures. Peracetic acid-based disinfectants seem to be a good option for disinfection, in addition to being effective against aerobic and anaerobic microorganisms.

It is a safe material for the patient, operator and environment. This is water soluble, a non-toxic material, is not allergenic at low concentrations and does not have residual adverse effects. Peracetic acid has been used in medicine and dentistry for disinfection of thermo sensitive devices.

Peracetic acid is highly biocidal oxidizer that maintains its efficacy in the presence of organic soil. Peracetic acid removes surface contaminants and works fast and is effective against bacteria, fungi, viruses and spores. Unlike most chemical disinfectants, peracetic acid-based disinfectants are not inactivated in the presence of organic matter. Furthermore, peracetic acid does not leave residues and does not produce harmful byproducts because its mechanism of action involves release of free oxygen and hydroxyl radicals decomposing in oxygen, water and acetic acid.

Sterilife® peracetic acid-based disinfectant (Lifemed Produtos, São Paulo, SP, Brazil) was introduced to the market in 1998 and has been indicated for high-level disinfection and sterilization of critical and semi-critical articles.

MANUFACTURING

Peracetic acid (C2H4O3) is a mixture of acetic acid (CH3COOH) and hydrogen peroxide (H2O2) in a watery solution. This organic peroxide is a colorless liquid with a characteristic acrid odor reminiscent of acetic acid. It can be highly corrosive.

Peracetic acid is a weaker acid than the parent acetic acid, with a pKa of 8.2

Peracetic acid is produced industrially by the autoxidation of acetaldehyde:^{1,4}

$O2 + CH3CHO \rightarrow CH3CO3H$

It forms upon treatment of acetic acid with hydrogen peroxide with a strong acid catalyst:

 $H2O2 + CH3CO2H \rightleftharpoons CH3CO3H + H2O$

As an alternative, acetyl chloride and acetic anhydride can be used to generate a solution of the acid with lower water content.

Peracetic acid is usually produced in concentrations of 5-15%.

MECHANISM OF ACTION

Peracetic acid acts by oxidating the sulfur (SS)- and sulfydryl (SH)-bonds of the outer cell membrane, cytoplasmatic content and genetic material, oxidizing enzymes essential to chemical reactions for cell survival and reproduction ^{4,5} Peracetic acid is a peroxidate that acts rapidly against all microorganisms even at low concentrations.

PAA could possibly dislocate the chemosmotic function of membrane transport through rupture or dislocation of cell walls, which impedes cellular activity.⁶ Intracellular PAA may oxidize essential enzymes impairing vital biochemical pathways, active transport across membranes, and intracellular solute levels.⁷ PAA inactivates catalase, an enzyme known to detoxify hydrogen peroxide .³ Anaerobes are particularly sensitive to PAA as they lack both catalase and superoxide.³ PAA is also a protein denaturant

EFFECTIVENESSASAGERMICIDE

A number of studies for various antimicrobial applications have been carried out on solutions of PAA to show their efficacy. PAA was found to be bactericidal at 0.001%, fungicidal at 0.003%, and sporicidal at 0.3% in early studies by Greenspan and MacKeller.⁷ As noted by Block4, near ambient temperatures, PAA will inhibit and kill gram-positive and gram-negative bacteria, fungi, and yeasts in 5 min or less at less than 100 ppm. It is noted in the studies of Baldry ⁸ and Orth and Mrozek ⁹ that the activity of PAA is higher at higher temperatures (20-25 vs. 4-5°C) and at lower pH. ^{10,11}

Sporicidal activity increases with higher concentrations and higher temperatures .^{12,13} In the work by Lensing and Oei1^{4,} the sporicidal time concentration product for glutaraldehyde was 32 times higher and that for formaldehyde was 64 times higher than that for PAA against Bacillus anthracis. PAA has also been noted to destroy pyrogens.^{15,16} The effect of PAA is not diminished when used in combination with detergents.¹⁷ Peracetic acid is a very powerful oxidant; the oxidation potential outranges that of chlorine and chlorine dioxide

Table 1: oxidation capacity of various disinfectants

Disinfectant EV (elektronic volts)Ozone2,07Peracetic acid1,81Chlorine dioxide1,57Sodium hypochlorite1,36

PERACETIC ACID EFFECTIVITY

Peracetic acid can be applied for the deactivation of a large variety of pathogenic microorganisms. It also deactivates viruses and spores. Peracetic acid activity is hardly influenced by organic compounds that are present in the water.

However, pH and temperature do influence peractetic acid activity. Peracetic acid is more effective when the pH value is 7 than at a pH range between 8 and 9. At a temperature of 15 °C and a pH value of 7, five times more peracetic acid is required to affectively deactivate pathogens than at a pH value of 7 and a temperature of $35 \,^{\circ}$ C.¹⁰

CONCLUSION

When properly used, disinfection and sterilization can ensure the

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safe use of invasive and non-invasive dental devices. However, current disinfection and sterilization guidelines must be strictly followed. It can be concluded that disinfection with the proposed agents did not produce significant alterations of the impressions and the peracetic acid could be considered a reliable material to disinfect semi critical items.

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Review Articles

ROLE OF IATROGENIC FACTORS IN PERIODONTAL DISEASE: THE PRESENT PERSPECTIVE

Rasveen Kaur, Supreet Kaur Thind, Shiva Gupta, Surinder Sachdeva

ABSTRACT

Iatrogenic damage in dentistry has been known to exist right from the earliest records of the field, when magic played an important part in the treatment of dental ills, and people had odd beliefs concerning teeth. .With the advent of mechanical dentistry and various advances made in the understanding of disease processes, the onus of cause of iatrogeny shifted from inadequacy of knowledge to improper application of the newly gained knowledge. This paper addresses the iatrogenic factors in dentistry.

Keywords: Biologic width, bone loss, gingivallaceration, iatrogenic factors, occlusal trauma periodontium, plaque, recession

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The word 'IATROGENIC' has its origins from Greek words 'Iatros' - physician and 'Gennan' meaning to produce i.e. "resulting from the activity of physicians". The term is applied to any adverse condition in a patient occurring as a result of treatment by a physician or surgeon, especially to infections acquired by the patient during the course of treatment.¹

Since Hippocrates advised his disciples, "Primum non nocere" (first, do no harm). Man also has long been aware of the hazards of the dentist-patient relationship, as well as the benefits. It should not be assumed that iatrogenic disorders always stem from malpractice, or poor practice, in some instances they are unavoidable consequences of treatment or they are unforeseen consequences of dental treatment.²

RESTORATIVE DENTAL PROCEDURES AFFECTING THE PERIODONTIUM

Properly designed and created dental restorations provide functional stimulation and contribute to and support the periodontium. Conversely, the healthy periodontium is essential to the proper function of the restoration.³

Physiologic dimensions of periodontium

In 1962, Cohen defined "biologic width" of supracrestal gingival tissue as those junctional epithelial and connective tissue elements of the dentogingival continuum that occupy the space between the base of the gingival crevice and the alveolar crest. This term was based on the work of Garguilo et al 1961, who described the dimensions and relationship of the dentogingival junction in humans. The mean dimensions are:

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a. Sulcus depth of 0.69mm

b. An epithelial attachment of 0.97mm

c. A connective tissue attachment of 1.07mm

Based on this work, the biologic width is 2.04mm, which represents the sum of the epithelial attachment and connective tissue measurements.⁴

If the tooth preparation margins are placed into the zone of the biologic width leading to violation of biologic width resulting in an inflammatory response with alveolar bone resorption, increased pocket depths, exacerbation of accumulation of subgingival bacteria and periodontal breakdown.⁵

[A] IATROGENIC FACTORS DURING TOOTH PREPARATION

i) Rubber dam placement

The rubber dam is placed to isolate one or more teeth from the oral environment but it often interferes with adequate intracrevicular margin extension causing migration of epithelial attachment and abrade the root surface. Precautions must be taken to prevent excessive gingival abrasion with stones or burs especially where the zone of attached gingiva is insufficient or where the surrounding gingival tissue is thin and delicate.³

ii) During retraction

The chemicals in the retraction cords diffuse in blood circulation through crevicular epithelium, which being semi-permeable cause vasoconstriction resulting in transient gingival shrinkage, transient ischemia and help to control seepage of blood or GCF6 Histopathological evaluation in humans show that gingival retraction with the cord caused destruction of the junctional epithelium and the average postoperative gingival recession seen as 0.2 ± 0.1 mm.⁷Forceful wedging of gingival retraction cord injures the gingiva and damages the epithelial attachment resulting in immediate haemorrhage into the area of the gingival sulcus.⁸

iii) Cavity and crown preparation

During tooth preparation, vibration irritates the periodontium leading to laceration of the periodontal ligament fibres, injury to the adjacent gingival tissue causing recession thereby depleting the entire zone of attached gingiva.^{9,10}

[B] IATROGENIC FACTORS DURING PLACEMENT AND CEMENTATION OF RESTORATIONS

i) Margins of the restoration

The location of the restorative margin depends on factors like esthetics, need for additional retention of restoration, degree of personal oral hygiene, susceptibility of the individual to root caries, susceptibility of the marginal gingiva to irritants, morphologic characteristics of the marginal gingiva, degree of the gingival recession and severe cervical abrasion.¹⁰

The margin placement is of three types:

- 1. Supragingival
- 2. Equigingival
- 3. Subgingival

Usually periodontal tissues show more signs of inflammation around crowns with subgingival margins than those with supragingival margins due to defective margins, inaccurate fit, roughness of the tooth–restoration interface, improper crown contour and violation of the connective tissue attachment and greater pathogenicity of the subgingival dental plaque.¹¹

ii) Contours of the restoration

The undercontouring caused no apparent gingival pathoses, whereas overcontouring leads to inflammation, the collection of debris; decrease the access for oral hygiene; hyperplasia, scant keratinization and destruction of the fibres of the gingival collar.¹² **iii) Restoration overhangs**

