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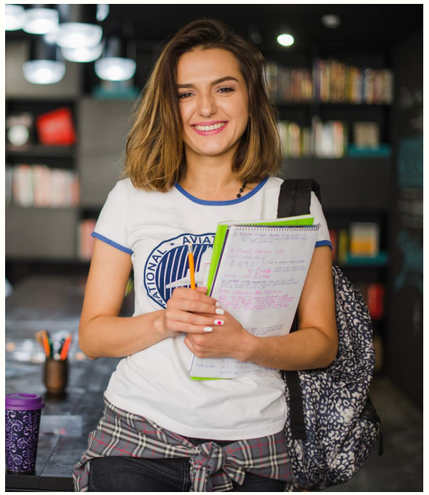

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EDITOR'S MESSAGE

Dear Colleagues,

" Dreams pass into reality of action . From the action, stems the dream again; and this interdependence produces the highest form of living….."

This quote by Anais Nin beautifully and truly describes what we, at Government Dental College & Hospital, Mumbai, have tried to achieve by launching the college journal , ' **International Journal of Advanced Dental Sciences'** for the first time amongst all Maharashtra Government Dental Colleges.

This journal would never have seen the light of the day without the dynamic initiative and persuasion of our beloved Dean and Joint Director DMER, **Dr Vivek Pakhmode**; who has been keen to see the scientific journal compiled and launched right from the time of his joining this institution.

I wish to extend my gratitude to all my associate editors and the young enthusiastic members of the editorial committee as they have been the backbone of this endeavor, their dedication and diligence towards completion of this journal is much appreciated. We could not envisage starting this journal without the support of all the authors who have contributed their manuscripts to this journal. I would also like to acknowledge the creative genius of **Mr Ashish Jalamkar** in conceptualizing the cover design of this journal.

Educating students is a part of the college's fundamental mission. But education stretches beyond classrooms and preparing them for careers and professional life remains the constant commitment of a college. This journal will help their personal and professional growth, which would definitely help them to succeed in this competitive world.

I would also like to express my sincere gratitude to our Director, DMER, **Dr Tatyasaheb Lahane** in believing in the policy of "Educate, Enrich and Excel" in imparting professional education.

My heartfelt appreciation to the honest efforts and dedication put forth by **Dr Viral Maru,** Associate Professor, who has lended a huge support in the making of this journal.

I would like to extend my thanks to all **reviewers** and the entire **advisory board** for dedicating their time and for their valuable inputs and expert comments.

I look forward to a successful 1st year as Editor In Chief and welcome any comments or suggestions you may have that would improve the journal.

Dr Dimple S. Padawe
Senior Professor & HOD
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Guest Editorial

'Dentistry is not only Art and Science but also Research.'

Dear Colleagues,

Warm greetings from Government Dental College and Hospital, Mumbai. I am very happy and excited on this occasion of inauguration of first ever scientific journal of our college – 'International Journal of Advanced Dental Sciences'.

As we all know that dentistry is a perfect combination of science and art. But in my view, dentistry is a profession where lot of scope and avenues are available for research, be it a new treatment modality, some advanced dental material, or various different approaches to diagnosis and treatment. At present two areas which offers immense scope for research in dentistry are - genetics and human evolution.

The human genome is considered to be the most important scientific achievement of all time .The explosion of scientific information, coupled with technological advances in bioinformatics, genetics, molecular biology, physics and chemistry and the interdisciplinary approach have opened new avenues for multiple research topics in dentistry. Integrating information from all these areas will change the approach to dental health issues, providing effective strategies, diagnosis, prevention, intervention and treatment of craniofacial diseases.

The embryonic development, morphogenesis and differentiation of teeth is the result of complex interactions at molecular level between the ectoderm and the mesenchyme. Until now more than 200 genes involved in these processes have been identified. Recently many efforts have been made for the understanding of molecular and cellular mechanisms that control the development and pathology.

Most of the noticeable changes in the evolution of the genus Homo (which includes ourselves and our extinct close relatives) have been in the dentition and the jaws which support them.

Teeth are prevalent in archaeological sites: scientists often find dozens or hundreds for every skeleton or skull. That's because the enamel covering a tooth is 97% mineralized, and teeth are stronger than bones, so they're more likely to survive. In other words, teeth are like the pennies of ancient human remains; they turn up everywhere.

But unlike pennies, they're often a treasure trove. Everything from the tooth's shape to its enamel thickness, it tells the researchers something about the human whose mouth the tooth once inhabited: what they ate, where they lived, what diseases they had. Teeth may seem humble compared to more dazzling specimens like skulls, but the bony protuberances offer more than their share of surprises!!!!

"Teeth are "little pieces of a puzzle that could help see the
'big picture' of someone's life."

Dr. Vivek Pakhmode M.D.S
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Applications of Dental tissue-derived Stem cells in systemic conditions

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Abstract

Ever since their discovery, the aim of stem cell research has been to develop therapeutic solutions to various disease conditions. Earlier challenged, it is now established that adult stem cells in the human body are capable of differentiating into cell/tissue types other than their source of origin and lineage; therefore, show promise in regenerative medicine research and cell-based therapy. These cells can be isolated from deciduous teeth, apical papilla of the tooth, dental pulp, as well as periodontal ligament. Stem cells isolated from various oral/dental tissues show similar or higher proliferation and differentiation potentials when compared to other systemically derived stem cells. This communication highlights the potential application of dental stem cells in systemic conditions.

Key Words: Dental stem cell, Mesenchymal stem cell, Systemic disease.

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Alexander Maksimov, a Russian histologist, proposed the term 'stem cell' in 1868.[1] However, it was the seminal works of Friedenstein et al. between the 1960s and 70s that laid the groundwork for mesenchymal stem and stromal cells.[2] These cells were considered 'building blocks' of the body and were responsible for homeostasis. By definition, stem cell is one that has the ability to continuously divide to either replicate itself (self-renewing), or produce specialized cells than can differentiate into various other types of cells or tissues (multilineage differentiation).[3]

Research is currently booming in the field of regenerative medicine and cell-based therapy. Adult stem cells that were earlier thought to be present only in specific sites such as bone marrow, adipose tissue etc., are now being isolated from various other tissues such as skin, hair, muscles, as well as oral and dental structures among others. Dental stem cells can be isolated from different parts of teeth and include those derived from exfoliated deciduous teeth, apical papilla, tooth germs, and periodontal ligament.

Adult stem cells (ASC) can be further divided into hematopoietic and mesenchymal stem cells (MSC) depending on the tissue of origin. ASCs were assumed to have restricted proliferative ability, considering that these were cells that are already differentiated for tissue/organ-specific functions. Contradicting the earlier reports, recent studies have suggested that, in addition to generating the derivatives of their specific system, hematopoietic and mesenchymal stem cells can also give rise to muscle and neuron-like cells in the brain among others.[4,5]

Self-renewal, multipotency, and immunosuppressive functions of MSCs have been extensively investigated for therapeutic applications. It is known that MSCs isolated from dental and orofacial tissues possess the ability to differentiate into odontoblasts, cementoblasts, and periodontal ligament cells. However, recent studies have also shown that dental stem cells have the capacity to generate adipocytes, osteoblasts, cartilage, smooth and skeletal muscle cells.[6,7] Moreover, dental stem cells are also capable of switching lineage to form ectodermal tissues (such as neurons or epithelial-like stem cells) and endodermal lineage (such as endothelial cells, hepatocytes, and insulin-producing cells).[8] Dental pulp stem cells (DPSC) are presumed to be derived from migrating neural crest cells; therefore, express neuronal markers such as nestin and βIII tubulin.[9]

An interesting aspect is the fact that stem cells from human exfoliated deciduous teeth (SHED) represent a population of multipotent stem cells that are perhaps more immature than previously examined postnatal stromal stem-cell populations. Miura et al. reported that SHED were able to induce bone formation, generate dentin, and survive in

mouse brain along with expression of neural markers.[7] SHEDs are considered to have higher proliferation rate and increased cell-population doublings. As deciduous teeth exfoliate naturally, there is potential for these stem cells to be preserved for later use in neurological conditions such as stroke, Parkinson's disease, multiple sclerosis etc.

Similarly, stem cells isolated from the dental pulp are known to produce neurotrophic factors and rescue motor neurons after spinal cord injury.[10] In the aforementioned study, by Nosrat et al., it was observed that co-culturing DPSCs with trigeminal neurons promoted survival and a specific and elaborate neurite outgrowth pattern, whereas skin fibroblasts did not provide a similar support.[10] Dental pulp stem cells have shown positivity for mesenchymal lineage markers (CD13, CD29, CD44, CD73, and CD105) but are negative for a monocytic marker (CD14), and hematopoietic lineage markers (CD34, and CD45). This makes them attractive target-specific candidates in cases of cerebral ischemia, muscular dystrophy, liver disease, cardiovascular conditions, diabetes, among others.[11,12]

Studies have also shown that dental pulp tissue becomes innervated when transplanted into the anterior chamber of the eye, and upregulates the nerve fiber density of the irises.[13] Recent studies have explored the potential of DPSC-mediated repair of ocular diseases, such as corneal blindness and glaucoma. It has been reported that DPSCs share similar characteristics with limbal stem cells and have the capability to differentiate into keratocytes.[14]

DPSCs and SHEDs have also been found to possess immunomodulatory functions, comparable to or even higher than those of bone marrow derived MSCs.[15] Therefore, these cells may be beneficial in cell-based therapies for a variety of immune and inflammation-related diseases. DPSCs have been shown to more strongly inhibit T-cell responses than bone marrow MSCs. DPSCs also inhibit allogeneic immune responses by release of TGF-β through stimulation of T lymphocytes. Similarly, SHEDs also significantly inhibit Th 17 cells compared to bone marrow MSCs. In animal experiments, SHEDs have been demonstrated to effectively reverse systemic lupus erythematosus.[15,16]

Plasticity of stem cells is currently being investigated widely. The capability of cells from dental tissues to induce regeneration of neural, muscle, and other tissues widens horizons in cell-based therapy.[17] DPSCs and SHED display an MSC-like character, including the capacity for self-renewal and multilineage differentiation. Owing to their accessibility, ease of isolation, minimally invasive procedure, and limited ethical concerns, dental stem cells can be considered an alternative to other systemic sources of stem cells.

Soucre of funding

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Conflict of Interest

Nil

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Behavioral response and pain perception: WAND versus traditional mandibular local anesthesia in school going children

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Abstract

Aim : The present study evaluated and compared the behavioral response and pain perception between traditional and WAND technique of mandibular local anesthesia in school going children both subjectively and objectively.

Study & Design : 60 school going children aged 7 to 11 years, were randomly divided into two groups – Group A [receiving inferior alveolar nerve block through traditional method] and group B [receiving inferior alveolar nerve block through WAND system]. The children from both groups were subjected to subjective evaluation with Modified Facial Image Scale and objective evaluation with Sound Eyes Motor Scale and heart rates [2 mins prior to local anesthesia, during anesthesia and 2 mins after anesthesia].

Results : School going children experienced less pain and disruptive behavior with WAND as compared to traditional method of anesthesia based on subjective and objective evaluation.

Conclusion : Use of WAND may be encouraged to achieve a relatively pain free, non threatening and successful pediatric dental practice.

Key words : WAND, school children, MFIS, SEM, Heart rate.

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Introduction

In dentistry local anesthesia is one of the most pain provoking procedures for both children and adult patients.[1] Hence there is a need to search for solutions or methods that will minimize or reduce pain and discomfort in patients in order to provide them with greater satisfaction. Some of the methods commonly used for the same are application of topical anesthesia, use of narrow size needles and slower delivery of the injected solution.[2]

WAND– an innovative computerize system for slow delivery of local anesthesia has been developed in order to reduce or minimize the pain. Asarch T et al conducted the first study involving the use of WAND in children in 1999.[3] A virtually painless needle insertion is experienced when one assures that the drops of solution should anesthetize the tissues ahead of needle.[4] All the techniques of local anesthesia – maxillary and mandibular infiltration and blocks and intraligamentary can be performed with the WAND. WAND provides an automatic delivery of local anesthetic solution at a fixed pressure:volume ratio regardless of variations in tissue resistance. Hence it provides highly efficient, effective and painless injection even in resilient tissues.[6]

PubMed search yields many studies assessing the efficacy of WAND system, evaluating the pain response by subjective methods[6-10] but very few with subjective as well as objective evaluations together. Hence the present study was conducted to evaluate and compare the behavioral response and pain perception rates in school going children with WAND and traditional method, both objectively and subjectively. The null hypothesis was that there would be no difference in behavioral response and pain perception

between traditional and WAND system of mandibular local anesthesia in school going children.