It is defined as an extension of restoration material beyond the

confines of a cavity preparation.¹³

Overhangs contribute to periodontal disease by complicating plaque control, violates the biologic width, impinges on the interproximal embrasure space and cause displacement of the gingiva leading to furcation involvement. Changes in the subgingival microflora after the placement of restorations with overhang leads to the initiation of periodontal disease associated with iatrogenic factors.^{14, 15, 16}

iv) Interproximal contact relationship

The proximal contacts determine marginal ridge relationships, occlusal embrasure form, buccal and lingual embrasure form, which in turn affect the health of the interdental tissues ³Tilting causes discrepancies in the marginal ridges. Marginal ridges of unequal height or of improper contour encourage food impaction and retention leading to interproximal bone loss.Excessively wide contact obliterates interdental embrasure causing hyperplastic bulging of the interdental papilla.³

IATROGENIC ENDODONTIC PROCEDURES AFFECTING THE PERIODONTIUM

Procedural errors during root canal treatment: the irrigants, medicaments, dressings, sealers, and filling materials have the potential to cause major destructive inflammatory processes in the periodontium.¹⁷

[A] Perforations during Endodontic treatment

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Perforations caused by creating a ledge in the canal wall. Using too large or too long an instrument and either perforating directly through the apical foramen or "wearing" a hole in the lateral surface of the root by over instrumentation (canal "stripping") causes injury to the periodontal ligament.¹⁷

[B] Post and core techniques

Misdirected post space preparation can lead to exacerbation of a preexisting periodontal lesion and development of a periodontal abscess with acute pain, swelling, drainage of pus from the pocket, increased tooth mobility and loss of fibrous attachment. Inflammatory lesions in the marginal periodontium as manifested by increased probing depth, suppuration, increased tooth mobility and loss of fibrous attachment may result from an undetected or unsuccessfully treated root perforation.¹⁷

[C] Vertical root fracture

It is an incomplete or complete fracture line that extends through the long axis of the root toward the apex. The etiology of vertical root fractures includes excessive root canal shaping during endodontic treatment, excessive hand pressure during lateral or vertical compaction of gutta-percha, excessive restorative procedures and inappropriate choice of tooth for a bridge abutment. Careful probing reveal a narrow isolated periodontal defect in the gingiva and radiographically thickening of the PDL is seen with deep localized vertical bone loss and periradicular bone loss.¹⁸

IATROGENIC PROSTHETIC PRODECURES AFFECTING THE PERIODONTIUM

Pontics are the artificial teeth of a partial fixed dental prosthesis (FDP) that replaces missing natural teeth, restoring function and appearance. These pontics create immense difficulties for self-performed plaque control, and therefore tend to initiate inflammation.¹⁹

[A] Improperly Designed Partial Dentures

Improperly designed clasps cause damage to the abutment teeth by exerting excess stress resulting in occlusal trauma.When pontic area is more than the abutmentitviolates Ante's law leading to plaque retention and creates harmful pressure on the gingival.¹⁹ **[B] Clasp impinging onto the gingiva**

There is constant irritation to the gingival tissues leading to plaque retention, increased gingival bleeding, inflammation of the gums, periodontal pocket formation & bone loss.¹⁹

[C] Prosthetic replacement that creates excessive forces on the antagonist teeth

If the premature contact is on a natural tooth, damage to the tooth or its periodontal ligament may occur. If the saddle bears the brunt of the force of closure leads to localised mucosal inflammation

and resorption of the underlying bone.²⁰ IATROGENIC EXODONTIC PROCEDURES AFFECTING THE PERIODONTIUM

Injudicious tooth removal often can initiate periodontal disease or aggravate an existing pathosis in the vicinity of the extraction. In tooth extraction, some common errors in technique that affect the periodontium are manner in which facial and lingual flaps are raised, the teeth are luxated and elevated, degree of post extraction debridement, way in which the wound is closed.

i) Extraction of the third molars

Removal of the bone overlying the crown of an impacted wisdom tooth directly in contact with the distal root of the second molar which is not separated by a bony septum result in the formation of a deep periodontal defect on the distal aspect of the second molar. Epithelium may migrate down into the defect and prevent bone fill resulting in periodontal pocket formation.²³

Injudicious use of the forceps or elevators during luxation, elevation, and extraction may result in crushing injuries to the alveolar bone.²¹Other factors that play a role in the development of lesions on the distal surface of second molars, include the presence of visible plaque, bleeding on probing, root resorption in the contact area.²²

IATROGENIC ORTHODONTIC PROCEDURES AFFECTING PERIODONTIUM

Orthodontic therapy may affect the periodontium by favoring plaque retention, by directly injuring the gingiva as a result of overextended bands, by creating excessive forces on the tooth and supporting structures. Other adverse effects after orthodontic treatment include damage to the periodontal tissues (e.g. gingival recession, marginal bone loss) and tooth substance (eg, root resorption). Allergic reactions to the materials of the appliances and mandibular dysfunction are also reported.²⁴

[A] Circumstances before therapy

Proper case selection is important: Age group ranging from 12-15 years, incidence of any periodontal disease in children, oral hygiene status, gingival width & biotype and type of tooth movements to be performed.²⁵

[B] Circumstances arising during therapy

i) Plaque retention

Bands, brackets and arch wires can easily disturb the biologic balance of the oral cavity and allow increased plaque accumulation. The placement of bands in subgingival areas alters the environment within the sulcus. Once bands are placed, one cannot avoid band extension below the crest of the interdental gingiva.²⁵

The placement of orthodontic bands in the absence of optimal oral hygiene will promote the growth of subgingival plaque causing shifts in bacteriological composition. The abilty to fit the bands by stripping to gain space cause direct trauma to the soft tissue.¹⁰

ii) Gingival inflammation

During orthodontic treatment, increased retention sites for microbial samples, which cause gingivitis and decalcification. Baer & Coccaro noted that gingival enlargement occurs after placement of a fixed appliance which improves within 48 hours of the appliance being removed.²⁶

iii) Effect on the periodontium

Effect on periodontal health status starts immediately after bonding resulting in greater plaque accumulation, tendency for bleeding, and increased pocket depth more frequently for molars with orthodontic bands with greater interproximal loss of attachment.²⁷

iv) Alveolar bone loss

The orthodontic treatment aggravate a pre-existing plaqueinduced gingival lesion causing loss of alveolar bone and periodontal attachment.

The mechanical forces cause sublethal damage and stimulate a hyperplastic tendency in the tissue components increasing the amount of glucose aminoglycans responsible for possible relapse.²⁸

v) Recession

Orthodontic bands should not be forcefully placed beyond the level of attachment because this will detach the gingiva from the tooth resulting in apical proliferation of the junctional epithelium with an increased incidence of gingival recession. If more torque is incorporated into the arch wire, the magnitude of force is increased and the apex may be displaced through the cortical bone resulting in a fenestration.²⁸

vi) Root resorption

Orthodontic forces usually result in bone remodelling and repair, excessive orthodontic forces increase the risk of apical root resorption.²⁸

1.Magnitude of force: Continuous heavy forces cause resorption, whereas the pause in treatment with intermittent forces allows the resorbed cementum to heal and prevents further resorption²⁸

2. Direction of tooth movement: If the movement of torque is not performed carefully, the apices of these teeth may be forced against the dense alveolar bone with shortening of the roots.²⁸

3.Intrusion: It usually change the position of dental plaque from supragingival sites to subgingival sites resulting in formation of infrabony defects and loss of connective tissue attachment.²⁸

[C] Circumstances arising after therapy:25

Root proximity – stripping or tilting, movement of roots outside confines of alveolar process, loss of attached gingiva, post treatment occlusal status.

IATROGENIC PERIODONTAL PROCEDURES

A) Non surgical iatrogenic factors:

i) Hand instrumentation

The instrument design, the proper instrument and the correct area in which it will be performed is essential for the dental procedure.

1. Sharpness of instruments: Dull instruments lead to incomplete calculus removal and trauma to the gingiva because of the excess force applied to compensate for their ineffectiveness.

2. Finger rest: A good finger rest prevents injury and laceration of gingiva.

3. Instrument activation – adaptation: A curette improperly adapted cause trauma and discomfort as the toe or sharp tip will jut out into soft tissue.

4. Angulation: Of < 45 degrees &> 90 degree, the cutting edge will not engage the calculus properly instead, it will slide over the calculus, smoothing or burnishing it.

5. Lateral pressure: Repeated application of excessively heavy strokes nicks the root surface.

6. Instrumentation Roughness: Root debridement with a fine-grained diamond point causes extensive roughness which promotes more subgingival bacterial colonization than smoother curette-treated surfaces.¹¹

ii) Scaling in shallow pockets

Sub gingival scaling in shallow pockets results in undesired gingival recession and attachment loss.²⁹

iii) Periodontal abscess: Inadequate scaling leads to incomplete calculus removal which during the resolution of the inflammation at the coronal pocket area will occlude the normal drainage leading to the abscess formation.30

iv) Polishing: Abrasive effect of air-powder polishing devices using sodium bicarbonate on cementum and dentin show tooth substance loss causing transient damage to the gingival tissues. Aggressive use of the rubber cup with any abrasive may remove the layer of cementum, which is thin in the cervical area.

v) Dentin sensitivity: Sensitivity from scaling and root planing therapy develops one week after treatment due to the presence of a smear layer formed when dentin is cut or abraded.¹¹

[B]Surgical iatrogenic factors:

(i) Improper suturing : Sutures pull the flap beyond its passive

positioning creating tension on the flap interfering with the blood supply to the gingiva thereby hindering the wound stability resulting in necrosis of the marginal portion of the flap.

(ii) Laterally positioned flap can result in mucogingival defect in the donor site which can be avoided by using a partial thickness flap or by placing the coronal aspect of the incision in a sub marginal location in the donor site.

(iii) Dental implants:

1. When implants are placed too close to the adjacent the neighbouring tooth: Resorption of the interproximal alveolar crest to the level of that on the implant, reduction in the papillary height, vertical bone loss on adjacent teeth.

2. When implants are placed too coronally: Circumferential bone loss, undesired soft recession, reduction in the facial bone height.¹¹

CONCLUSION

A healthy periodontium is a pre-requisite for any form of dental treatment to be given. The skill, experience and up to date knowledge of dentists are the main factors to prevent possible iatrogenic traumas. Dentist should also bear in mind the consequences of reckless and unplanned treatment because in the process of eliminating one problem there may be birth of another with greater consequences in terms of tooth loss. Thus, in an interdisciplinary approach the periodontal health should be given due consideration before ,during and after any treatment modality. Although "To err is human," careful practice is very important for the principle "Primum non nocere" ("First do no harm").

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Review Articles

PREWARMING OF COMPOSITES: A CRITICAL ANALYSIS

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ABSTRACT:

Improving the adaptation of resin composites during placement is necessary to increase durability and reduce microleakage. Pre warming of composite for enhancing the mechanical properties like degree of conversion and reducing the viscosity and increasing marginal adaptation of the restoration is well adapted technique to be followed. Heating the composite also decreases the curing time this adds the benefits of greater depth of cure and increase chemical conversion. Thus avoiding incomplete polymerization that can lead to significantly increased wear decreased mechanical strength.

Keywords: Composite, preheating, prewarming

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INTRODUCTION

The increasing demand among patients for esthetics has led to the widespread use of tooth colored composite resins for the restoration of both anterior and posterior teeth. The ideal composite resin for posterior teeth would exhibit high strength and wear resistance, low shrinkage to prevent untoward stress on the adhesive bond, and low viscosity to ensure adaptation to tooth structure.¹ Unfortunately these desirable characteristics are often at odds with one another. High viscosity and stickiness of highly filled composite makes insertion and adaptation of the material to the prepared walls difficult. Poor adhesion between the dentin and restorative material leads to gap formation ultimately leading to micro leakage. The increase in flow ability by decreasing the filler concentration results in decrease in physical properties and an increase in polymerization shrinkage.²

Although various researches have been done regarding the placement technique to reduce polymerization shrinkage but there has been a little attention paid to the properties of the directly placed composite under varying thermal conditions.³

Viscoelastic materials such as composite resins exhibit decreased viscosity and greater flow ability with an increase in temperature. Viscosity of the composite can be decreased by taking the advantage of viscoelastic property of resin by increasing the temperature before placement. So taking this in consideration and to improve the properties of composite resin, more recently the concept of pre heating of the composite before placing it in the cavity was introduced by Bertolotto et al,⁴ with preheating polymerization process is accelerated and completed to more extent. There by, leading to higher surface hardness, flexural

strength, flexural modulus, fracture toughness and diameteral tensile strength. The wear resistance is also known to be increased. Preheating of composite resin make more durable, highly filled, highly viscous conventional resin to reduce the viscosity, to provide flow values that are similar to that of less filled, flow able composite resins without undermining the mechanical properties.³

Thus the purpose of this review article is to critically analyse all the studies/reports related to this concept of pre warming of composite.

SCIENTIFIC EXPLANATION FOR EFFECT OF PREHEATING

Preheating of composite results in reduced viscosity; along with additional advantage of improved degree of monomer conversion, polymerization rate, hardness and reduced curing time.

REDUCED VISCOSITY-

The viscosity of the resin decreases and flow increases by heating them prior to placement and curing.⁵Preheatingof composites puts the monomer in the state of thermal agitation. As a result of high thermal energy, there is increase in molecular motion and thus enhancing fluidity. The flow increases and subsequently adapts more easily to the intricacies of the cavity.

IMPROVED DEGREE OF MONOMER CONVERSION

On average, resin composites can achieve 50%-70% conversion of monomer at room temperature. During polymerization, monomer conversion occurs as soon as exposure to light is initiated. As the reaction progress, the viscosity of the resin composite increases through the formation and growth of polymer chains, which result in decreased molecular movement. The increased viscosity prevents completion of polymerization process because movements of molecule in this vitrified state become limited. Prolong curing temperature do not increases the degree of polymerization further. Conversely, preheating of composites; increases monomer mobility and ultimately thermal energy which lead to enhance molecular motion. The collusions frequency of unreacted active groups and radicals also increase with elevated curing temperature when it is below glass transition level. Delay in both propagation and termination of diffusion controlled reaction permit enhanced conversion, such delay result in greater number of collisions since free radicals are able to diffuse and react before self-deceleration occurs, which in turn increases the degree of monomer conversion before vitrification. Daronch M et al6observed that increase in polymerization temperature increases the conversion of dimethacrylate monomers but only to certain limit. This occurred due to reactant

			CRITI	Cal A	ANALYSIS				
÷	YEAR	AUTHOR	TEMPERATURE (in ° C)	FLOW	MARGINAL ADAPTATION/	DEGREE OF CONVERSION	HARDNESS	BOND STRENGTH	CONCLUSION
	2003	Bortolotto and Krejci ⁴	40		MICROLEANAGE		+		Surface hardness increased as compared to composites inserted at 22°C. The hardness values were almost double. Curing tie could be halved for 2mm increment if composite is prewarmed to 40°C
	2004	Aksu M N et	54		+				Less micro leakage seen at cervical margin in teeth with preheated composite as compared with flowable composite
	2004	Wagner W C et al ¹⁴	54				+		Preheating caused minor changes, overall hardness was affected by curing depth
	2004	Trujillo M et	23 to 70			+			Increased rates and conversion thus leading to improved
	2005	Daronch M ⁶	3 to 60			+			Greater conversion, shorter exposure duration
	2006	DaronchM et al ¹⁶	60		+				Neither the restorative material type nor the preheating affected the microleakage in Class I and Class V cavities
	2006	Broome J C ²⁰	55 and 60	+					Preheating at 55 to 60 ° C provided effective increase in flowability from 5 to 76%
	2006	Conditt and Leinfelder ²¹	54	+		+			Increase in flow by 80%
	2007	Prasanna N et al ¹⁰	40, 50, 60			+			Monomer conversion and residual stresses are also increased
	2007	Awliva W Y ⁷	37				+		Prewarming increased the polymerization of composite especially in deeper areas of restoration.
	2007	Papacchini E et al ¹	4 to 37					+	NICCONSTRAINESS OF TOP and BOTTO OF restoration increased. Interfacial quality improved by raising temperature from 4° C to 37° C
	2008	Wagner W C et al ²²	54.4		+				Indicated that the marginal adaptation improved by preheating
	2008	Munoz C A et al ²³	70,100,140			+	+		The monomer conversion rate, depth of cure and hardness of tested composite was seen. Shorter polymerization times with a pre heated resin can produce similar hardness values as a room temperature resin with <u>longer_curing</u> times.
	2008	<u>Uctasli</u> M B et al ³	40, 45, 50						No correlation was found between preheating and flexural strength and modulus of composite
	2008	<u>Cantaro</u> A et al ²	4, 24, 37, 60					+	Preheating the composite to 60° C enhance the interfacial strength and adaptation of <u>Panavia</u> , but it is of no use with Rely X Unicem as curing is accelerated and cement sets at time of dispensing.
	2009	LucevS et al ³	60				+		Preheating reduces the viscosity and enhances the surface hardness
	2009	Jin M U ²⁴	4, 17, 48, 56			+	+	+	Shear <u>bondstrength</u> , <u>microhardness</u> , degree of conversion were higher with high temperature (i,e 56°C)
	2009	Walter et al ¹¹	37, 54, 68	+	+				Preheating composite to relatively high temperature(54,68) to increase flow and adaptation causes an increase in volumetric shrinkage.At body temperature , composite shrinkage is similar to that at room temperature
	2009	Lohbauer U et al ²³	10 to 68			+			No significant increase in immediate as well as final degree of conversion from preheating at 68° C compared to 54 and 39° C
	2010	Froes- <u>Salgoda</u> N R ¹³	68		+	+			Preheated composite showed increased marginal adaptation than room temperature composite which showed higher <u>puber</u> of gaps irrespective of the energy density mainly in axial walls.
	2010	EI-Korashy D I	37,54,68			+			Preheating of resin composite prior to curing increased its DC but also increased its Post gel shrinkage strain.
	2011	Agostinho dos Santos R E et al ²⁷	23,54,60		+				The group preheated to 60°C showed no difference when compared to the group heated to 23°C. Preheating the resin composite (54°C and 60°C) did not improve the microleakage means when high-irradiance LED was used; however, it decreased the microleakage means when a QTH with low irradiance was used
	2011	Nada K and El- <u>Mowafy</u> O ²⁸	37, 54				+		Surface hardness, compressive strength & diametral tensile strength was significantly increased by prewarming of composite.
	2011	Deb S et al ²⁹	22,60	+	+				Prewarming enhanced the flow and did not significantly affect other properties
	2011	Torres R G C ³⁰ Choudbary N	5,24,54 37 54		+			+	Preheating increased the microhardness Better adaptation was seen at 54° C increased adaptation and
		et al ³¹							lowered gap surface area. Posterior composite proved better for class II restorations than universal <u>nanohybridFiltes</u> 2350
	2012	Karaarslan E S et al ³²	24,54,68,		+				Microleakage was higher at gingival margins than at occlusal
	2012	Arslans et al ³³	4,25,37,60		+				Preheating showed reduce microleakage values
	2013	et al ¹⁸	45						riexural strength was not affected by preheating
	2013	Didron P P et al ⁹	37 and 60		+				Preheating to 60° C resulted in less microleakage and increased polymerization contraction stress of composite
	2014	Ayub K V et al	37,68	+		+	+		Preheating increased microhardness and decreased viscosity and greater monomer conversion

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evaporation and photo initiator degradation. INCREASED POLYMERIZATION RATE-

By pre-heating of composites similar degree of conversionas at room temperature can be achieved even after reducing the exposure time to a great extent. The theory being that even though fewer radicals are formed due to shorter exposure time, there is a greater mobility due to increased temperature, and therefore a greater conversion rate.⁷DaronchM et al⁶ suggest that the curing time may be reduced by up to 75% with preheating of composites. It was found that, shorter polymerization time with a preheated resin can produce similar hardness values as a room temperature resin with longer curing time. Bortolotto and Krejci⁴ found that curing time for a standard 2mm layer of composite at room temperature e(22° C) could be halved when it was warmed to 40° C, without affecting its hardness properties. Trujillo M and Stansbury JW8 found that depending upon the composite used, 8% to 17% increase in the degree of cure can be achieve and curing time is reduced by 50% to 80%.