Material and Method

The present study was carried out in the Department of Pediatric and Preventive Dentistry, Government Dental College & Hospital Mumbai, India. The study was approved by the Institutional ethics committee. This controlled, randomized clinical trial involved 60 pediatric patients from both sexes between 7 and 11 years old after obtaining a written consent from their respective parents/ guardians. Following were the inclusion criteria's – non restorable and/or over retained mandibular primary teeth, no previous history of dental treatment, children with American Society of Anesthesiologist I status[11] and children with Frankl behavior rating III & IV.[12] The exclusion criteria's were - children allergic to local anesthesia [lignocaine], children under medications that could alter the pain perception, medically compromised and special children and children with Frankl behavior rating I & II.[12]

Sample Size and Source :

Sample size was determined using the proportion of cases from literature using the formula[13],

$$n = \frac{(Z_\alpha + Z_\beta)^2 \; p(1-p)}{d^2}$$

where Z_α is the z variate of alpha error i.e. a constant with value 1.96,

Z_β is the z variate of beta error i.e. a constant with value 0.84, p is the proportion of events

Approximate estimates:

1. 80% power
2. Type I error to be 5%
3. Type II error to be 20%
4. Expected proportion to be 90%
5. Least detectable error to be 20%

Substituting the values,

$$n = \frac{(2.8)^2 \; [0.09]}{(0.20)^2}$$

n = 17.64

In order to adjust for possible drop out and to increase the power of significance we decided to have 30 patients per group in this study.

Randomization

Sixty school going children of age 7-11 years were randomly divided in two groups -

Group A [30 children] : Receiving inferior alveolar nerve block through 1.8ml cartridge of Lignospan.

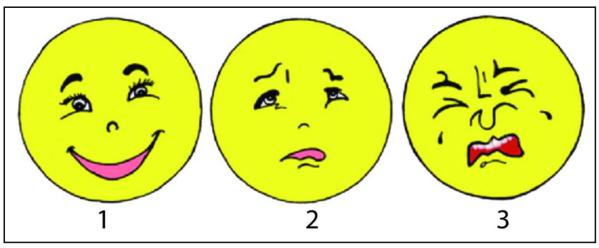
Group B [30 children]: Receiving inferior alveolar nerve block using WAND. [Single tooth Anesthesia system, Milestone Scientific Inc, USA]

Both methods used lidocaine HCL 2% with 1:80,000 epinephrine [Septodont, France] as the anesthetic solution with a one inch long 30 gauge needle. A preoperative radiograph was taken prior to extraction. Each child was assigned to receive either traditional local anesthesia or WAND by random sampling using chit method. All the injections were carried out by the same experienced and skill pediatric dentist to ensure that the results were not influenced by inter operator variability.

The oral soft tissues were dried with a gauze. The topical anesthetic 20% benzocaine [Mucopain, IPCA Laboratories, Bangalore, India] gel was applied and left in place for one minute. In group A, injections were given slowly at approximately 1ml/min with an aspirating cartridge syringe [Septodont, France]. In Group B, injections were administered with WAND mode [1cc per 207s] was used initially till 1/4th of cartridge was administered followed by the normal mode [1cc per 35s]. Doses used were well below the maximum dose of local anesthesia which is 6.6mg/kg body weight.[14]

A] Subjective evaluation

Prior to starting the dental treatment, the researcher explained the three point Modified Facial Image Scale [MFIS] [15] to the children. This scale involves three faces with following scores **[Fig No I]**



1] No discomfort

2] Mild discomfort

3] Severe discomfort

Immediately after injection, the patient were asked

about the amount of pain they had perceived during the injection and asked to point and mark on MFIS.

B] Objective evaluation

Sound, Eyes and Motor [SEM][16] scale and heart rate recording were used. In SEM scale sound, eye and motor pain reactions of patient were observed. The reactions were classified on a scale from 1-4 categories: comfort, mild discomfort, moderately painful, and painful for each of the S, E and M code (Table 1). The S, E and M values of a child were added to get SEM score for that child. The second researcher (first was the Pediatric dentist giving local anesthesia) standing at a distance of 1.5 meter from the dental chair, evaluated the patient's sounds, eye - signs and body movements during injection. Second researcher was an impartial observer, who was not part of the study. For calibration 15 children were observed by both the researchers and rated separately. Each disagreement was discussed until full agreement was reached. These patients were not included in the study. Intra-evaluate kappa values for second researcher were 0.7.

Heart rate, as a physiological indicator of pain response, was recorded using pulse oximeter (Schiller Ag, Switzerland). It was placed on the right index finger of the patient and heart rate recorded before during and after giving local anesthesia. For heart rate measurement, the subjects were connected to a pulse oximeter (Schiller Ag) by means of a sensor attached to the nail of the right index finger. No audible beeping noise was emitted by the pulse oximeter. Three readings were taken: Reading one - was 2 minutes before injection, reading two- was during injection and reading three -2 minutes after the injection administration.

Statistical Analysis

Descriptive statistics was done to find the frequency, minimum, maximum, mean and standard deviation for all the groups. Independent t-test was applied for comparison between the groups (Traditional LA and WAND) for Subjective and Objective evaluation. One-way ANOVA with Tukey's Post hoc analysis was applied for between and within the group comparison for heart rate 2 mins prior,

Table I : Sound, Eyes and Motor [SEM] scale[16]

Score	Designation	Sound	Eyes	Motor
0	Comfort	No sound indicating pain.	No eye signs of discomfort.	Hands relaxed, no apparent body tenseness.
1	Mild discomfort	Nonspecific possible pain indication.	Eyes wide show of concern, no tears.	Hands show some tension.
2	Moderately Painful	Specific verbal complaint.	Watery eyes.	Random movement of arms/body grimace, twitch.
3	Painful	Verbal complaint indicates intense pain.	Crying, tears running down the face.	Movement of hands to make aggressive physical contact, pulling head away punching.

Graph I : Subjective evaluation and comparison between traditional and WAND technique of anesthesia.

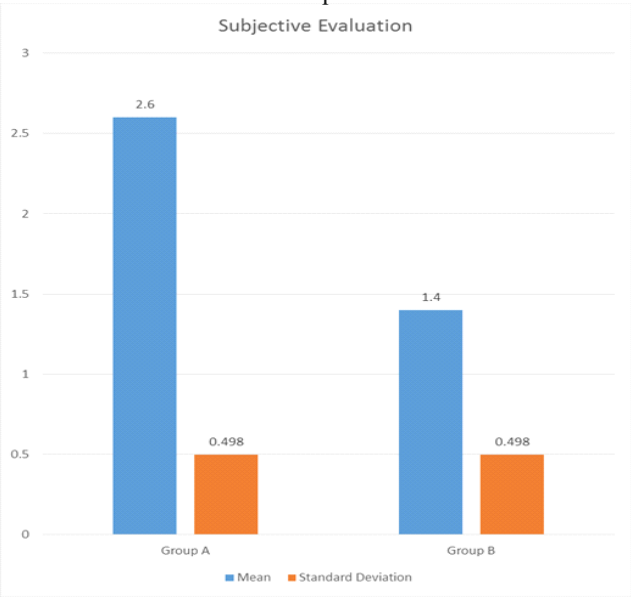
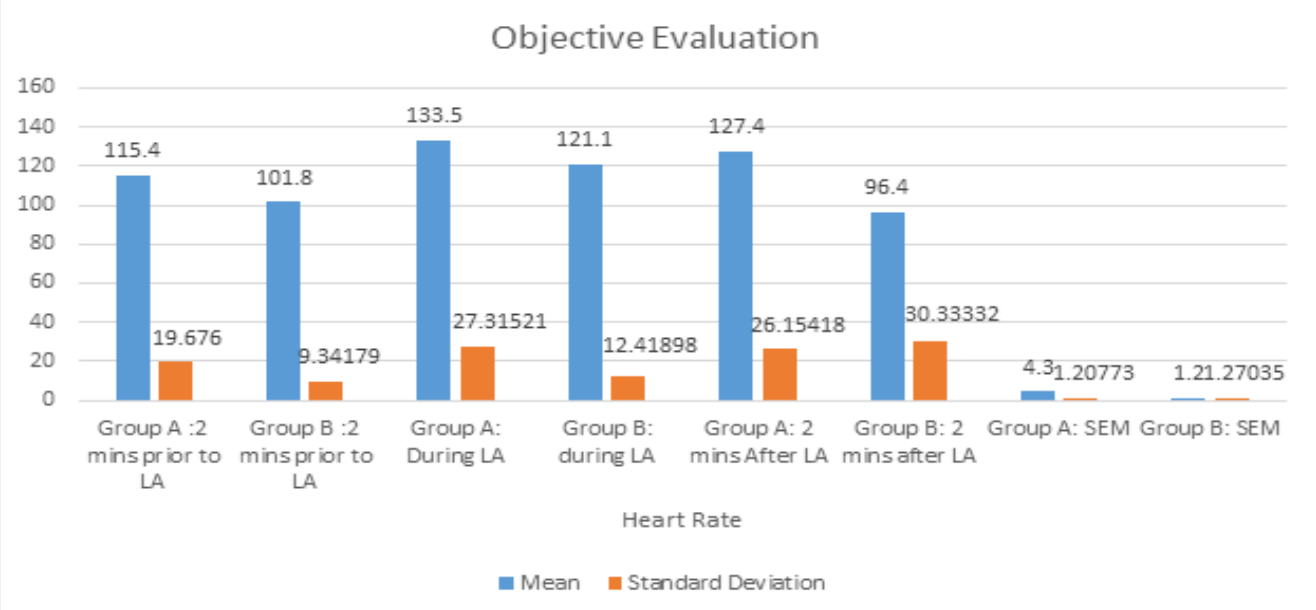


Table II : Distribution of MFIS score, SEM scores and mean heart rate during traditional and WAND system of anesthesia.

Groups	N	Minimum	Maximum	Mean	Std. Deviation
Subjective evaluation -Lignospan	30	2	3	2.60	0.498
Subjective evaluation-WAND	30	1	2	1.40	0.498
Traditional LA - Heart rate 2 mins prior to administration	30	82.00	144.00	115.4000	19.67600
Traditional LA - Heart rate during administration	30	105.00	188.00	133.5000	27.31521
Traditional LA - Heart rate 2 minutes after administration	30	92.00	170.00	127.4000	26.15418
WAND - Heart rate 2 mins prior to administration	30	88.00	123.00	101.8000	9.34179
WAND - Heart rate during administration	30	100.00	141.00	121.1000	12.41898
WAND - Heart rate 2 minutes after administration	30	11.00	124.00	96.4000	30.33332
Traditional LA - [SEM]score	30	3.00	6.00	4.3000	1.20773
WAND - [SEM]score	30	.00	3.00	1.2000	1.27035

Graph II : Objective evaluation and comparison between traditional and WAND technique of anesthesia.



during and 2 mins after administration of LA.

Results

The average age was 8.37±1.193years old with a range of 7 to 11 years old. Out of total of 60 children, 36 were boys and 24 were girls.

According to MFIS score, children experienced significantly less pain of injection with computerized as compared to traditional method [Table No 2 and Table No 3 & Graph No1]

As per SEM score statistically significant less pain was experienced with computerized anesthesia as compared to traditional method of anesthesia [Table No 2 and Table No 3 & Graph No 2].

A statistical significant increase in heart rate was reported with group A – 2 minutes prior to administration of local anesthesia, during an anesthesia as well as 2 minutes after giving anesthesia when compared to group B. [Table No 3 and Graph No. 2].

In Group A girls reported with lower pain perception

Table III : Comparison of objective and subjective evaluation between traditional and WAND system of anesthesia

		Mean (Standard Deviation)		*p* value
		Group A	Group B	
Subjective Evaluation		2.60±0.498	1.40±0.498	<0.05*
Objective Evaluation	Heart Rate 2 mins Prior to local anestheia	115.4000+19.67600	101.8000+9.34179	<0.05*
	Heart rate during local anesthesia	133.5000+27.31521	121.1000+12.41898	<0.05*
	Heart rate 2 mins after local anesthesia	127.4000+26.15418	96.4000+30.33332	<0.05*
	SEM	4.3000+1.20773	1.2000+1.27035	<0.05*

Table IV : Comparison of MFIS, SEM and Heart rate in boys and girls in traditional and computerized anesthesia.