ENHANCED MECHANICAL PROPERTIES-

The mechanical properties of a material are dependent on the characteristics of polymer network i.e. density of cross links. The temperature increase of the composites before photo-activation provides higher mobility of the radicals, resulting reduction of the viscosity of the system, increased conversion rate and degree of conversion of monomers. Thus, increase in conversion rate and degree of conversion provides more cross links therefore, better mechanical properties and increased wear resistance.

In various studies polymerization rate and overall monomer conversion were reported to be higher at the top surface of preheated specimen.6

Bortolotto and Krejci4 found that restorations inserted at 40° C were significantly harder than the composite restorations inserted at room temperature (22 °C). the hardness value at 40 C were approximately double than the composites done at 5 °C(selected because this is the temperature of a commercial refrigerator).

POLYMERIZATION SHRINKAGE-

Preheating composites to relatively high temperature (54 °C or 68 °C) to increase its flow and adaptation results in an increase in volumetric shrinkage. Didronet al⁹ found that preheating of composites leads to significant increase in polymerization contraction stress in composites. Preheated composite produces thermal contractions along with polymerization shrinkage which ultimately increases shrinkage of the composite during curing. Moreover, Prasana et al¹⁰ found that preheating of composite

increases degree of conversion as well as rate of polymerization thus resulting highly crosslinked polymer with increased contraction stresses.

Waltter¹¹ demonstrated that at body temperature, composite shrinkage was similar to that at room temperature. A delay in curing preheated composite may allow the thermal contractions to take place in the unset composite and minimize the contribution of thermal contraction of the composite from pulling away from the cavity walls.

REDUCED MICROLEAKAGE-

This is in contrast with several studies that have shown a direct relationship between contraction stresses and marginal leakage in resin composite restorations which can contribute to problems like microleakage and post-operative sensitivity etc. but with preheating of composites even after increased contraction forces there are reduced microleakage at the margins.¹²This may be explained as, preheating of composites results in increased flow and ability of the operator to closely adapt the material to tooth structure. If heating improves the adaptation of a highly viscous or sticky material to the preparation, a slight increase in polymerization shrinkage would be an acceptable compromise.¹¹ Froes Salgado et al¹³ and Wagner et al¹⁴ found that preheating of composites to tooth structure and significantly reduced microleakage.

LIMITATIONS OF PREHEATING

A concern regarding preheating is the impact of the elevated temperature on pulp tissue and on the properties of composite itself due to elevated temperature and repeated heating.

EFFECT ON PULPAL TEMPERATURE-

Commercially available pre heating devices are used at a temperature ranging from 37° -68°C, which is questioned regarding the pulp compatibility in deep cavities specially regarding damaging increase in intra-pulpal temperature of more than 100 C.¹⁵

The pulp vitality may potentially be compromised by rise in temperature of pulp greater than about 5°C from the baseline level of application i.e. 32 - 34°C.

Various studies have demonstrated that preheating of composite did not significantly increase the intrapulpal values when compared to that delivered at room temperature. Ruggerberg¹⁶indicated that the maximum intra-pulpal temperature rise from the application of a 57.2 0 C composite material was approximately 1.60C, which is well within the established pulpal tolerance.Friedman¹⁷ also found that Insertion of composite resin heated to 130 F into cavity preparation results

in a pulpal temperature rise of only 1.6° C (2.9 F) when 1mm of dentin remains. However, heating the composite to a temperature higher than 60 C may not be advisable in the clinical scenario.

Once composite is preheated the heated composite cools rapidly because of the time delay between dispensing it from the syringe or from the compule and placing it in the preparation. After 45 sec the average temperature decline ranged from 5.2 °C to 8.7 °C. Moreover, once heated composite is placed to the cavity, tooth act as a heat sink, which aids in rapidly decreasing temperature of warmed composites.

The heated composite may cool down rapidly, decreasing the benefits of heating. But even if it cools to below 50 °C, to about 40 °C, benefits may still be seen in comparison to that of room temperature composites.

PREMATURE POLYMERIZATION-

With preheating of composite, one concern might be that polymerization may occur if the compule are left in the heater for an extended period of time. JW Stanbury⁸ found that compule can be left in the unit for upto 8 hours without causing premature polymerization of the composite.

EFFECT OF REPEATED HEATING-

As a general consensus in the literature on the absence of harmful effect of preheating procedures on the mechanical properties of resin composites. Daronch⁶ and others reported that neither prolonged preheating nor 10 repeated continuous preheating cycles (cycles of 15 minutes from room temperature to 60 °C) affected the degree of conversion of preheated composites compared with composites maintained at room temperature. However, Amario MD et al¹⁸ concluded that highly repeated preheating cycles (40 preheating cycles to a temperature of 45 C) seem to negatively influence the flexural strengths of three commercially available resin composites. They found that even highly repeated cycles of preheating to a temperature of 39C did not negatively influence the mechanical properties of the resin composites tested. Heating the composites several times causes no problems with the materials. Daronch et al⁶ found that no polymerizable components were lost upon heating, nor there was any degradation of monomer during different heating treatments. **HEATING TEMPERATURE-**

Rueggeberg16 demonstrated that once the filling material was at body temperature, the next 20 °C of warmth did not significantly reduce the curing time. At 58 °C there was another major advance in the conversion ratio, which then remained constant for next 10 °C. this indicates that ideal warming of composite should be to the lower level of each of these thermal windows, either body temperature (37 $^{\circ}$ C) or a slighter higher temperature (58 $^{\circ}$ C) however; greater temprature rise can lead to evaporation and pulpal damage.

CLINICAL RECOMMENDATIONS-

Preheating procedure do not causes any pulpal damage or negatively influence the mechanical properties of the resin composites even when highly repeated. Within a temperature limit preheating procedure can be steadily adopted without compromising the mechanical properties of heated composites.

Generally composites are refrigerated until just immediately prior to use and in between patients as well. But probably this is the worst possible course of action. To the contarary, the warming of composite immediately prior to placement in the cavity has shown to improve adaptation and properties of composites.

The era of curing composites under elevated heated conditions, long accepted and practiced during the fabrication of extra oral composite restoration, is now available for direct intraoral composite restorations. The early researches, confirmed by clinical practice, indicates that this is a practical and effective means of rapidly and easily improving composite properties in dental restorations.

It is advised to work with the composite quickly in order to ensure the least temperature drop possible and achieve the best clinical performance. Pre placement of the compule directly into the delivery syringe during compule heating seems advantageous over preheating only the individual compule.

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Review Articles

EXPOSING THE UNEXPOSED GINGIVA- A REVIEW

Nitika Gupta, Tamanna Sharma, Manu Gupta, Navneet Kukreja, Urvashi Sukhija

ABSTRACT

Various advancements have occurred in impression making for fixed prosthesis in the present era. Need of improvised materials and sophisticated techniques are propagated only with the aim to record the margins and the gingival tissues properly. Gingival retraction methods not only provide ample vision and ideal working environment, but also maintain hemostasis to certain extent. The choice of a retraction method depends on clinical situation and accessibility. This review revolves around recent advances in cordless retraction techniques.

Keywords: Cordless retraction, gingiva, tissue management, , recent advancements.

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INTRODUCTION

An objective of restorative dental procedures is the placement of dental materials to restore teeth to proper form, function, esthetics, and comfort.¹Gingival tissue management can be defined as "The procedure of temporary eversion or resection of gingiva away from the tooth surface or deepening of gingival sulcus to expose the cervical portion of tooth in order to have proper marginal finish to the restoration or by establishing a good cervical cavosurface margin to the tooth preparation.

NEED FOR THE GINGIVAL RETRACTION

1. Helps in placement and finishing of the margins on the prepared tooth

2. To widen the gingival sulcus in order to provide access for impression material to reach the subgingival margins and to record the finish line accurately.

3. Helps in obtaining a perfect die with accurate margins, which helps in margin placement and contouring of the restoration.

4. It helps the dentist in visually assessing the marginal fit and any cervical caries if present.

5. In situations where it is necessary to extend the restoration below the gingival margin to enhance retention (Bjorn et al 1970)² 6. To enhance access and to prevent damage to the soft tissue during cavity preparation procedure, it may be desirable to carry out some degree of gingival retraction prior to commencement of preparation. Generally for retraction of soft tissues, three basic methods are used: 1) Mechanical, 2) Chemo-mechanical and 3) Electrosurgical. Each type is loaded with its own pros and cons. To overcome these limitations, various newer retraction system are introduced e.g.- Expasyl, Magicfoam cord, Merocel strips, Lasers, stay put retraction cord and matrix impression system.

- Matrix impression system
- · Gingitrac
- Magic foam cord
- Lasers
- Expa-syl temporary gingival retraction system
- Merocel STRIPS
- Stay put Retraction cord

MATRIX IMPRESSION SYSTEM

Matrix impression system is a new system that requires a series of three impression procedures, using three viscosities of impression technique. It attempts to overcome the deficiencies of the older systems and at the same time incorporate their best features. A matrix of occlusal registration elastomeric material is made over the tooth preparations. Depending on the distribution and complexity of the preparations, the matrix may be made in one piece or in two or more sections. The retraction cord is removed and a definitive impression is made in the matrix of the preparations with a high viscosity elastomeric impression material. After the matrix impression is seated, a stock tray filled with a medium viscosity elastomeric impression material is seated over the matrix and remaining teeth to create impression of the entire arch.^{3,4}

This system effectively controls the four forces that are relapsing, retraction, displacement, and collapsing that impact on the gingiva during the critical phases of impression making. The design of the matrix also forces the high viscosity impression material along the preparations and into the sulcus where it cleanses the sulcus of debris and the matrix impression system uses three impression material :

A suitable elastomeric semi rigid material required to form the matrix.

A high viscosity elastomeric impression material, which will preferably bond to the matrix-forming material, required to make an impression of the preparations in the matrix.

A stock tray with a medium viscosity impression material to pick up the matrix impression and the remaining arch not covered by the matrix. (Figure 1,2,3,4,5)

Advantages

1. Eliminate chances of tearing of the sulcular flange by developing the optimal configuration.

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Clean blood and debris from the sulcus area at critical moments.
 Delivers impression material in the sulcus gently but with increased accuracy and speed.

4. Holds the sulcus open for an increased time.



Figure 1: Clear plastic carrier is selected from assortment of premade forms. Carrier may also be formed of wax.



Figure 2:Matrix is made in carrier with polyvinyl siloxane material before soft tissue is retracted.



Figure 3: Registration of gingival crest is primary objective. Tissues under attachments has to be included.



Figure 4: Matrix is painted with polyether adhesive to generate more secure bond with non-bonding materials. Impression syringe is used to fill matrix with high viscosity impression

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Figure 5: Matrix impression is seated with light pressure. Marks can be marked on the facial surface for proper orientation, as many references are covered with impression material.

GINGITRAC

material.

It is a gingival retraction paste system that uses a preloaded syringe to apply the paste around the margins. The paste contains aluminium sulphate as astringent, and if necessary, a hemostatic agent can be applied prior to its use. For single tooth use, a cap is used to apply pressure for up to 5 minutes after application of paste. The cap is first filled with the paste, and then placed over the tooth and paste is syringed around the margins. For multiple tooth preparations, a plastic tray is first used with a firm paste matrix over which the Gingitrac paste is syringed before the tray is placed over the arch and held in position for 3-5 minutes (Figure 6). For both single and multiple tooth preparations, gingival retraction is achieved through the application of pressure. The paste is removed prior to impression taking.



Figure 6: Gigitrac kit

MAGIC FOAM CORD

This is a new development. It consists of Comprecap- a hollow cotton and Magic Foam Cord, vinyl polysiloxane material designed for retraction of the gingival sulcus without the potential traumatic and time consuming packing of retraction cord. The material is syringed around the crown preparation margins and a cap (Com-precap) is placed to maintain pressure.⁵ After five minutes, the cap and foam are removed and the tooth is ready for final impression(Figure 7). The material claims to have an expansion of 160% after 5 minutes.



Figure 7: Magic FoamCord.

LASERS

Use of lasers is adjunctive in fixed prosthodontics. One of the important elements of success in fixed prosthodontics is the care and accuracy of the component treatment stages and the laser can, often, confer minimal damage of collateral tissue through proper consideration of the use of minimal laser energy of the correct wavelength.6,7

Types

Neodymium: Yttrium-Aluminum - Garnet (Nd-YAG) Lasers: The use of this type is contraindicated near tooth surface as they tend to absorb energy and heat. This heat can be transmitted to bone and may result in bone loss.

Erbium: Yttrium-Aluminum - Garnet (Er: YAG) Lasers :

These minimally penetrate the soft tissues, so they are fairly safe to MEROCEL STRIPS use.

Co2 lasers :

surfaces.CO2 lasers absorb little energy near tissue surfaces, with only small temperature increases (< 3°C) and minimal collateral damage. Also, these lasers do not alter the structure of the tissues.

Advantages

Excellent hemostasis is provided by CO2 laser.

There is reduced tissue shrinkage.

It is relatively a painless procedure and sterilizes the sulcus.

Disadvantages

Er: YAG laser is not good in hemostasis as co2 laser.

CO2 laser provides no tactile feedback, leading to risk of damage to junctional epithelium.

EXPA-SYL TEMPORARY GINGIVAL RETRACTION SYSTEM

injected into the sulcus prior to impression making. The paste is left The Merocel retraction strips tend to expand with absorption of

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washed off and impression is made. Since, passive technique is used in placing the material, expasyl is less traumatic to the tissues leading to reduced chances of bleeding. Secondly, aluminum chloride incorporated in the product is an effective haemostatic agent (Figure 8).

Advantages

Effectively achieves hemostasis Little pressure – atraumatic Less time consuming Easy removal Easy to dispense with the gun

Disadvantages

Expensive

Thickness of the paste makes it difficult to express into the sulcus. Metal tips too big for interproximal areas



Figure 8: Expasyl Paste

Merocel retraction strips are a synthetic material that is specifically chemically extracted from a biocompatible polymer The prime chromophores for CO2 laser is water, hence it reflects off (hydroxylate polyvinyl acetate) that creates a netlike strip without debris or free fragments. It can be easily shaped and adapted around the tooth.⁸ It is highly effective in absorption of oral fluids. It is not abrasive and hence provides a gentle displacement.

Method :

Tooth is initially prepared at the gingival level without retraction of the gingival sulcus. A provisional crown is lined with acrylic resin and then inserted. A gingival finish line is prepared within the intracrevicular space during the second appointment, and caution is exercised to avoid injury to the gingival tissue. A 2 mm thick Merocel retraction strip is inserted around the tooth and the provisional crown is reinserted.

The patient is asked to maintain pressure on the artificial crown This consists of an aluminium chloride containing paste, which is and concomitantly on position is sustained for 10 to 15 minutes. in sulcus for 3-4 minutes to achieve the desired retraction. It is selected oral fluids, exerting pressure on surrounding tissues to

provide gingival retraction.

The material in the intracrevicular space is removed and an impression is made. The gingival tissue returned to the original position 1 day after the surgery. The metal-ceramic crowns were cemented 1 week later (Ferrari et al., 1996).⁹

STAY PUT RETRACTION CORD

Time and again dentists are faced with a problem when placing a retraction cord: it is difficult to place in the sulcus and to keep it there. Stay-put is the answer to this problem. The pliable core is so effective that the cord is not only easy to place in the sulcus but it stays there. Overlapping is not necessary. Impregnation with aluminium chloride promotes quick hemostasis without causing any cardiovascular problems.¹⁰ Stay-put impregnated cord stops bleeding quickly and effectively and does not need to be replaced. It is quick, efficient and gives improved results.

CONCLUSION

Proper tissue management is a key factor in accurately duplicating the margins. Moreover, a particular clinical situation may indicate the specific technique. Hence the type of gingival retraction to be employed should be thoroughly thought over before using, keeping in mind the gingival tissue health and comfort of both patient and the practitioners.

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Case Report

RADICULAR CYST WITH APICECTOMY- A CASE REPORT

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ABSTRACT

Radicular cysts are common odontogenic cyst. It is a chronic inflammatory response to the epithelial rest of malassez which occurs in the periodontium of affected teeth. It involves the apex of carious tooth. It is a true cyst, sincethe lesion consists of pathologic cavity lined by epithelium and is often fluid filled. Traumatic injuries commonly affect the anterior teeth leading to slow death of the pulp. This may give rise to aperiapical or radicular cyst which results from the proliferation of cell rests of Malassez following pulpal necrosis of a non-vital tooth. This condition is usually asymptomatic but can result in a slow-growth tumefaction in the affected region. On radiography the lesion can be seen as a round or oval, well circumscribed radiolucent area involving the apex of the infected tooth. The present case, a characteristic radicular cyst, was successfully managed with root canal therapy (RCT) along with surgical enucleation followed by apicectomy. This paper presents a case of radicular cyst in 12 years old boy in the maxillary anterior region, with its complete endodontic and surgical intervention.

Key Words: Apicectomy, endodontic treatment, enucleation, radicular Cyst, non-vital tooth

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Source of Support: Nil Conflict of Interest: Nil INTRODUCTION

Radicular cysts are the most common inflammatory jaw cysts and develop as a sequel of untreated dental caries with pulp necrosis and periapical infection. Around 60% of all jaw cysts are radicular or residual cysts.¹These cysts can occur in the periapical area of any teeth, at any age but are rarely associated with primary dentition. It is more frequent in maxillary than mandibular teeth.² They are the most common found at the apices of the involved teeth, however, they may occur on the lateral aspects of the roots in relation to lateral accessory root canals. The radicular cyst is usually symptomless and detected incidentally on plain orthopantomogram (OPG) while investigating for other diseases. However, as some of them grow, they can cause mobility and displacement of teeth and once infected, lead to pain and swelling, after which the patient usually becomes aware of the problem. The swelling is slowly enlarging and initiallybony hard to palpate, which later becomes rubbery and fluctuant. Radiographically, most radicular cysts appear as round or pear shaped unilocular radiolucent lesion in the periapical region. The cyst may displace adjacent teeth or cause mild root resorption and can even cause nerve compression. The treatment options for radicular cyst can be conventional non-surgical root canal therapy when lesion is localized or surgical treatment such as enucleation, marsupialization, or decompression when the lesion is large.³The present case, a characteristic radicular cyst, was successfully managed with root canal therapy (RCT) along with surgical enucleation followed by apicectomy.

CASE REPORT

A male patient aged 12 years reported to the department of Paediatric and Preventive dentistry, Surendera Dental College and Research Institute, Sriganganagar, Rajasthan, with a chief complaint of pain and swelling in upper left front region of mouth since 6 months. On clinical examination, a diffuse localized palatal swelling was found, that was of approximately 3 x 2 cms in size extending from mesial aspect of 13 to distal aspect of 11. Anteroposteriorly, it extended 0.5 cm from the incisive papilla to 2 cms posteriorly. The swelling was tender and fluctuant on palpation (Figure 1). An Occlusal radiograph of the maxilla (Figure 2) revealed large well defined periapical radiolucency extending from, mesial aspect of 13 to distal aspect of 11. On probing and radiograph examination, there was extensive bone loss in relation to the same teeth. Vitality testing by heat test with a hot gutta-percha stick and electric pulp testing revealed no response in these teeth. On the basis of clinical and radiological investigations, a provisional diagnosis of Radicular cyst was made. The differential diagnosis included was Nasopalatine cyst, Median palatal cyst, Traumatic bone cyst, and Globulomaxillary cyst.



Figure 1: Intraoral photograph showing palatal swelling w.r.t 12 in maxillary occlusal view



Figure 2: Intraoral maxillary occlusal radiograph

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An endodontic therapy was done with respect to 12 (Figure 3). After complete blood investigations, the surgical enucleation of the cyst through a palatal approach was planned. A full thickness flap was raised, the cystic lining was clearly visible through the perforation and cyst enucleation was then carried out. The root of 12 was sealed with retrograde filling material after performing apicectomy (Figure 4).