Variables	Group A			Group B		
	Boys n=18	Girls n=12	P value	Boys n=18	Girls n=12	P value
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
Subjective Evaluation	2.67±0.485	2.50±0.522	<0.001*	1.33±0.485	1.50±0.522	<0.001*
Objective Evaluation Heart Rate 2 mins prior LA	119.33±16.439	109.50±23.23	<0.001*	97.33±4.814	108.50±10.613	<0.001*
Heart rate during LA	141.83±30.643	121.00±15.226	<0.001*	117±14.233	127.25±4.975	<0.005*
Heart rate 2 mins after LA	128.50±24.815	125.75±29.099	<0.001*	105.17±11.105	83.25±43.826	<0.001*
SEM	4.25±1.138	4.33±1.283	<0.001*	0.83±1.249	1.75±1.138	<0.05*

when compared to boys. Whereas in Group B boys reported with lower pain perception when compared to girls. [Table No. 4].

Discussion

Pediatric dentist all over the globe prefer techniques and procedures that helps to enhance the behavior of the children in the dental office. Dental anxiety and fear are strongly related to impairment of having a quality oral health care in an individual's life. Successful dental treatment in a child depends not only on the quality of treatment, but also in instilling a positive attitude towards dental care.[15] For this reason, only children who were cooperative, having 'positive' or 'definitely positive' behavioral ratings according to Frankl scale [12]were included in this study.

Extraction procedures was selected as this procedure is considered to be most painful procedure for children.[17] Extraction of mandibular teeth is common than maxillary, hence they were included in the present study. The children aged 7-11 years were included in the present study since this age group belongs to concrete operational period according to Jean Piaget's cognitive theory. The children in this age group become capable of reasoning logically when the problem is displayed before them which would help them in making the decision regarding pain perception.[18] Children who had a previous history of dental treatment were excluded as their previous experiences might influence the results of the study.

Facial Image Scale [FIS] was used to assess the subjective pain response. This scale is a valid and reliable measure of dental anxiety for employment with young children in clinical settings. Ideally a scale should be short in length to maximize response from children and minimize time for administration; easy to hold the attention of child and be simple to score and interpret.[19,20] In the present study the scale was modified to three faces to reduce the confusion among the children while assessing the pain.[15]

Every child has different pain thresholds and thus physical reactions to a stimulus may vary from child to child. Thus one scale cannot be considered sufficient for pain evaluation. For better outcome of study, the present study used three scales namely – MFIS, SEM and heart rate measurement.[1] SEM scale introduced by Wright GZ[16] is an objective method that observes sound, eye and motor reactions and has been used in previous studies to measure comfort or pain in children.[17,21]Heart rate measurement was the physiological parameter used for objective pain evaluation. This measurement can provide indirect measures of pain and anxiety.[1] This measurement is not subject to observe bias and can provide important validation to direct observation measures.[22]

Benzocaine gel was applied prior to administration of anesthesia in the present study since Yogesh K and associates reported that this gel produces less pain response and disruptive behavior.[15] Nayak R and Sudha P showed that benzocaine gel had the most rapid onset of action and was superior in pain reduction when compared to 5% lignocaine ointment and 5% eutectic mixture of local anesthetics cream due to its low dissociation constant.[23]

The present study suggests that children belonging to Group B showed significantly less pain and disruptive behavior when compared to children of Group A. Gibson RS and associates compared WAND and traditional syringe in children of 5-13 years and concluded that there was no significant difference in pain ratings between them.[24] Palm AM and associates compared the pain perception while administering mandibular block with CCLAD and traditional method in children aged 7-18 years and concluded that mandibular block was less painful with CCLAD.[25] Children of group A showed more facial expressions, leg movements and were difficult to console when compared to WAND group. Ram D and Peretz B reported that there was no significant difference in crying, facial expression, hands, legs and torso movements while receiving injections with WAND and conventional syringes. This was seen irrespective of the age groups [3-5 yrs, 6-10 yrs] being compared.[2] Body movements, crying and application of restraints occurred more frequently while using a traditional syringe.[26] San Martin – Lopez reported a significant difference in heart rate on comparing computerized device and conventional syringe.[27] Langthasa M and associates found no significant differences in pulse rate, blood pressure and body temperature while administering injections with CCLAD and traditional syringe.[28]

In the present study girls reported with lower pain perception when compared to boys with traditional syringe method of anesthesia, whereas boys reported with lower pain perception when compared to girls with WAND device. Ram D and Peretz B found no significant difference in pain

perception between boys and girls receiving traditional injection as compared with the WAND.[2] Versloot J and associates reported that Wand system reduces internalizing behavior [such as muscle tension] in girls and externalizing behavior [such as verbal protest and body movement] in boys.[4]

There were few limitations in the present study that needs to be considered. The operator and the subjects were not blinded to the mode of local anesthetic delivery. An attempt was made to minimize this bias by using an independent observer for coding the behaviors.

Conclusion

Based on this study results, the following conclusions can be drawn –

1. School going children experienced less pain and disruptive behavior with WAND as compared to traditional method of anesthesia based on subjective and objective evaluation.

2. Girls reported with lower pain perception when compared to boys with traditional syringe method of anesthesia, whereas boys reported with lower pain perception when compared to girls with WAND device.

Use of WAND can be considered as a possible step forward towards achieving a relatively pain free, non-threatening and successful pediatric dental practice.

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Conflicts of interest

There are no conflicts of interest.

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Clinical assessment of identification of symptomatic tooth by the patients and the clinicians in various endodontic emergencies: A cross-sectional hospital-based study

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Abstract

Introduction: Pain of endodontic origin is the major cause to seek emergency dental services. Identification of the offending tooth is very crucial for its emergency management and to maintain a healthy Doctor-patient relationship.

Aim: This study was conducted to evaluate the frequency of identification of the painful tooth by the patient and the clinician in various Endodontic Emergencies (EE).

Methodology: 352 patients with EE who had given voluntary consent for the study were evaluated in this study. Identification of offending painful tooth was done by the patient and it was also identified and diagnosed by Endodontists using a standard clinical protocol and Visual Numeric Analogue Scale (VNAS). The frequency of identification of painful tooth by patients and clinicians was assessed and compared.

Results: The results of this study showed that patients were less accurate than the clinicians in identification of painful tooth in EE especially in Symptomatic Irreversible Pulpitis (SIP).

Conclusion: Clinician's knowledge, judgement and experience helps to locate the offending tooth precisely in EE. The spread of the infection to the periradicular area significantly increases the probability of identification of the painful tooth by the patients and clinicians.

Keywords: Dentist, Doctor-patient relationship, Endodontic Emergencies, Painful tooth.

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Introduction

In day to day dental practice, the pain of endodontic origin is the common cause which often requires the patient to visit the dentist on emergency basis.[1] International Association for the Study of Pain defines pain as, "Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage."[2] Endodontic Emergency (EE) may be observed as an acute pulpal pain, acute apical abscess, phoenix abscess or the trauma causing the pulpal injury.

When the patient visits the dentist in emergency, the quick and prompt diagnosis is vital and the treatment should be directed to relieve the painful episode. In that visit, the patient narrates the history of spontaneous or continuous, throbbing pain or swelling or trauma associated with a particular tooth or teeth. Often, the patient may not always be able to locate the involved tooth which causes severe odontalgia. Thus, the patient may demand treatment of wrong tooth by their mis-judgement. Different EE have presented clinically such as; Symptomatic Reversible Pulpitis (SRP), Symptomatic Irreversible Pulpitis (SIP), Symptomatic Acute Apical Periodontitis (SAAP) or Acute Apical Abscess (AAA).[3]

In a dental emergency, the identification of a painful tooth is also important to gain the patient's confidence in the dentist. Improper diagnosis may not cause the relief, rather it would degenerate the patient's trust and confidence in the treating dentist. The fundamental of this study was based on

whether the dentist should blindly trust patient in identification of painful tooth in EE or to carry out the diagnosis using their clinical knowledge, experience and clinical protocol. Thus, this study was conducted to evaluate, whether the patients reported with the EE could correctly identify the offending tooth as per the clinician's diagnosis and their pain severity was measured using Verbal Numerical Rating Scale (VNRS).[4]

Methodology

For this purpose, a pilot study was carried out including 30 patients aged between 21-60 years. Patients were selected randomly, who were reported with EE in the Emergency unit of Department of Conservative Dentistry and Endodontics of the Government Dental College and Hospital, Mumbai; from the Out-Patient Department section (OPD) of the hospital. Selected patients were diagnosed by two experienced Endodontists based on the case history questionnaire, clinical evaluation and the radiographic examination. Identification of the painful tooth with its clinical diagnosis was established by both the clinicians separately for all the patients. When there was a disagreement of opinion, the inter-operator bias was eliminated by arriving at the final diagnosis through discussion by both the clinicians. In this pilot study, 17 (56.66%) patients identified the painful tooth correctly whereas; the clinicians identify the correct tooth in 29 (96.66%) patients.

In the present study 4000 adult patients, aged between 21 to 60 years (mean age 35.7 years); referred to the Department of Conservative Dentistry and Endodontics from a period of 01/06/2016 to 30/06/2018 (24 months) were screened. Among the screened patients, 400 patients irrespective of their gender exhibited EE were randomly selected. Out of 400 patients, 352 patients; who were willing to participate voluntarily in the study were evaluated. They were divided into four groups according to the age as 21-30, 31-40-, 41-50 and 51-60 years.

Inclusion criteria

1) Any male or female with the age between 21 to 60 years.
2) The patient diagnosed with EE.
3) The patient who gave the consent voluntarily for the study.

Exclusion criteria

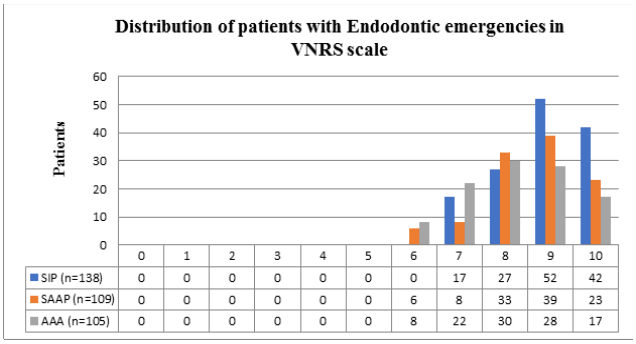
1) Patients having pain of non-endodontic origin.
2) All third molar teeth with EE.
3) Patients diagnosed with symptomatic reversible pulpitis, phoenix abscess and endodontic failure cases.
4) Patients on analgesic or antibiotic medications since a week.

The aim of the study was to assess whether the patients could precisely identify the troublesome tooth during their first endodontic emergency visit and compared it with the identification done by a team of two clinicians i.e. Endodontists. Diagnosis for each patient such as Symptomatic Irreversible Pulpitis (SIP), Symptomatic Acute Apical Periodontitis (SAAP) or Acute Alveolar Abscess (AAA) was done after thorough case history, clinical and radiographic examinations. All patients were scheduled immediately for EE management after the diagnosis irrespective of their participation in the study. The severity of pain was measured from 0 to 10 using VNRS Scale rating as 0-No pain to 10-Worst pain imaginable (Table I & Graph I).[4] The correct frequency of identifying the painful tooth by the patient using their tongue, finger or

Table I : Distribution of patients with Endodontic emergencies with VNRS scale

VNRS Scale	SIP (n=138)	SAAP (n=109)	AAA (n=105)
0 (No pain)	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5 (Moderate pain)	0	0	0
6	0	6	8
7	17	8	22
8	27	33	30
9	52	39	28
10 (Extreme pain)	42	23	17

Graph I: Distribution of patients with Endodontic emergencies in VNRS scale



the expression with the operator's diagnosis of the EE condition was noted and compared.

For the present study, a hypothesis was made, that the patients with symptomatic EE could identify the painful tooth more accurately when the disease advances from dental pulp to the periradicular tissues. Data obtained was compiled on MS Office Excel Sheet (v 2010) and was subject to statistical analysis using Statistical package for social sciences (SPSS v 21.0, IBM). Descriptive statistics like, disease-wise and gender-wise distribution was depicted. Comparison of frequencies of the patients to identify the correct painful tooth and pain severity and affecting teeth was done using Chi-square test. For all the statistical tests, $p<0.05$ was considered to be statistically significant.

Results

Out of 352 selected patients with EE, 203 (57.7%) were males and 149 (42.3%) were females. Out of evaluated EE, 138 (39.2%), 109 (30.9%) and 105 (29.9%) patients were diagnosed as SIP, SAAP and AAA respectively. Results showed that the clinicians were more accurate in painful tooth identification than the patients. It was also observed that in SAAP or AAA when the disease progressed apically, the patients and the clinicians could identify the affected tooth more significantly than patients diagnosed with SIP (**Table II, III & Graph II, III**). It was also observed that the maxillary and mandibular molars were the most commonly affected teeth in EE (**Table IV**). Similarly, patients were more precise in the identification of painful teeth of the maxillary region than the mandibular molars.

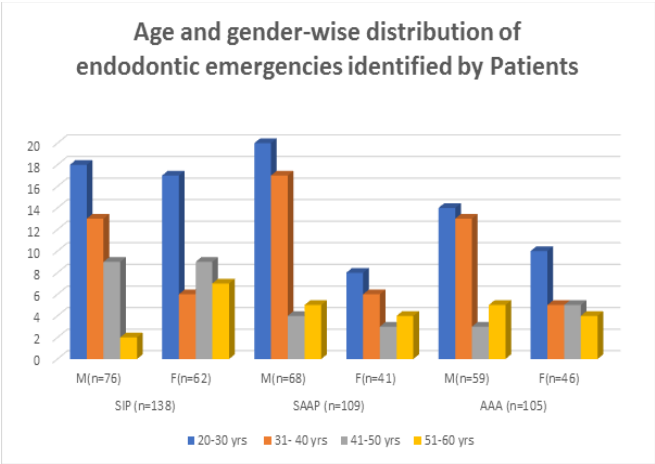
Table II : Age and gender-wise distribution of Endodontic emergencies identified by patients

Age groups (n=352)		**SIP (n=138)**		**SAAP (n=109)**		**AAA (n=105)**	
M (n=203)	F (n=149)	M(n=76)	F(n=62)	M(n=68)	F(n=41)	M(n=59)	F(n=46)
20-30 yrs		18/30 (60%)	17/24 (70.8%)	20/22 (90.9%)	8/14 (57.1%)	14/26 (53.8%)	10/18 (55.5%)
31- 40 yrs		13/22 (59.0%)	6/12 (50%)	17/27 (62.9%)	6/12 (50%)	13/21 (61.9%)	5/10 (50%)
41-50 yrs		9/18 (50%)	9/15 (60%)	4/8 (50%)	3/8 (37.5%)	3/7 (42.8%)	5/9 (55.5%)
51-60 yrs		2/6 (33.3%)	7/11 (63.6%)	5/11 (45.4%)	4/7 (57.1%)	5/5 (100%)	4/9 (44.4%)

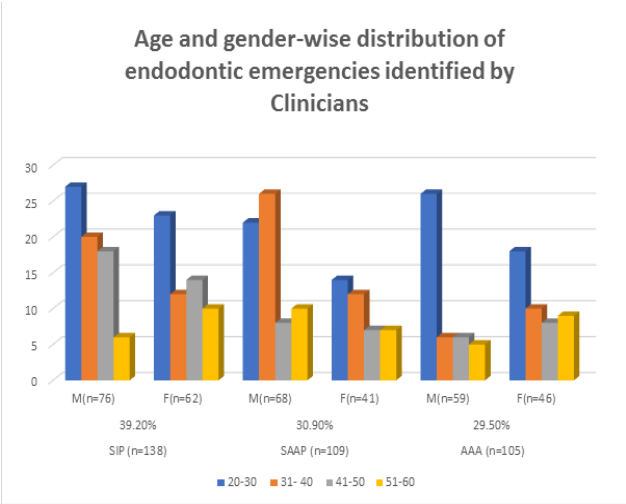
Table III : Age and gender-wise distribution of Endodontic emergencies identified by Clinicians

Age groups (n=352)		**SIP (n=138) 39.2%**		**SAAP (n=109) 30.9%**		**AAA (n=105) 29.5%**	
M (n=203)	F (n=149)	M(n=76)	F(n=62)	M(n=68)	F(n=41)	M(n=59)	F(n=46)
20-30 yrs (n=134)		27/30 (90%)	23/24 (95.8%)	22/22 (100%)	14/14 (100%)	26/26 (100%)	18/18 (100%)
31- 40 yrs (n= 104)		20/22 (90%)	12/12 (100%)	26/27 (96.2%)	12/12 (100%)	21/21 (100%)	10/10 (100%)
41-50 yrs (n= 65)		18/18 (100%)	14/15 (93.33%)	8/8 (100%)	7/8 (87.5%)	6/7 (85.7)	8/9 (88.8%)
51-60 yrs (n= 49)		6/6 (100%)	10/11 (90.9%)	10/11 (90.9%)	7/7 (100%)	5/5 (100%)	9/9 (100%)

Graph II : Age and gender-wise distribution of endodontic emergencies identified by Patients



Graph III : Age and gender-wise distribution of endodontic emergencies identified by Clinicians



Discussion

EE is an unpleasant and unexpected event in which a patient with odontalgia may visit the dental office at any time. In underdeveloped or developing countries due to inadequate health awareness regarding general as well as the oral health; people may visit the dentist usually when the pain is severe or when their routine functional life is disturbed. In a developing country like India; the oral health awareness has been increased drastically in urban sectors, leading to an increased number of patients visiting the dentist regularly. Some of the factors are still restraining the exposure of oral health services to the common masses including lack of education, poor economy, lack of time and the self oral health care negligence etc.

In the management of any EE, knowledge of such emergency and its diagnosis has a vital role. Academic emphasis on management of EE like imparting the knowledge, live doctor-patient communication, demonstration of various clinical examination, tests and investigations help to improve the patient management skills among the budding clinicians. Thus, it is recommended that before arriving at a diagnosis and initiating any endodontic treatment the patient's chief complaint must be reproduced. It is crucial, particularly when the patient may not be able to point out the offending tooth and may misguide the clinician. Thus, for successful endodontic practice standard clinical protocol has been adopted for diagnosis and treatment plan which includes; taking the detail case history, history of medications, thorough clinical examination, carrying out necessary clinical tests and the radiographic investigation of

Table IV : Quadrant-wise distribution of Endodontic emergencies identified by Clinicians

Age groups 352	Maxillary right side							Maxillary left side							Mandibular left side							Mandibular right side						
Tooth no.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**41**	**42**	**43**	**44**	**45**	**46**	**47**
20-30 yrs	6	4	3	3	3	6	6	6	4	3	4	5	7	6	4	3	4	5	5	8	7	3	3	3	5	6	7	5
31- 40 yrs	3	3	4	4	3	5	5	3	5	2	3	2	5	6	5	2	1	2	4	6	4	3	4	3	5	6	6	5
41-50 yrs	1	2	2	1	1	2	5	5	2	1	2	2	3	3	3	3	1	2	1	4	3	2	2	1	3	1	4	3
51-60 yrs	1	2	1	1	2	1	2	1	2	2	2	1	3	3	1	2	2	2	3	2	3	2	1	1	1	1	2	2

the patient.[5] Usually, diagnosis depends on the clinical symptoms and intraoral radiographs but Cone Beam Computed Tomography (CBCT) is superior to conventional radiographs in diagnosing the periapical pathosis when there are no signs or symptoms to conclude the correct diagnosis.[6] Similarly, the patients on analgesic or antibiotic medications were excluded from this study as these drugs may mask the symptoms and lead to incorrect diagnosis.[7]

In clinical point of view, the diagnosis of EE essential not only to manage the painful episode but also; to prevent the systemic spread of the infection leading to life-threatening conditions like space infection or Ludwig's angina.[8,9] A rare complication was reported in a case where patient died because of the cavernous sinus thrombophlebitis following the root canal treatment where; the most the suspected route for the spread of the infection was from the tooth to the maxillary sinus, the eye and the brain.[10] Thus, dilemma or wrong identification of affected tooth by the patient or the clinician may lead to wrong diagnosis, treatment or life threatening complications. It may also result in the persistence of the pain which leads to loss of the trust in the operating dentist.

Sometimes in clinical practice, diagnosing the SAAP and the SIP is confusing because of similar clinical symptoms whereas; the diagnosis of AAA is much simpler due to the obvious or visible swelling associated with the carious tooth. SIP is usually presented as severe, sharp-shooting, continuous pain associated with irreversible inflammation of the pulp whereas; SAAP indicates the spread of infection to periradicular tissue and the tooth becomes tender to percussion. Relief from the pain after a cold application in SIP is the key feature to distinguish between SIP and SAP. Also, SAP diagnosed teeth may present with a history of severe pain to cold stimuli for less than a week and the probability of diagnosed SAP was 72 %.[11] In a study, the clinical diagnosis of healthy pulp and reversible pulpitis were coincident with the histologic finding in 96.6% teeth whereas; the clinical and histologic finding of irreversible pulpitis coincided in only 84.4% cases.[12]

In the complicated cases when such infection remained undiagnosed and untreated, it leads to the formation of the periapical lesion and may cause systemic infection.[9] It is well documented that in the majority of the painful conditions of teeth involving EE; could be diagnosed using electric and cold stimuli. Painful tooth identification in the maxillary or mandibular arch may also vary and it may depend on the type of teeth involved. Results of our study indicated that patients may not correctly identify the offending tooth diagnosed with SIP but as the infection advanced to the periradicular area, the identification of painful tooth becomes more specific as in cases of SAAP or AAA.

The diagnosis is important in various EE; as the management also varies from case to case.[8,13] Removal of a major portion or complete inflamed pulp tissue relieves the patient's pain in SIP whereas; thorough cleaning-shaping with or without occlusal grinding is recommended to relieve the pain in patients with SAAP.[14] The patient with AAA, usually requires drainage either through root canal or through fluctuant and dependent soft tissues. The complication may arise when the spread of infection occurs from the infected tooth to the other vital structures or facial spaces present in the proximity. SAAP or AAA may also endanger the life of the patient if not treated appropriately and timely due to bacteraemia, septicaemia and the systemic involvement.[15]

In a busy schedule of modern dental practice; when unexpected EE case has reported to the dentist, where there may be limited time permitted for the treatment, the procedures for relieving the pain in SAAP and SIP may also vary. In a short time, the EE management for single-rooted and multi-rooted teeth may also differ. In SIP or SAAP of the single-rooted tooth, removal of the complete pulp tissue is advised whereas; in multi-rooted tooth with SIP, removal of coronal inflamed pulp i.e. pulpotomy may relieve the pain. In case of SAAP when the time does not permit the pulpectomy; the removal of pulp tissue from the largest root canal is generally recommended.

Treating the EE is a challenging task as the patient's sensibility is altered due to severe pain and difficulty in achieving anaesthesia especially in 'Hot Tooth' as in SIP or SAAP. Teeth with AAA usually do not require anaesthesia to get access to the pulp chamber. But, sometimes one or the other canal may exhibit partially vital pulp tissue which may need the pulpal anaesthesia for complete pulp extirpation and the debridement.

Diagnosis of EE is a critical issue as it requires skill and knowledge to identify the offending tooth and to gain the patient's confidence. The dentist-patient relationship relies on the trust in doctor's knowledge, skills, communication as well as correct diagnosis and treatment rendered by the doctor, especially critical situations like EE. In our study, the

gender and age of the patients have not shown any significant difference in the identification of painful tooth when compared to different EE. Diagnosis made by the clinicians was also consistent and there exists no statistically significant difference. Among all emergencies, the large number of patients diagnosed with AAA could be able to identify the painful tooth, followed by SAAP and SIP conditions. Identification of the offending tooth by clinicians and tooth identified by patients may not be the same in more than half of the cases of SIP; but as the diseases progress, identification of painful tooth becomes accurate for the patient especially in AAA cases and was similar to the observations of the clinician.

Literature search shows that very few studies were published which discussed the localization of pain in the oral cavity region.[16-18] A major study was carried out by McCarthty et al. in 2010 discussing the importance of identification of painful tooth in an EE by patients in its diagnosis and emergency management. The study showed similar results as in our study and exhibited that the patient could identify the arch more accurately than identifying the correct painful tooth in SIP or SAAP cases.[19] Friend and Glenwright found that 79.3% patients could identify the offending tooth when one tooth mesial or distal side was considered as correct.[17] In a study by McCarthy, the tooth localization probability was observed to be 90.7% when one tooth on either side of the identified tooth would have been considered as correct.[19]

For assessing the pain severity, response to pain usually measured in verbal-numerical observation.[20] VNRS scale has been used in this study as it has been regarded as an acceptable and practical method for initial pain assessment (Table I).[4] As pain is a subjective phenomenon, it often varies from individual to individual, time to time and sometimes also differs in the same patient. Thus, initial pain scale reading would act as primary reading which may be used as a reference to compare with post-emergency management.

In our study, none of the patients have reported the pain crossing the midline and the results were same as in the study by Van Hassel and Harrington.[18] Conversely, in another study it was reported that pain has crossed the midline in 1.5% of the examined population may be due to cross-innervation.[17] Seltzer et al. in their study concluded that mandibular posterior teeth may cause pain in ear and temporal region on the ipsi-lateral side and usually cause referred pain to the other jaw.[21] Our study reported that there was a significant difference between tooth identified by patients and by the clinicians. In some situations where the patient is in severe pain, may confuse and misguide the dentist. If the clinician relies on the patient's chief complaint without carrying out necessary examinations and investigations; it may render the wrong treatment.