Figure 3: IOPA X-Ray of endodontic treatment



Figure 4: Intraoral photograph showing palatal flap with cystic cavity w.r.t 12 in maxillary occlusal view

Enucleated cystic lining was sent for histopathological examination which revealed 6-7 cell layered thick, nonkeratinized stratified squamous epithelium. Connective tissue capsule showed the presence of cholesterol crystals along with acute and chronic inflammatory cells. Based on the clinical, radiological and histopathological investigations, the final diagnosis of an Infected Radicular cyst was made. Platelet Rich Fibrin (PRF) was placed in the cystic cavity and flap was secured in position with (3-0) silk sutures (Figure 5 and 6).



Figure 5: Intraoral photograph showing cystic cavity after enucleation and apicectomy w.r.t 12



Figure 6: Intraoral photograph showing repositioning of palatal flap with silk sutures in maxillary occlusal view

DISCUSSION:

Radicular cysts, with an incidence of 0.5-3.3% of the total number in both primary and permanent dentition. Occur more commonly between third and fifth decades, more common in males than in females, and more frequently found in the anterior maxilla than other parts of oral cavity.⁴That can be characteristically appreciated in the present case. The periapical cyst is the most common odontogenic cyst (52.3-70.7 percent) followed by the dentigerous cyst (16.6-21.3 percent) and odontogenic keratocyst (5.4 - 17.4 percent).⁵The choice of treatment may be determined by factors such as the extension of the lesion, relation with noble structures, evolution, origin, clinical characteristic of the lesion, systemic condition and cooperation of the patient. However, in large lesions the endodontic treatment alone is not sufficient and it should be associated with decompression or marsupialization or enucleation.⁶ In the present case, endodontic treatment was carried out. Radicular cyst also known as periapical cyst, periodontal cyst, root end cyst or dental cyst, originates from epithelial cell rests of malassez in periodontal ligament as a result of inflammation due to pulp necrosis or trauma. Pathogenesis of radicular cysts has been described as comprising of three distinct phases: the phase of initiation, the phase of formation and the phase of enlargement. Radicular cysts are usually asymptomatic and are left unnoticed, until detected by routine radiographic examination where as some long standing cases may undergo an acute exacerbation of the cystic lesion and develops signs and symptoms such as Swelling, tooth mobility and displacement of unerupted tooth.⁷ Associated teeth are always non-vital and may show discoloration. It clinically exhibits as buccal or palatal swelling in maxilla, whereas in mandible it is usually buccal and rarely lingual. At first, the enlargement is bony hard but as the cyst increases in size, bony covering becomes very thin and the swelling exhibits springiness and becomes fluctuant when the cyst has completely eroded the bone as seen in present

case.⁸Radiographically, most radicular cyst appears as round or pear shaped radiolucent lesion in the periapical region. Greater likelihood of radiolucencies being radicular cysts rather than chronic periapical periodontitis lesions with increased size of radiolucencies, particularly those over 2cm. The choice of treatment may be determined by conventional non-surgical RCT when lesion is localized or surgical treatment like enucleation, marsupialization or decompression when the lesion is large.⁹, ¹⁰This case report presents successful surgical enucleation of large radicular cyst alongside with root canal treatment followed by apicectomy. Considering patient's young age and good health, bone graft was not used. This case is a good example of a large lesion been treated with conventional endodontic intervention, cyst enucleation followed by apicectomy and later cystic cavity filled with the use of materials which enhance bone regeneration like Platelet Rich Fibrin (PRF).

CONCLUSION

The clinical case reported was managed successfully by endodontic therapy with emphasis on thorough debridement and disinfection of the root canalsystem which was followed by surgery and apicectomy. Various treatment options have been recommended depending on the size and location of cyst. However some authors propose non-surgical management of small lesions. This case presents surgical management of a large radicular cyst with endodontic treatment, followed by placement of platelet rich fibrin.

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Case Report

PLEOMORPHIC ADENOMA OF THE ACCESSORY PAROTID GLAND – A RARE OCCURRENCE IN THE MID-CHEEK REGION WITH REVIEW OF LITERATURE

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ABSTRACT

Pleomorphic adenoma (PA) is the most common tumor of the major and minor salivary glands. Rarely is it found evolving from an ectopic location of major salivary glandular tissue (accessory parotid gland) in the mid cheek. The accessory parotid gland exists in 21% of individuals. The accessory parotid gland is salivary tissue separated from the main parotid gland and lying on masseter muscle. It has secondary ducts emptying into the Stenson's duct. However, the appearance of an accessory parotid gland tumor is rare, with a reported frequency of 1-7.7% of all parotid gland tumors. Here, we report a case of accessory parotid gland PA of the cheek in a 35-year-old male with brief review.

Keywords: Accessory parotid gland, excision, midcheek, pleomorphic adenoma

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INTRODUCTION

Pleomorphic adenoma (PA), also known as benign mixed tumor, is the most common salivary tumor, constituting up to two-thirds of all salivary gland neoplasms.¹ Mostly, PA is located in the parotid glands (85%), minor salivary glands (10%), and the submandibular glands (5%).² Rarely, it can evolve from an ectopic location of major salivary glandular tissue (Accessory parotid gland) in the mid-cheek region. Accessory parotid gland (APG) tissue has been described as salivary tissue adjacent to Stenson's duct that is separate from the main body of the parotid gland.³APG are present in approximately 21% of the population.⁴ These small flat structures were once considered to be mere extensions of the main parotid gland, but it is now known that they are independent glandular units with respect to their function and anatomic location. However, APG tumors are rare with an incidence of only 1–7.7% of all parotid gland tumors.⁵

All tumor pathologies that occur in the main parotid gland may also occur in the APG. According to previous reports, the most common subtype of benign APG tumors is pleomorphic adenoma (PA).^{6,7} Here, we present case of PA of the APG in a 35-year-old male patient.

CASE REPORT

A 35-year-old male presented with a slowly growing painless swelling over the left side of cheek for the past 4 years. History revealed that the swelling was gradual in onset, appeared first intraorally and slowly attained the present size. There was no history of fever, bleeding, pain, sensory changes and disturbance

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of salivation or trauma. The past dental history and medical history was unremarkable and no other abnormalities were found. General physical examination did not reveal any abnormalities. Extraoral examination showed a mild facial asymmetry due to the diffuse solitary swelling on the right side of cheek extending supero-inferiorly from zygoma to lower border of the mandible and antero-posteriorly 1 cm away from commissure and tragus (Figure 1).Figure 1: Extra oral photograph showing diffuse swelling of right cheek



Figure 1: Extra oral photograph showing diffuse swelling of right cheek.

Figure 2: Intra oral photograph showing diffuse swelling with tooth indentations

Figure 3: Gross specimen with lobulated surface

The skin over the swelling appeared normal and was pinchable with no localized increase in temperature. Intraorally, the swellingmeasured5 × 3 cm in diameter, firm in consistency, nonfluctuant and non-reducible, non-pulsatile and freely movable with tooth indentations on overlying mucosa (Figure 2).Based upon the history and clinical examination, the provisional diagnosis of benign buccal sub mucosal nodule was made. The hematological report was normal & OPG examination did not reveal any abnormality. CT revealed a large well-defined, heterogeneous soft tissue mass involving the right cheek.

The mass was dissected and excised with safety margins under local anesthesia. It did not involve facial muscles or subcutaneous tissue of the cheek. Grossly, the lesion was slightly ovoid, well-demarcated, whitish grey in color with firm consistency. It was approximately 5X4 cm with solid cut surface(Figure 3).

Histopathology showed an encapsulated lesion with epithelial and stromal components. The epithelium appeared to be in the form of ducts, cords, islands and sheets. The ducts were varying in size and contained luminal cuboidal cells with 2-3layers of angular abluminal cells. Many ducts showed the presence of eosinophilic material within the lumen. Some islands of epithelium showed squamous metaplasia with keratin formation. Stromal component showed myxoid and hyalinized areas. Adipose tissue was also noted in different areas of section (Figure 4, 5, 6, 7).



Figure 4: Scanner view showing lesional tissue with capsule (H&E stain, x40)

Figure 5: Scanner view showing epithelial (ducts, islands) and stromal(myxoid) component (H&E stain, x40)

Figure 6: Low-power view showing variable sized ducts with luminal & abluminal cells with eosinophilic coagulum in the lumen (H&E stain, x200)

Figure 7: low - power view showing central myxoid area with epithelial component at periphery (H&E stain, x200)

Based on clinical and histopathological features the diagnosis of Pleomorphic adenoma of APG was established. The patient is remaining disease-free on follow-up.

DISCUSSION

The accessory parotid gland (APG) is normal salivarytissue separated from the main parotid gland and is typically located approximately 6 mm anterior to the main gland.³It exists in approximately21% of individuals. Frommer has described anatomical features of the APG with two types of anterior extension of the parotid gland: one is "facial process" which is attached directly to the main gland. The other is "detached glandular mass" or "accessory parotid gland" which is completely separated from the main gland. The average distance of separated accessory parotid glands from the anterior edge of the main gland is about 6 mm. The accessory parotid gland exists in 21–61% of individuals according to various autopsy studies.4Accessory parotid gland tumours are rare, comprising 1–7.7% of all parotid gland tumours are malignant^{5,8}

Toh H et al reported on histological examination of cadaveric parotid glands and their associated accessory parotid glands revealed that the accessory glands consisted of mixed secretory glands, containing both serous and mucous acini.9 On the contrary, only serous cells were found in the main parotid glands. It was speculated that the difference in cellular composition between the two types of glands may account for the histological difference in the tumours arising from them.

Our presentation was similar to that of literature. PA of the APG usually presents as an asymptomatic and painless mid-cheek mass growing slowly over years.⁷Malignant transformation should be suspected if the tumor presents with clinical symptoms such as rapid enlargement, tenderness, and facial weakness.

CT and MRI are very useful tools in the evaluation of tumor localization and in the differentiation between benign and malignant tumors. CT findings of PA show a well-circumscribed ovoid or lobulated mass with homogeneous or heterogeneous enhancement, and intra-tumoral calcification may occasionally be seen. MRI findings of PA are characterized by an ovoid or lobulated, well-defined mass with hypo-intensity on T1-weighted MR images, homogeneous or heterogeneous hyperintensity on T2-weighted MR images, and well enhancement on contrastenhanced T1-weighted MR images.10The well-defined benign nature of our case report was confirmed with complete clinical examination and CT scan.