Conclusion

Identification of pain source in the EE is a vital issue in the pain management. VNRS scale is a simple, quick and reproducible tool in pain assessment. Patient's certainty about the painful tooth may not always guide the clinician to conclude the diagnosis, especially in EE. Though, in some critical cases where patients could not identify painful tooth; the clinician's knowledge, judgement and experience would help to identify the offending tooth. Also, the spread of odontogenic infection to the periradicular area significantly increases the probability of identification of the painful tooth by the patients with severe odontalgia.

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Conflicts of interest

There are no conflicts of interest.

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"HEALTHY ORAL CAVITY = HEALTHY BABY" – Do our OBGY friends know??

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Abstract

Aim: To assess the knowledge, attitude and practices of Obstetricians and Gynecologists in Mumbai city regarding the association between periodontal health and pregnancy outcomes.

Methodology: A cross-sectional survey of 162 randomly chosen obstetrician and gynecologists from Mumbai was carried out by using a self-structured, closed-ended questionnaire containing 13 questions.

Results: A fair percentage of participants were aware of the correlation between gingival/ periodontal inflammation and pregnancy outcomes, however, a lesser percentage of them were aware that pregnancy increased the likelihood of gingival inflammation.

Conclusion: The study demonstrates that Obstetrician and Gynecologists of Mumbai city have decent knowledge about periodontal disease and pregnancy outcomes, however there exists a clear misconception regarding the provision and their approach to different types of dental treatment during pregnancy.

Key words : Periodontitis, Gynecologists, Pregnancy , Preterm Low Birth Weight.

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Introduction

It is a known fact that pregnancy involves complex physical and hormonal changes that have a significant impact on almost every organ system, including the oral cavity. Studies done in this field identified periodontitis as a potential risk factor for preterm birth and low birth weight.[1-6] This potential association between periodontitis and adverse pregnancy outcomes becomes an important concern because Preterm birth and Low Birth Weight [PLBW] are a major cause of infant mortality[1,3]. The highest rates of low birth -weight babies are reported from Asia, and the incidence in India is quite high at about 20%.[7]

In 1996 Offenbacher et al. first reported an association between periodontal disease and preterm delivery[8]. Many studies, systematic reviews and meta-analyses have since assessed the role of periodontal disease in causing adverse pregnancy outcomes and the findings have generally been supported. Nevertheless, there is still a need for larger, randomized controlled trials to confirm this association.

A pregnant woman is first seen by an Obstetrician and she may only visit a Dentist if advised to do so by her Doctor. Hence it becomes important to evaluate the knowledge, awareness and practices of Obstetricians and Gynecologists about periodontitis and its association with adverse outcomes of pregnancy. Hence the aim of the present study was to assess the knowledge, attitude and practices of obstetricians and gynecologists practicing in government hospitals, private hospitals or a private set up in Mumbai city regarding the association between periodontal health and adverse pregnancy outcomes.

Methodology

Subjects and sampling: The present study was a randomized, cross-sectional study. Study population

included randomly selected practicing Obstetrician and Gynecologists in Mumbai city. Data was collected in a Questionnaire format.

Questionnaire design: A structured anonymous questionnaire was prepared which consisted of 13 closed-ended questions. The first three questions were related to the participants' demographic characteristics like gender, practice type and years in practice. The following 10 questions aimed to evaluate the knowledge and practiced behaviors of the Obstetrician and Gynecologists' towards oral health care of pregnant patients. The approached doctors were provided with a covering letter explaining the nature and aim of the study. All Obstetrician and Gynecologist's entered the study voluntarily. Majority of the participant took 5-10 mins to complete the questionnaire form.

Figure I

QUESTIONNAIRE

Q. 1) Gender?
- ☐ Male
- ☐ Female

Q. 2) Type of Practice?
- ☐ Private clinic
- ☐ Private hospital
- ☐ Government hospital

Q. 3) Years in practice?
- ☐ <10 years
- ☐ 10-20 years
- ☐ 21-30 years
- ☐ >30 years

Q. 4) Do you agree that pregnancy increases the likelihood of gingival inflammation?
- ☐ Yes
- ☐ No

Q. 5) Do you believe that gingival/ periodontal inflammation can affect the outcome of pregnancy?
- ☐ Yes
- ☐ No

Q. 6) Do you think periodontal disease can lead to preterm labour and/or low birth weight?
- ☐ Yes
- ☐ No

Q.7) If Yes, do you make your patients aware of this relationship?
- ☐ Yes
- ☐ No

Q.8) Do you check oral/gingival health of expectant mother's?
- ☐ Yes
- ☐ No

Q.9) Have your patients ever mentioned small swellings/ bleeding gums, to0oth mobility etc?
- ☐ Yes
- ☐ No

Q.10) If yes, have referred your patients to a....
- ☐ Dentist
- ☐ Periodontist
- ☐ None

Q.11)Which procedures do you consider safe during pregnancy?
- ☐ Routine cleaning
- ☐ Fillings/ Crowns
- ☐ Extractions
- ☐ Periodontal surgery
- ☐ Intra-oral/ Extra-oral radiographs

Q.12) Safest trimester of pregnancy for dental treatment?
- ☐ First trimester
- ☐ Second trimester
- ☐ Third trimester

Q.13)Where have you come across this relationship between health of gums and outcome of pregnancy?
- ☐ Journals
- ☐ Online articles
- ☐ CMEs
- ☐ Others
- ☐ None

Statistical Analysis: The results were analyzed and expressed as the number and percentage of respondents for each question.

Results

A total of 162 Obstetrician and Gynecologists responded to the survey. Of these, 129 were female and 33 were male practitioners. 47 participants were linked to government institutions; 77 to private hospitals and 38 of the participants had their private practice.

110 of the 162 participants agreed that pregnancy increased the likelihood of gingival inflammation. 127 participants agreed on the relationship between gingival inflammation and pregnancy outcomes and 121 of these participants accepted that these outcomes include preterm labor and/or low birth weight.

While 118 of the 162 participants made their patients aware of the above relationship, 94 of them checked the oral/gingival health of expectant mothers.

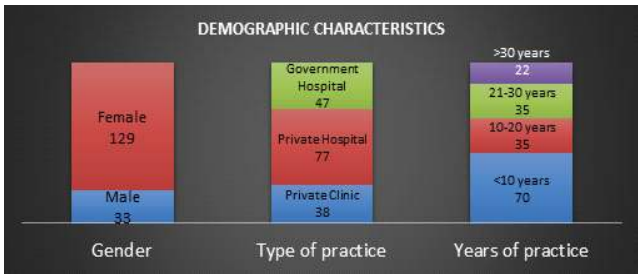
148 of the participants accepted that their patients complained of gingival or periodontal problems. Most Obstetrician and gynecologist's (135) of them referred their patients to a dentist (general practioner) and only 18 of them referred their patients to a periodontist.

When asked which dental procedures they considered safe during pregnancy; 33.5% considered routine oral prophylaxis safe; 24.9% of them considered fillings and crowns safe; only 15%-20% participants considered

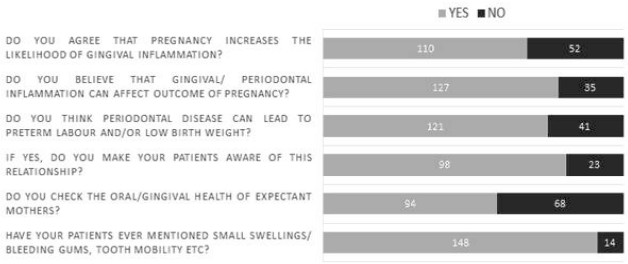
periodontal surgeries and extractions safe and only 7.8% of the participants considered intra-oral/ extra-oral radiographs safe during the pregnancy term.

55.3% of the participants considered only the second trimester safe for dental treatment during pregnancy. 25.3% considered first trimester safe and 19.4% considered the third trimester also safe.

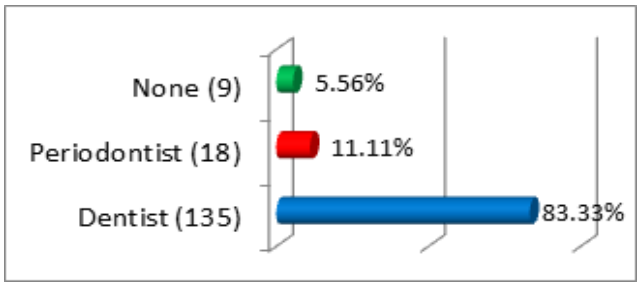
Graph I : Demographic characteristics of the participants of the study



Graph II : Questions in the questionnaire and their corresponding answers.

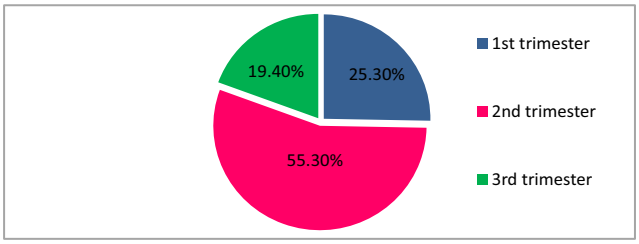


Graph III: Referral by an Obstetricians and Gynecologists.



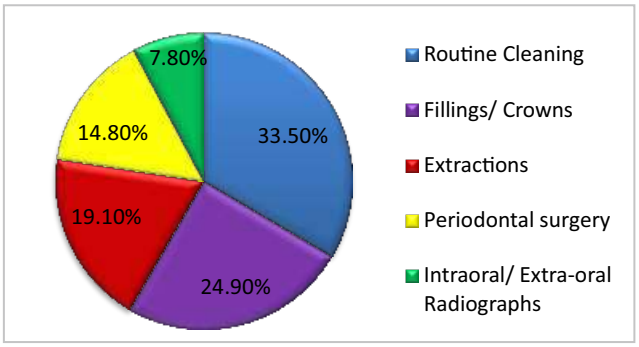
IF YES, HAVE REFERRED YOUR PATIENTS TO A....

Graph IV : Safest trimester considered by Obstetrician and Gynecologists for dental treatment



SAFEST TRIMESTER OF PREGNANCY FOR DENTAL TREATMENT ?

Graph V : Dental procedures considered safe by Obstetricians and Gynecologists during pregnancy.



WHICH PROCEDURES DO YOU CONSIDER SAFE DURING PREGNANCY ?

Discussion

To our knowledge, this is the first study conducted in the Mumbai city to assess the knowledge, attitude and practices of the gynecologists in relation to the association of periodontal disease and adverse pregnancy outcomes.

In agreement with the finding of previous studies[11-12] the present study found no difference in mean knowledge score between age groups, gender, type of practice and years of practice.

This study demonstrated that a high percentage (68%) of the gynecologists were aware that pregnancy increases the likelihood of gingival inflammation. Almost three-fourth (78.6%) of the surveyed gynecologists agreed that periodontal disease could lead to adverse pregnancy outcomes, preterm labor and/or low birth weight, which is in accordance with studies carried out by Morgan *et al* (USA), Neves *et al* (Brazil), Suri V et al [13](Chandigarh, India), Uma et al (Bangalore, India).

While almost 73% of the subjects made their patients aware of this relationship, which is similar to the figures in study done by Tarannum et al[9] and Nutalapati et al[10] , a number close to 50% of gynecologists did not check the oral cavity of expectant mothers.

As majority 91.36% of the patients came with complaints of swellings in their gums and/or mobile teeth, almost 83.3% of the Doctor referred them to a Dental Surgeon and not a specialist/periodontist. The Obstetrician and Gynecologists are unaware of the role of a Periodontist in the treatment of "gum diseases".

Although the overall knowledge level of the Gynecologists was satisfactory in this study, however, there

still exist misconceptions regarding provision of dental treatments during the term of pregnancy. With the advances in the field of health, pregnancy is no longer regarded as a contraindication to the provision of quality dental care. The results showed no clear understanding regarding the treatments considered safe during pregnancy, by Obstetrician and Gynecologists.

While 20-30% of them considered extractions, routine cleaning and fillings to be safe, only 7.8% considered intra oral/ extra-oral radiographs as 'safe'. Dental radiographs play an important role in diagnosis and treatment of many dental conditions. Studies have reported that it is safe to take necessary intraoral and extraoral dental radiographs of pregnant women, and they do not pose any risk to the developing fetus. However, it is recommended to use protective lead aprons and thyroid collar to shield the sensitive areas[14-15]

In this study, more than 50% (55.3%) of the Gynecologists considered the second trimester of pregnancy as the safest for provision of dental treatment. These findings corroborate previous studies. [9,11]Research has constantly verified that dental treatment can be safely administered during any of the three trimesters of pregnancy. The AAPD recommends that all pregnant patients should seek professional oral health care during the first trimester [19]. Pregnant woman is generally more comfortable during 14 to 20 weeks of gestation. Emergency dental care can be provided in any trimester but in third- trimester patient positioning modifications are needed because the pregnant uterus is below the umbilicus, in addition, dental appointments should be short in duration [1,18,19]

Based on the findings of this study, it is highly recommended that the Obstetrician and Gynecologists of Mumbai city/ India should be advised to check the oral cavity of expectant mothers for health or disease and must advice their patients a visit to a dentist or Periodontist for the same. For the practicing Obstetrician and Gynecologists, education courses on periodontal disease and relationship with adverse pregnancy outcomes could be developed by the dental community.

Conclusion

Although study participants had a fair knowledge about oral health and its relationship with pregnancy outcome, but there is a gap between their knowledge and practice. Their preventive oral health practice is inadequate, which showed no difference across age, gender, type and duration of practice.

Oral health care should be made an integral part of the obstetric examination throughout the gestational period. The importance and role of referral to a specialist, a periodontist, should be emphasized on. There is need for a coordinated interdisciplinary effort for prevention of adverse pregnancy outcomes.

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Conflicts of interest

There are no conflicts of interest.

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Comparative analysis of dentinal tubule penetration of three different root canal sealers along with resilon and gutta-percha to root dentin - An in vitro SEM study.

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Abstract

Aim: To evaluate the dentinal tubule penetration depth of three different sealers namely Zinc oxide Eugenol sealer, AH Plus and Epiphany with Resilon and Guttapercha core materials under SEM at various levels of radicular dentin.

Materials and methods: Forty five Single root mandibular premolars were collected considering inclusion and exclusion criteria. All the 45 specimens were randomly allocated into three groups as follows - Group I: Obturation was done using gutta-percha cones and zinc-oxide Eugenol sealer, Group II: Obturation was done using gutta-percha cones and Epoxy resin based AH Plus sealer. Group III: Obturation was done using Resilon cones and Epiphany SE sealer. The specimens were then subjected to SEM analysis after one week.

Photomicrographs of coronal, middle, and apical thirds of root canal were taken for sealer penetration at a magnification of x1000. The values obtained were measured in micron meters (µm) which were then subjected to statistical analysis.

Results and Observations: The tabulated observations were then statistically analysed using one way ANOVA at significant level of ($p<0.05$) at each third of the root canal that showed maximum penetration depth in the coronal third with statistically significant difference ($p<0.05$) between the three sealers.

Conclusion: The maximum penetration of all the three sealers was seen in the coronal third, least or negligible in the apical third with maximum depth of penetration was observed in Group III - Epiphany sealer.

KeyWords: AH plus sealer, Epiphany-Resilon, Resin Monoblock System, Scanning Electron Microscope, Zinc Oxide eugenol sealer.

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Access this article online

Introduction

The aim of Endodontics is the preservation of tooth in the oral cavity to its function. It consist of endodontic triad containing access cavity preparation, cleaning shaping and three dimensional obturation of the canal.

The cleaning and shaping procedure is considered as one of the prime steps and requires instrumentation using endodontic instruments and activated irrigation. During instrumentation the generated smear layer may cover the prepared canal walls and occlude the dentinal tubules. Thus, complete elimination of microorganisms from the root canal is not achieved which ultimately affects the prognosis of root canal therapy.[1] Goldberg and Abramovich suggested that the smear layer might prevent the penetration of intracanal disinfectants and filling materials into dentinal tubules.[2] Studies concluded that the removal of the smear layer is mandatory in order to facilitate the adaptation of adhesive plastic root canal filling materials so as to promote the sealers to penetrate into dentinal tubules.[3,4,5]

Obturation of the root canal space eliminates all avenues of retrograde leakage into the root canal system by creating a fluid tight seal.[6] Usually, a core filling material is used in conjunction with root canal sealers to attain a fluid impervious seal between the core material and root canal walls[7] as most of the sealers exhibit the ability to penetrate into the accessory canals, lateral canals and dentinal tubules. Since ages, the material of choice as a sealer used in Endodontics is based on zinc oxide and eugenol formulations, but however the drawback is that they are not adhesive.[8] AH Plus on other hand (Epoxy – based sealer) is one of the most commonly used adhesive resin sealer. It has higher bond strength to dentin in comparison to zinc oxide – eugenol, glass ionomer and calcium hydroxide – based sealers.[9]

Resilon is a synthetic polymer based obturating material introduced in 2004[10,11] broadens the dimensions of endodontic adhesion. This system consists of a combination of primer, dual cure sealer and resin obturating material[12] and creates a mono-block effect. The Monoblock effects is created by the adhesion of Resilon cone to resin based sealer, which in turn adheres to the dentinal wall via penetrating into dentinal tubules.[10,13] Shipper et al. called it as "Resilon Monoblock System" (RMS) which has the potential to strengthen the root canal walls against the fracture and decrease the micro leakage.[14] The sealer cements within dentinal tubules also entombs the residual bacteria within the tubules and the chemical components of sealer may exert an antibacterial effect that will be enhanced by closer approximation to the bacteria.

Thus, this in-vitro study was conducted to compare the dentinal tubule penetration of three different root canal sealers - zinc oxide eugenol, AH Plus and Epiphany sealer with Resilon and Gutta-percha core materials, under Scanning Electron Microscope (SEM).

Material and Method

In this invitro study, forty five single root mandibular premolars were collected from the Department of Oral and Maxillofacial Surgery, Government Dental College and Hospital, Mumbai. (Sample size- 45, margin of error 5, confidence level 95% and population size 50). The inclusion criterias were -sound teeth without caries and teeth with single and straight canals with fully developed apices. Teeth with open apices, cracks, curved and multiple canals, fractured teeth were excluded from the study.

The specimens were cleaned off soft tissue, calculus and stains with the help of scaler and were stored in 0.9% normal saline in a glass beaker till the time they were used further.

Decoronization of all 45 specimens was done using a double sided diamond disc under copious water cooling where coronal surface was perpendicular to the long axis of the root and the remaining root length was kept as 14mm using digital vernier calliper.

Cleaning and shaping :

Working length was determined by placing a No.#10 K file into the root canal, until it was just visible at the apical foramen and then withdrawing it by 1 mm. The pulp tissue remnants were removed using barbed broach. The specimens were instrumented using Protaper Ni-Ti rotary instrument system. All the root canals were prepared to final apical size of F2. Copious irrigation was done using 5ml of 3% sodium hypochlorite (NaOCl) solution using a syringe and 27 gauge needle throughout instrumentation. All specimens were flushed with 1ml of 17% EDTA solution followed by 5ml of 3% sodium hypochlorite solution for 1 minute in order to remove the smear layer. This was followed by a final irrigation with 5ml of 0.9% Normal saline. Each of the root canal specimens were dried with the sterile paper points and kept ready for obturation.

All the 45 specimens were randomly allocated into three groups:

Group I : Obturation was done using gutta-percha cones and Zinc-oxide Eugenol sealer.

Group II : Obturation was done using gutta-percha cones and Epoxy resin based AH Plus sealer.

Group III : Obturation was done using Resilon cones and Epiphany SE sealer.

In Group III after obturation the coronal portion of the sealer was subsequently subjected to polymerization using light curing unit for 40 seconds. Excess material was seared-off at the root canal orifice and condensed with a plugger to 1mm below the canal orifice which are then sealed using Intermediate Restorative Material (IRM). The specimens in all the four groups were stored separately for 1 week at room temperature to allow sealer to set completely.

Preparation of specimens for SEM examination :

A slow speed, water- cooled diamond impregnated disc was used to section the specimens parallel to their long axis, resulting into two specimens per tooth. One segment from each split specimen was selected and was prepared for SEM examination. The surface of all the specimens was demineralized with 10 minutes application of 17% EDTA. A further 10 minutes application of 3% NaOCl was used to remove debris and the surface layer of organic matrix around the sealer tags.

The specimens were then washed with distilled water and air dried. The specimens were then desiccated using graded concentration (30%, 50%, 70% 90%, 100%) of ethanol. All the specimens were vacuum dried and mounted onto existing aluminium stubs. The specimens were sputter coated with a thin gold coating using Gold sputtering machine and examined under Scanning Electron Microscope.

Photomicrographs of coronal, middle, and apical thirds of root canal were taken at a magnification of x1000 and maximum depth of sealer penetration was measured in µm at coronal, middle and apical thirds of root canal. The values obtained were measured in micron meters (µm). The results were tabulated and subjected to statistical analysis.
[Table I- XV]

TABLE – I

Penetration Depths In Micron Meters Of Group – I (Zinc-oxide Eugenol) At Various Thirds Of Root Canal

Sample	Coronal third	Middle third	Apical third
1	13 ìm	13 ìm	04 ìm
2	18 ìm	-	-
3	17 ìm	14 ìm	-
4	18 ìm	10 ìm	03 ìm
5	21 ìm	-	-
6	18 ìm	11 ìm	02 ìm
7	17 ìm	12 ìm	06 ìm
8	20 ìm	-	-
9	19 ìm	10 ìm	05 ìm
10	18 ìm	-	-
11	15 ìm	13 ìm	-
12	20 ìm	10 ìm	02 ìm
13	18 ìm	-	04 ìm
14	17 ìm	12 ìm	-
15	20 ìm	11 ìm	03 ìm

TABLE – II

Penetration Depths In Micron Meters Of Group – II (AH Plus) At Various Thirds Of Root Canal

Sample	Coronal third	Middle third	Apical third
1	49 ìm	18 ìm	16 ìm
2	47 ìm	20 ìm	-
3	50 ìm	26 ìm	13 ìm
4	52 ìm	29 ìm	12 ìm
5	53 ìm	42 ìm	14 ìm
6	57 ìm	22 ìm	-
7	55 ìm	35 ìm	-
8	53 ìm	22 ìm	13 ìm
9	48 ìm	24 ìm	-
10	52 ìm	20 ìm	09 ìm
11	52 ìm	20 ìm	13 ìm
12	46 ìm	34 ìm	10 ìm
13	42 ìm	26 ìm	-
14	48 ìm	32 ìm	11 ìm
15	50 ìm	30 ìm	09 ìm

TABLE – III

Penetration Depths In Micron Meters Of Group – III (Resilon-Epiphany) At Various Thirds Of Root Canal

Sample	Coronal third	Middle third	Apical third
1	52 ìm	44 ìm	30
2	60 ìm	36 ìm	32
3	56 ìm	32 ìm	26
4	62 ìm	37 ìm	23
5	57 ìm	22 ìm	19
6	58 ìm	21 ìm	18
7	56 ìm	18 ìm	16
8	53 ìm	20 ìm	19
9	55 ìm	24 ìm	17
10	58 ìm	35 ìm	22
11	51 ìm	34 ìm	28 ìm
12	49 ìm	26 ìm	22 ìm
13	52 ìm	28 ìm	24 ìm
14	54 ìm	27 ìm	26 ìm
15	56 ìm	32 ìm	21 ìm

TABLE - IV

Maximum Penetration Depth (in µm) Of Zoe, AH Plus, and Epiphany Sealers

Sample	ZOE	AH Plus	Resilon-Epiphany
1	13 ìm	49 ìm	52 ìm
2	18 ìm	47 ìm	60 ìm
3	17 ìm	50 ìm	56 ìm
4	18 ìm	52 ìm	62 ìm
5	21 ìm	53 ìm	57 ìm
6	18 ìm	57 ìm	58 ìm
7	17 ìm	55 ìm	56 ìm
8	20 ìm	53 ìm	53 ìm
9	19 ìm	48 ìm	55 ìm
10	18 ìm	52 ìm	58 ìm
11	15 ìm	52 ìm	51 ìm
12	20 ìm	46 ìm	49 ìm
13	18 ìm	42 ìm	52 ìm
14	17 ìm	48 ìm	54 ìm
15	20 ìm	50 ìm	56 ìm

TABLE -V

Table Showing Mean, Standard Deviation,
Standard Error In Coronal Third Of All The Three Sealers

	N	Mean	Std. Deviation	Std. Error
ZOE	15	17.9000	2.13177	.67412
Resilon	15	56.7000	3.02030	.95510
AH Plus	15	51.6000	3.13404	.99107
Total	45	42.0667	17.71602	3.23449

TABLE – VI

Table Showing Mean, Standard Deviation,
Standard Error In Middle Third Of All The Three Sealer

	N	Mean	Std. Deviation	Std. Error
ZOE	15	7.0000	6.14636	1.94365
Resilon	15	28.9000	8.96227	2.83412
AH Plus	15	25.8000	7.58361	2.39815
Total	45	20.5667	12.30274	2.24616

TABLE-VII

Table Showing Mean, Standard Deviation,
Standard Error In Apical Third Of All The Three Sealers

	N	Mean	Std. Deviation	Std. Error
ZOE	15	5.0000	2.13936	1.00045
Resilon	15	19.2000	5.96271	1.45412
AH Plus	15	12.3100	3.58001	1.21815
Total	45	9.5783	6.76274	1.12616

TABLE-VIII

Analysis Of Variance (one-way Anova) Coronal Third

	Sum of Squares	d.f.	Mean Square	F	Sig.
Between Groups	8890.467	2	4445.233	567.745	.000
Within Groups	211.400	27	7.830		
Total	9101.867	29			

TABLE-IX

Analysis Of Variance (one-way Anova) Middle Third

	Sum of Squares	d.f.	Mean Square	F	Sig.
Between Groups	2808.867	2	1404.433	23.992	.000
Within Groups	1580.500	27	58.537		
Total	4389.367	29			

TABLE-X

Analysis Of Variance (one-way Anova) Apical Third

	Sum of Squares	d.f.	Mean Square	F	Sig.
Between Groups	1606.845	2	1091.421	16.092	.000
Within Groups	1079.245	27	26.217		
Total	2456.231	29			

TABLE-XI

Post Hoc Tests Multiple Comparisons In Coronal Third

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.
Resilon	AH Plus	5.10000(*)	1.25137	.000
	ZOE	38.80000(*)	1.25137	.000
AH Plus	Resilon	-5.10000(*)	1.25137	.000
	ZOE	33.70000(*)	1.25137	.000
ZOE	Resilon	-38.80000(*)	1.25137	.000
	AH Plus	-33.70000(*)	1.25137	.000

* The mean difference is significant at the .05 level.