The differential diagnosis for mid-cheek soft-tissue neoplasms includes inclusion cysts, lymphadenopathy, hemangiomas,lipomas, neurofibromas, schwannomas, neurilemmomas, fibromas, metastasis of malignancies and sialocoeles.¹¹ Immunohistochemical assessment with epithelial markers, especially Epithelial membrane antigen along with S100 and actin can help in diagnosis.¹² Ultrasonography-guided FNAC is also a minimally invasive procedure that can provide valuable information for APG tumors.¹³

In the management of PA of the APG, complete resection of the tumor with a margin of normal salivary tissue without damaging the fibrous capsule is recommended to avoid tumor recurrence. Since an APG tumor is located near the facial nerve branches (especially the zygomatic and buccal branches) and the Stenson duct, care should be taken to avoid damage to these structures.¹²Four surgical approaches have been established for such excisions including a standard parotidectomy incision or a facelift incision, intraoral approach, direct skin incision and an endoscopic approach.^{13, 14}Our case was also treated by careful surgical excision without any damage to nearby vital structures. Recurrence rates after removal of APG tumours are low.¹²Our patient is also remaining disease free on follow-up.

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CONCLUSION:

In conclusion, an APG tumor should be considered a differential diagnosis in a patient with a mid-cheek mass. An APG tumor may be suspected to be PA when the above-described typical clinical manifestations and imaging findings are present. However, as the incidence of malignant APG tumorsis reportedly high, it should be confirmed with prompt histopathological assessment of such masses in the mid-cheek region.

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Case Report

TRIPLE ANTIBIOTIC PASTE, APEXUM AND APEXIFICATION PROCEDURE ASSISTED NON-SURGICAL HEALING OF LARGE PERIAPICAL LESION: A CASE REPORT WITH 2 YEAR FOLLOW UP

Monika Panwar, Yogesh Kumar , Neetu Jindal, Renu Aggarwal

ABSTRACT: With dawn of era of minimal intervention in dentistry, surgical management of periapical lesions become controversial. Non-surgical or conservative management of periapical lesions not only cause less trauma to the tissues, but also promote healing. This case report presents non-surgical healing of large periapical lesion by triple antibiotic paste; apexum procedure and apexification with 2 years follow up.

Keywords- Apexification, apexum,non -surgical healing, triple antibiotic paste

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INTRODUCTION

Pulp necrosis resulting from infection of the root canals, initiates an inflammatory response in the periapical region due to ingress of the toxic by-products of microorganisms. Failure to eradicate the microbial load from the necrotic root canals lead to the development of periapical lesions that increase in size with time.1 In the past, large periapical lesions were managed by root canal treatment of involved teeth followed by surgical enucleation. However, awareness of the complex root canal morphology and development of newer techniques and intracanal medicaments has led to the paradigm shift of treating such lesions conservatively.²Calcium hydroxide Ca(OH)2, commonly used as an intracanal medicament, however, is ineffective against all members of the endodontic microbiota.³ Use of a combination of antibiotics- a mixture of ciprofloxacin, metronidazole and minocycline is reported to be very effective in healing of large cyst-like periradicular lesions.4,5 This case report describes successful management of a large periapical lesion resistant to Ca(OH)2, treated with triple antibiotic paste (TAP) containing ciprofloxacin/cefaclor/metronidazole as an alternative intracanal medicament with 2 years follow up.

CASE REPORT :A 26 year old male patient reported to department of Conservative Dentistry and Endodontics with the chief complaint of yellowish discoloration of upper left front teeth since 8 months. Patient gave history of trauma 1 year back. There was no significant medical history. Intraoral examination revealed yellowish discoloration present w.r.t 21 (Figure 1). Vitality test showed no response to heat and cold w.r.t all maxillary incisors. Preoperative radiograph revealed a periapical radiolucency, widening of PDL w.r.t all maxillary incisors and blunder buss canal w.r.t 21(Figure 2). Based on clinical and radiographic

features diagnosis was made that chronic apical periodontitis and treatment plan decided was RCT followed by crown w.r.t 11,21 and 22 and RCT followed by apexum procedure and apexification w.r.t 21.



Figure 1: Intra oral view



Figure 2: IOPA w.r.t all maxillary incisors

Access cavity preparation was done w.r.t 11,12,21,22 under the isolation of rubber dam and working length was established with # 20 and # 80 K files and biomechanical preparation was done along with saline and 2.5% sodium hypochlorite irrigation solutions w.r.t all maxillary incisors (Figure 3). After that calcium hydroxide dressing was placed and teeth were sealed with temporary restoration and patient was recalled after 1 week.



Figure 3: working length w.r.t 12,22,11,21

After one week all incisors were mild tender on percussion and tooth number 21 showeddischarge through the root canal. So the dressing was changed w.r.t 12,11,22 and custom made apexum procedure was performed with high flex rotary file. (Figure 4)

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Then triple antibiotic paste was placed for 2 weeks w.r.t 21 and tooth was sealed with temporary restoration.



Figure 4: Apexum procedure w.r.t 21

After 2 weeks, triple antibiotic paste was removed using irrigating solutions. The exudate through the root canal w.r.t 21 was stopped and all maxillary incisors were asymptomatic, so teeth were obturated with gutta-percha (Dentsply Maillefer, Switzerland) and resin based sealer (Resino Seal) using lateral condensation technique w.r.t 12, 22, beefill w.r.t 11 and apexification with MTA & PRF was performed at apical third of the canal w.r.t 21. A moist cotton pellet was placed over MTA in the canal w.r.t 21, and the access cavities sealed with temporary restoration.

Next day temporary restoration was removed and the remaining canals were obturated with beefill. Access cavities of other incisors were also sealed with GIC and patient was referred to department of Prosthodontics for fixed prosthesisw.r.t all maxillary incisors(Figure 5).



Figure 5: Post-operative View



Figure 6: Follow up after 1 year

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Figure 7: Follow up after 2 years

Radiographic examination after a follow-up of 2 years revealed complete resolution of the periapical lesion (Figure 7).

DISCUSSION

The precise mechanism involved in the formation of periapical lesions is not fully understood. It is generally agreed that if the pulp becomes necrotic, its environment becomes suitable to allow microorganisms to multiply and release various toxins into the periapical tissues, initiating an inflammatory reaction, and leading to the formation of the periapical lesion.⁶

Conventional root canal treatment is aimed primarily at eliminating these bacteria. It has been proved that if the microbial load is reduced with an effective intracanal medicament, it is possible to stimulate the immunological system to induce repair, even in large lesions. Considering all this, nonsurgical root canal treatment should be considered as the first choice in cases of nonvital teeth with infected root canals. Calcium hydroxide has been considered the gold standard for optimally disinfecting root canals.⁷

In this study, calcium hydroxide was used, but the symptoms were not relieved. The treatment protocol was changed, and a triple antibiotic paste was used instead. After its application, the symptoms resolved. Since the overwhelming majority of bacteria in the deep layers of the infected dentine of the root canal wall consist of obligate anaerobes,⁸ metronidazole was selected as the first choice among antibacterial drugs. It is reported that metronidazole can penetrate the deep layers of carious lesions and disinfect the lesions in vivo⁹and diffuse throughout the dentine. The use of triple antibiotic paste consisting of ciprofloxacin, metronidazole, and minocycline, for disinfection is highly advocated. It is shown that this combination of drugs can kill any bacterium in the carious lesions, necrotic pulp, infected root dentin, and periapical lesions.

Bose et al compared the radiographically-assessed outcome of root formation between the triple antibiotic paste and calcium hydroxide treatment. It was found that the former produced significantly greater differences in root wall thickness than the latter. In this case report apexum procedure is also use. The advantage of apexum procedure are as follow ;removal and debunking of periapical lesions without using scalpels, periosteal elevators or sutures , minimal invasive technique, removes chronically inflamed periapical lesions through root canal access, Overcome the drawbacks of the conventional surgical procedure., enhanced healing kinetics of periapical lesions (Metzger et al., 2009; Metzger et al., 2009)., No events of severe postoperative pain or swelling (Metzger et al., 2009). The Apexum procedure is more likely to eliminate bacterial biofilm or at least mechanically disturb them to the extent of disrupting the host-bacteria equilibrium in favour of the host.

Triple antibiotic paste has been successfully used in the above cases to disinfect the canals and MTA was used to form a threedimensional hermetic seal at apex and also promote healing of perapical lesions.¹⁰

CONCLUSION

The clinical case report showed excellent healing of large periapical lesion achieved through a nonsurgical approach. The favorable and uneventful healing of the lesions confirms that even large periapical lesions can respond favorably to nonsurgical treatment. Therefore, it must be considered as the first treatment of choice.

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Reader, Department of Conservative Dentistry & Endodontics, Surendera Dental College and Research Institute, Sri Ganganagar. INDIA **Case Report**

EVALUATION OF PAIN, CLINICAL AND HISTOPATHOLOGICAL OUTCOME IN CRYOAND ELECTRO-SURGICAL GINGIVAL DEPIGMENTATION TECHNIQUES - A COMPARATIVE CASE REPORT

Sanjeev kamboj, Sanjeev Kumar Salaria, Rajni Aggarwal, Samyak Belkhede

ABSTRACT - Esthetics has become a significant aspect of dentistry and clinicians are faced with achieving acceptable gingival esthetics and functional problems. In addition to factors like shape, position and the color of the teeth, gingival color also contributes important role for an attractive smile. Gingival melanin hyperpigmentation (GMHP) hampers the gingival esthetic of patients with gummy smile or excessive gingival display that cause physiological disturbances & embarrassment, so patients demand esthetic therapy for the same. Literature suggested different depigmentation treatment modality forthe management of GMHP. The present case report comparatively evaluates the clinical, histopathological and pain outcomeof two different patients managed by cryosurgery and electrocautery assisted gingival depigmentation technique. It was concluded that at 3 months post operatively both treatment modalities were effective in the management of GMHP but patient felt more comfortable and pleased with the outcome as less pain was experiencedwith cryosurgery assisted gingival depigmentation technique.