TABLE-XII

Post Hoc Tests Multiple Comparisons In Middle Third

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.
Resilon	AH Plus	1.10000	3.42161	.373
	ZOE	16.90000(*)	3.42161	.000
AH Plus	Resilon	-1.10000	3.42161	.373
	ZOE	12.20000(*)	3.42161	.000
ZOE	Resilon	-16.40000(*)	3.42161	.000
	AH Plus	-10.18000(*)	3.42161	.000

* The mean difference is significant at the .05 level.

TABLE-XIII

Post Hoc Tests Multiple Comparisons In Apical Third

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.
Resilon	AH Plus	3.10000	4.34161	.142
	ZOE	21.90000(*)	4.34161	.000
AH Plus	Resilon	-3.10000	4.34161	.142
	ZOE	18.80000(*)	4.34161	.000
ZOE	Resilon	-21.90000(*)	4.34161	.142
	AH Plus	-18.80000(*)	4.34161	.142

* The mean difference is significant at the .05 level.

TABLE-XIV

Analysis Of Variance (one-way Anova)
Maximum Penetration Depth (in µm)
In Epiphany, Ah Plus, And Zoe

	Sum of Squares	d.f.	Mean Square	F	Sig.
Between Groups	8890.467	2	4445.233	567.745	.000
Within Groups	211.400	27	7.830		
Total	9101.867	29			

TABLE-XV

Multiple Comparisons Maximum Penetration Depth (in mm)
In Epiphany, Ah Plus And Zoe

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.
Resilon	AH Plus	5.10000(*)	1.25137	.000
	ZOE	38.80000(*)	1.25137	.000
AH Plus	Resilon	-5.10000(*)	1.25137	.000
	ZOE	33.70000(*)	1.25137	.000
ZOE	Resilon	-38.80000(*)	1.25137	.000
	AH Plus	-33.70000(*)	1.25137	.000

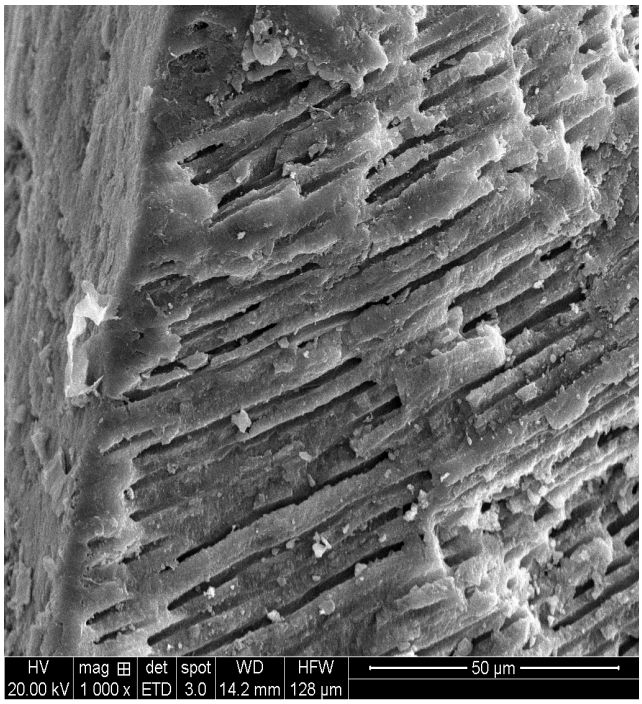
* The mean difference is significant at the .05 level.

Results

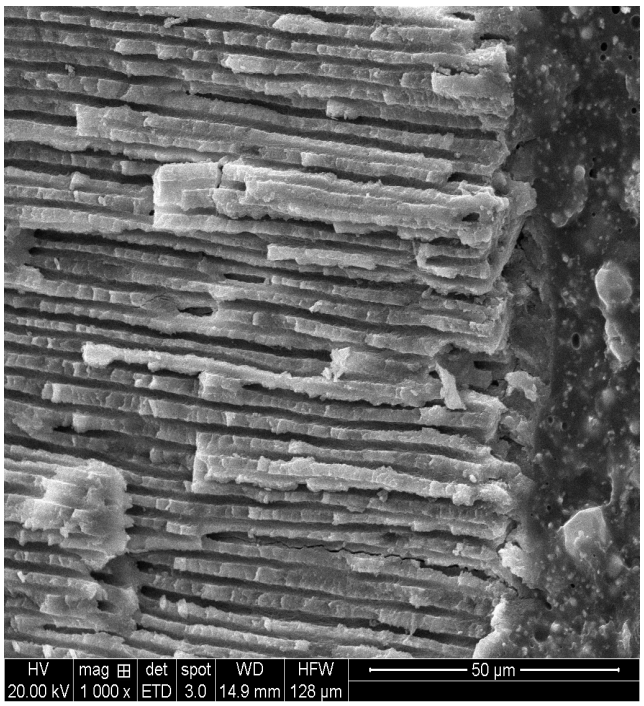
Group I (Zinc-Oxide Eugenol):

On examination under SEM, the sealer particles were large, spherical with limited penetration upto 21µm, 14µm and 6µm in coronal, middle and apical third respectfully (Photomicrograph IA, IB, IC)

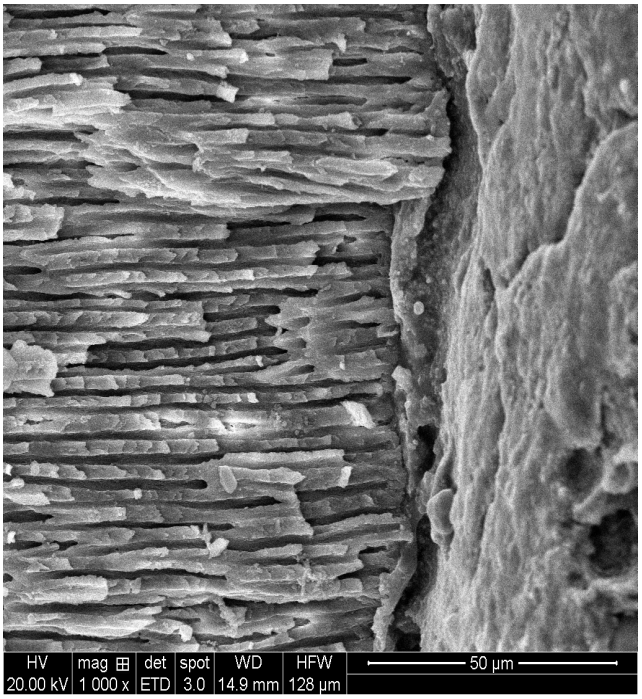
Photomicrograph I A:
SEM Photomicrograph of Group I at Cervical third



Photomicrograph I B:
SEM Photomicrograph of Group I at Middle third



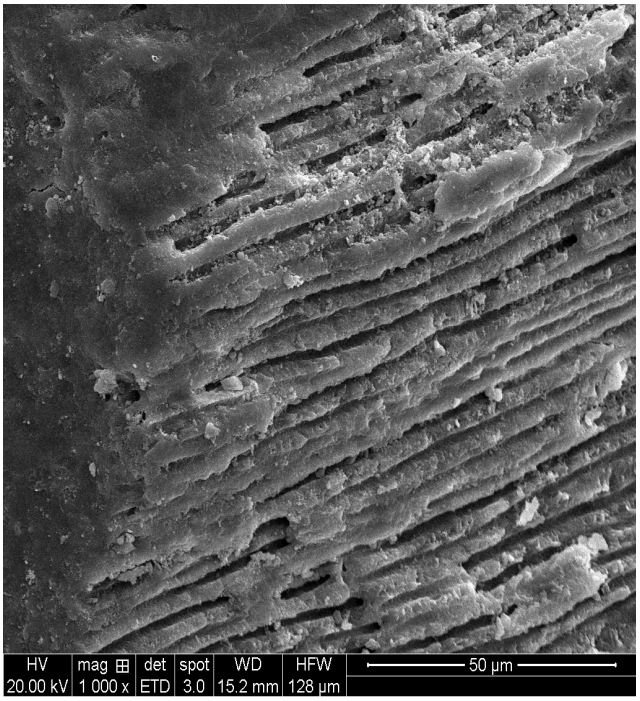
Photomicrograph IC:
Sem Photomicrograph of Group I at Apical Third



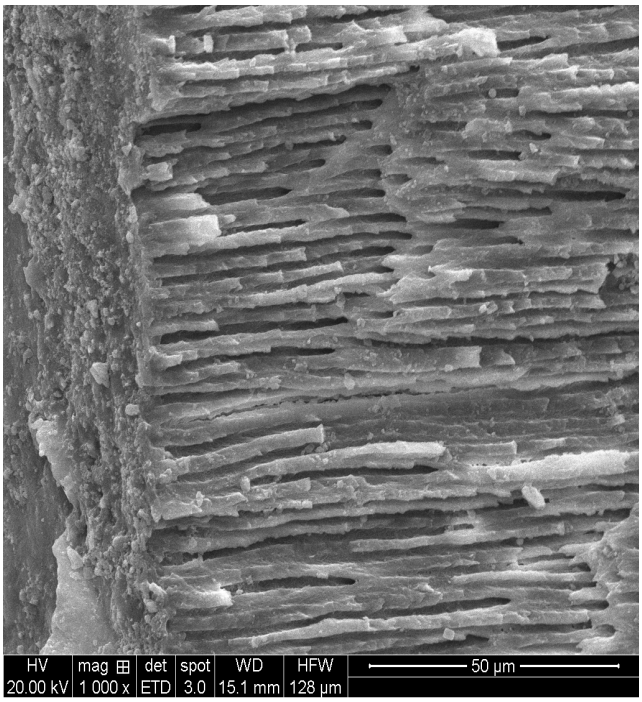
Group II (AH Plus):

The appearance of the sealer was granular with maximum penetration upto 57µm, 42µm and 16µm in coronal, middle and apical third respectfully (Photomicrograph IIA, IIB, IIC)

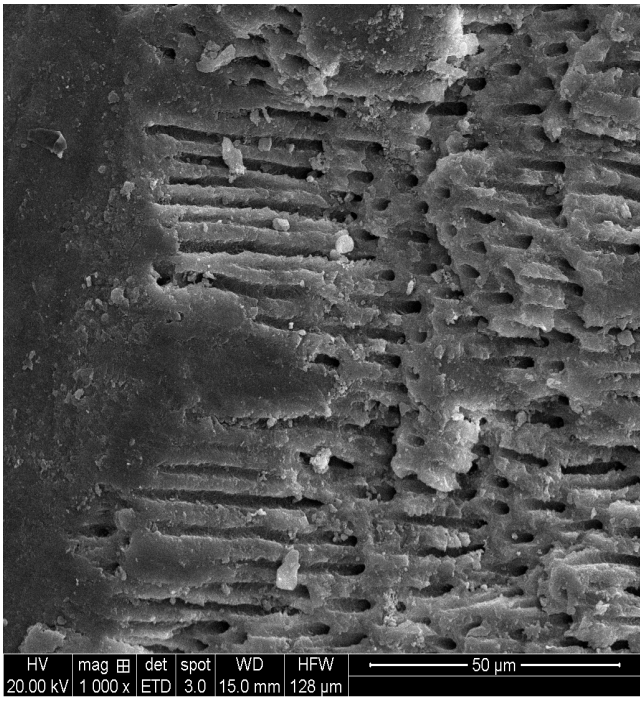
Photomicrograph II A:
SEM Photomicrograph of Group II at
Coronal third