Keywords:Cryosurgery, electrocautery,gingival melanin depigmentation, gingival melanin hyperpigmentation

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INTRODUCTION : Gingival melanin pigmentation occurs in all races. Melanin, a brown pigment, is the most common natural pigment contributing to endogenous pigmentation of gingiva and also on the mucosa. Melanin pigmentation is the result of melanin granules produced by melanoblasts intertwined between epithelial cells at the basal layer of gingival epithelium.¹

In some populations, gingival hyper melanin pigmentation is seen as a genetic trait irrespective of age and gender; hence it is termed physiologic or racial gingival pigmentation. It is frequently encountered among dark-skinned ethnic groups, as well as in medical conditions such as Addison's syndrome, Peutz-Jegher's syndrome etc.²Majority of patients with gingival hyper melanin pigmentation(GMHP) complains about unaesthetic appearance and embarrassment, for which they seek periodontal consultation. Various gingival depigmentation techniques are recommended in the literature ² but majority of the outcome observed was based on the clinical outcome only. As literature regarding clinical, histopathological and pain experience is scarce in the literature, thus the present case report compared the clinical, histopathological and pain outcome after cryotherapyand electrosurgical gingival depigmentation techniques.

.CASE REPORT

A 23-year-old male and a 25-year-old female patient visited the Department of Periodontology with the chief complain of unaesthetic appearing dark gums since birth (Figure 1A-2A). Patients were systemically and periodontally healthy. There was no history of associated parafunctional or personal habits such as smoking among both the patients. Patients wereduly explained about the treatment options with its associated risks and benefits. Then a duly informed written consent was procured from both the patients.

During the first visit, Phase I therapy was carried out along with a punch biopsy of 5mm for histopathological assessment of gingival melanin pigmentation in both the cases was done.Cryosurgery with liquid nitrogen was planned on the maxillary arches in the male patient (Figure1:1A–H), The area from the maxillay right side premolar to the left side premolar was included.Topical anesthesia with 10% xylocaine spray was administered to minimize the discomfort attributable to cooling.Before the application of liquid nitrogen, the tooth areas were separated with Coe-pak.The cotton swab was dipped in liquid nitrogen and immediately rolled gently over the pigmented area. In each area, a freezing zone was continuously maintained for 30-40 seconds. The time required varied from 20-25 minutes.

In the female patient, electrosurgical depigmentation was planned on the maxillary arch. (Figure: 2A-H). Topical anesthesia with 10% xylocaine spray was used to minimize the discomfort.Electrocautery was used for the depigmentation from the maxillary right side premolar to the left side premolar. A loop electrode in light brushing strokes with tip constantly in motion for deepithelizing the gingiva was used as keeping the tip in one place could lead to the excessive heat buildup and destruction of the tissue. The patient was sent after giving postoperative instructions. After 1day postoperatively, surgical area was examined in cryosurgical case the tissue necrosis become evident, which was sloughed off from the underlying tissue. There was no bleeding and mild pain was reportedwhereas in patient after electrosurgical procedure showed complete deepithelization of pigmented gingiva with no associated bleeding, but reported with moderate pain.Follow up after 3months included the biopsyfor histopathological assessment to determine the degree of melanin pigmentation. The healing was uneventful without any postsurgical complications in both the patients. The gingiva was

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healthy as it appeared pink with firm consistency and a pleasing esthetic outcome. The patient's acceptance after both the procedures was good, and the results were excellent, the grade 3 melanin pigmentation reduced to no melanin pigmentation as perceived by the patient. Clinical and histopathological examination revealed no repigmentation in both the patients during the follow up visits the but there was difference in the post operative pain perception by the patients. There was more post operative pain in patient treated with electrosurgical procedure was reported.



Figure 1Case I: (A) Preoperative (B)punch biopsy taken (C)biopsy (D) preoperative histopathological (E) depigmentation using liquid technique and the frozen site thawed spontaneously within 1 min (F) immediate postoperative (G) postoperative 3 month (H) postoperative histopathological.



Figure 2 Case 2: (A) Preoperative (B) punch biopsy taken (C) biopsy (D) preoperative hitophathological (E) depigmentation using electrocautery (F) immediate postoperative, (G) postoperative 3 month (H) postoperative histophathological.

DISCUSSION

Depigmentation with cryosurgery procedure was found to be equally effective to electro surgery; although the absence of pain, during the procedure as well as postoperative period are the obviously the key advantage of the cryosurgical method over the electrosurgery method. In the present study only the lignocaine spray were used. In cryosurgery, the gingiva is freezed with liquid nitrogen; induced the tissuedestruction is based on rapid freezing of water and slow melting repeatedly, leading to tissue deterioration. The cryotherapy has some direct effects including crystal formation in intra and extracellular fluid, cell dehydration, enzyme inhibition, protein denaturation and cell death due to thermal shock and has direct effects such as changes in vasculature and immune response of the tissue, which leads to cell death.³

The cryogens

Cryogen is a substance used for cryosurgery. Over the years, several cryogens have been used. They include the following. Cryogen effective temperature: Salt ice -20° C, CO2 slush -20° C, fluorocarbons (Freons) -30° C, nitrous oxide -75° C, CO2 snow -79° C, liquid nitrogen -20° C (Swab) -196° C (Spray), tetrafluoroethane (TFE) -20° C to -40° C.⁴

Cryosurgical procedure

The dose of cryogen and the choice of delivery method depend on the size, tissue type, and depth of the lesion. The area of the body on which the lesion is located, and the required depth of freeze also should be considered. Additional patient factors to consider includes the thickness of the epidermis and underlying structures, the water content of the skin, and local blood flow.⁵

- Dipstick method
- Spray technique
- Cryoprobe technique.

Clinical changes following cryosurgery

Arikan and Gürkan⁶ used TFE cooled cotton swab application in the cryosurgical depigmentation of gingiva. He concluded that TFE may be used as an off-label product with minor complications in melanin depigmentation of gingiva. Sheetra et al.⁷ performed gingival cryosurgery in segments in the maxillary anteriors, each segment measuring ~ 5 mm × ~5 mm was exposed to a gas expansion cryoprobe using nitrous oxide, and the cryoprobe was cooled to -70° C to -90° C for 30 s. Immediately after removal of the cryogenic probe, the tissue was frozen solid, taking on the appearance of a ball of ice. Thawing occurred in 15–20 s with progression from the periphery to the center of the ice ball. 30 min after freezing, the tissue area was indiscernible from adjacent gingiva.

Certain precautions need to be undertake including the prevention of loss of gas attributable to leakage and evaporation, and risk of accident during storage.

In the present case, the cryosurgical procedure was acceptable to the patient because it was not time-consuming, patient was comfortable because the procedure caused no pain&hemorrhageboth during and post operatively as well as both the clinical and histopathological changes were highly appreciable at 3 month follow up.

2) Electrosurgery

The electrical energy leads to molecular disintegration of melanin

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cells, present in basal and suprabasal cell layers of operated and surrounding sites and retarding migration of melanin cells from the locally situated cells.⁸

electrosurgery has a strong influence in retarding migration of melanin cells. However, electrosurgery requires more expertise than the techniques mentioned above. Prolonged or repeated application of current to the tissues induces heat accumulation and undesired tissue destruction. Contact of current with the periosteum and vital teeth should be avoided. Hence, it is to be used in light brushing strokes. The tip was kept in motion all the time to avoid heat build up on the tissues. Melanin pigments have been removed completely.⁹

The same method utilized in the present case, although the clinical and histological outcomes are comparable to cryosurgical case but patient feel more discomfort and pain and hemorrhage during and post operatively.

It is imperative to note the need to elucidate the findings of the present case by comparing it to a larger sample size of patients. Hence, additional studies of these variables, with larger sample sizes at histologic and histochemical levels to evaluate the activity and behavior of melanocytes after the cryosurgical procedures, are needed to validate the present findings.

CONCLUSION

To the best of our knowledge till date, majority of the studies evaluated only clinical outcome and few studies evaluated the histological parameters along with clinical parameters whereas the present case report compared the clinical, histopathological and pain outcome after cryotherapy and electrosurgical gingival depigmentation techniques. Within the limitations of the present case report, it can be concluded that both the modality were equally good in the management of gingival melanin pigmentation but the liquid nitrogen assisted gingival depigmentation with had a significant superior edge over electrocautery assisted gingival depigmentation technique in term of post operative pain experienced by patient.

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Introduction: Description of the research area, pertinent background information and the hypothesis tested in the study should be included under this section. The introduction should provide sufficient background information such that a scientifically literate reader can understand and appreciate the work to be described. A detailed review of the literature is not at all required under this section. The specific aims of the project should be identified along with rationale for the specific experiments and other work performed. The introduction must include in-text citations including a few references pertinent to the background and justification for the study.

Materials and Methods: Materials and/or subjects utilized in the study as well as the procedures undertaken to complete the work. The methods should be described in sufficient detail such that they could be repeated by a competent researcher. The sources of all major instruments and reagents used (kits, drugs, etc.) must be used with parenthesis. Illustrations and/or tables may be helpful in describing complex equipment elaborate procedures. The statistical tool used to analyze the data should be mentioned. All procedures involving experimental animals or human subjects must accompany a statement on ethical approval from appropriate ethics committee.

Results: Data acquired from the research with appropriate statistical analysis described in the methods section should be included in this section. The results section should highlight the important result obtained. Data should be organized into figures and tables. Qualitative as well as quantitative results should be included, if applicable.

Discussion/Conclusion: This section should relate the results section to current understanding of the scientific problems being investigated in the field. Description of relevant references to other work/s in the field should be included here. This section also allows the authors to discuss the significance of the results. This section should end with answers/questions that arise as a result of the author's work.

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Legends for illustrations should use Arabic numerals corresponding to the illustrations. When symbols, arrows, numbers or letters are used to identify parts of the illustrations, identify and explain each one clearly in the legend. Explain the internal scale and identify the method of staining in photomicrographs.

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1. Lee JS, Kim JK, Park YC, Vanarsdall RL. Applications of orthodontic mini implants. Chicago: Quintessence 2007.

 Baumgartner JC. Pulpal infections including caries. In: Hargreaves KM, Goodis HE (Eds). Seltzer and Bender's Dental Pulp. Chicago: Quintessence 2002:281-307.

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