Photomicrograph II B:
SEM Photomicrograph of Group II at Middle third



Photomicrograph II C:
SEM Photomicrograph of Group II at Apical third

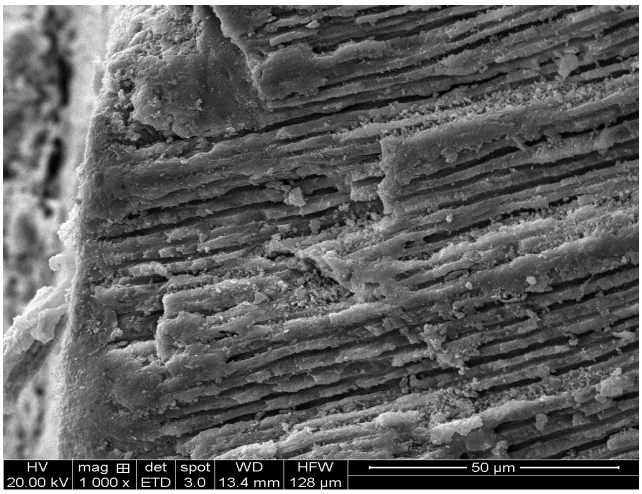


Group III (Resilon-Epiphany):

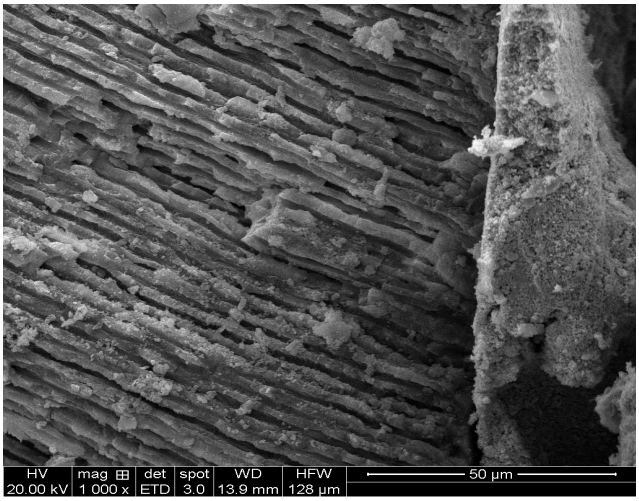
The appearance of the sealer was granular with maximum penetration upto 62µm, 44µm and 32µm in coronal, middle and apical third respectfully

(Photomicrograph IIIA, IIIB, IIIC)

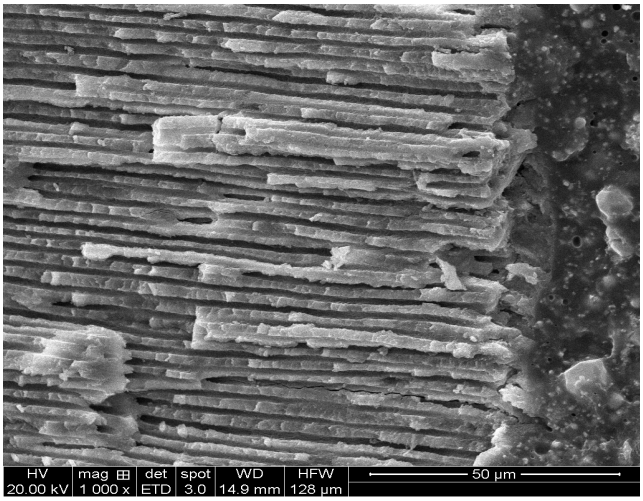
Photomicrograph 3 A:
SEM Photomicrograph of Group III at Coronal third



Photomicrograph 3 B:
SEM Photomicrograph of Group III at Middle third



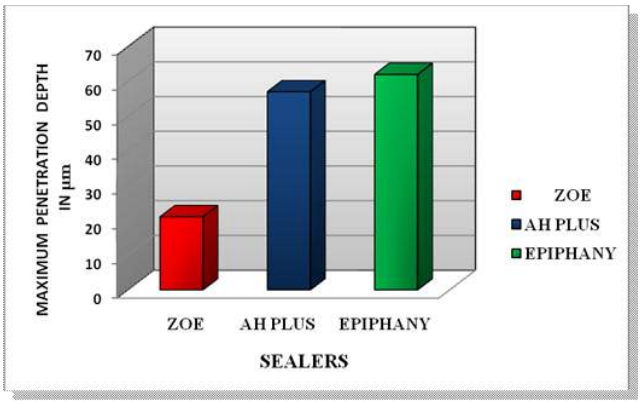
Photomicrograph III C:
SEM Photomicrograph of Group III at Apical third



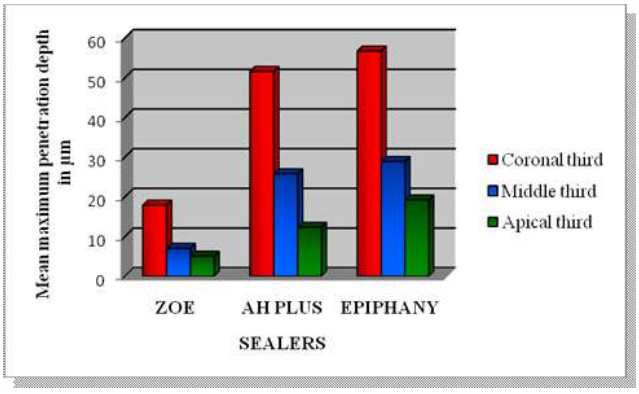
The tabulated observations were then statistically analysed using one way ANOVA at significant level of ($p<0.05$) at each third of the root canal. It was found that all the three sealers showed maximum penetration depth in the coronal third with statistically significant difference ($p<0.05$) between the three sealers.

Post Hoc test was also performed, to compare the variation of maximum penetration depth of sealer tested between the groups. In comparison to Group I (Zinc Oxide Eugenol sealer), Group II (AH Plus) and Group III (Epiphany) showed highly statistical significant difference. Group II and Group III also showed statistical significant difference.

GRAPH I
Graphical Representation Of The Maximum Penetration Depth (in mm) Of Zoe, AH Plus, And Epiphany Sealers



GRAPH II
Graphical Representation Of The Mean Maximum Penetration Depth (In Mm) Of Zoe, AH Plus, And Epiphany Sealers



Discussion

Three dimensional obturation of the root canal is one the main goals of endodontic treatment essential for preventing reinfection of the canal and to preserve the health of the periapical tissues, thereby ensuring the success of root canal therapy.[7]

Root canal sealers play an integral role in obturation and are important to attain an impervious fluid tight seal between the core material and root canal walls. Over the past century, gutta-percha (GP) combined with zinc oxide eugenol sealer has been the most commonly used obturation system and has served as a benchmark when evaluating newer materials.[15]

However, GP and ZOE sealer does not have adaptation to the root canal walls and does not form a 'monoblock' thereby may exhibit microleakage and various studies have exhibited leakage at their interface.[16,17] Due to these limitations, the newer materials are introduced to form a seal along the radicular dentin which is important in preventing re-infection of the root canal space.

Resin sealers and synthetic root canal filling material were introduced and their design is based on polyester chemistry and these exhibit looks and handles similar to gutta percha [7]. Studies have shown that bacterial leakage with Resilon is significantly less when compared with gutta-percha.[16] Resin sealers have shown to penetrate into the dentinal tubules much more than the conventional sealers[3,15]. This study was undertaken to evaluate the penetration depth of 3 sealers - Zinc oxide Eugenol, AH Plus and Epiphany sealer with Resilon and Guttapercha core materials into the dentinal tubules using a Scanning Electron Microscope (SEM).

Over the years, SEM have been used by a number of investigators to evaluate the sealer penetration into dentinal tubules.[18,19,20,21,22,23] The images produced using SEM allows for detailed observation of the dentinal tubules, the integrity and surface appearance of the sealer cement[5]. The penetration of the sealer into the dentinal tubules can be seen in detail and at high magnification.[4]

Instrumentation during root canal therapy produces a 1-5 µm thick smear layer. Mc Comb and Smith were the first to describe the smear layer on instrumented root canal walls[1].

Proponents state that the removal of the smear layer allows for intimate contact of irrigants, medicaments and sealers with the potentially infected dentinal tubules.[1,5,15,20,21] The smear layer plays an important role in root canal therapy because it affects the adaptation of filling materials to the root canal walls. Many studies conclude that the removal of the smear layer is mandatory for the adhesive root canal filling materials and sealers to penetrate dentinal tubules.[1,21,24] Application of EDTA and NaOCl removes the smear layer completely and allows all sealers to penetrate into the dentinal tubules, although to a varying depths.[3,21]

SEM analysis has shown that the smear layer comprises of both organic and inorganic substances. The components of the smear layer are very small particles with a large surface-mass ratio, which makes them very soluble in acids. Goldmen et al (1982) showed that when used alone, EDTA removed the inorganic portion and left an organic layer intact in the tubules [25]. NaOCl has been shown to be effective in dissolving pulpal remnants and predentin. The tubule orifices are enlarged due to the dissolution of peritubular dentin [2]. Various concentrations of NaOCl have been used to remove the smear layer in clinical endodontic practice. Studies have shown that 3%NaoCl removed the smear layer, bacteria and organic tissue satisfactorily[26] which is a strong oxidizing agent and may cause problems when used as the last irrigant. It leaves behind an oxygen rich layer on the dentin surface, which results in reduced bond strengths by inhibiting the polymerization of resins and increased microleakage.

Therefore ,it has been proposed to use NaOCl first, followed by EDTA for removal of the smear layer after the instrumentation, and then distilled water as a final rinse in order to minimize the compromising effect of NaOCl on primer/resin-sealer polymerization, and to achieve better adhesion of the sealers by permitting penetration of sealers into dentine tubules.[3,27]

According to Ingle[28] lateral condensation of guttapercha is the most widely used method of obturating root canals which is in accordance with the present study where root canal obturation was done by lateral condensation technique because it is a most widely recommended and a proven classic technique. [29,30]

Penetration of endodontic sealers into dentinal tubules decreases the interface between the material and the dentin and exert antibacterial effects against bacteria that reside within these areas has been well established.[31,32] Sealers that display greater penetration will potentially have a greater propensity to entomb viable bacteria within tubules, isolating them from potential nutrient sources.

The penetrability of resin sealers into accessory and lateral canals may be a function of their physical properties like flow, surface tension, solubility, working and setting time.[5,33] Flow is important as it reflects its ability to penetrate into small irregularities and ramifications of the root canal system and dentinal tubules and enter un-instrumented accessory root canal anatomy.[34]

Moreover, flow along with the sealer's antimicrobial effectiveness may aid the disinfection of the root canal system. Most endodontic sealers are psuedoplastic so that viscosity is reduced and flow is increased when shear rate increases during compaction [35]. This should facilitate sealer flow into accessory anatomy. Physically the penetration of a liquid (uncured resin) into a porous solid (dentin) is described by Washburn equation [36]. This equation assumes that the porous solid is a bundle of open capillaries; in this case the penetration of the liquid is driven by capillary force.[37]

Surface tension of filling materials determines the depth of their penetration into dentinal tubules: the lower the tension, the higher the penetration level [24,38,39] and this could conceivably improve the sealing ability of the root canal system by increasing the surface area contact of filing materials to prepared canal walls [26,40].

Polymerization shrinkage is often associated with resin sealers. Cavity configuration factor (c-factor) is the ratio of the bonded to unbounded surface area[7] where the volume of monomers is reduced, which creates sufficient shrinkage stresses to debond the material from the dentin, thereby decreasing retention and increasing leakage. As the thickness of the adhesive material or sealer is reduced, the volumetric shrinkage is reduced, which results in a reduction of shrinkage stress(s-factor).[41]

Within the limitations of the present study, the least depth of penetration amongst the three groups was witnessed in Group I and the mean depth of penetration seen in the coronal third was 21µm, 14µm in the middle third, 6µm at the apical third whereas Group II had a more penetration compared to Group I but showed les penetration when compared to Group III with a mean penetration of 57µm at the coronal third, 42µm at the middle third, 16 µm at the apical third.

Group III exhibited the maximum penetration depth into the radicular dentinal tubules compared to Group I and Group II. The mean depth of penetration at the coronal third was 62µm, 44m at the middle third, 32 µm at the apical third.

Kokkas et al.(2004)[20] examined the influence of the smear layer on dentinal tubule penetration depth of AH Plus, Apexit, and Roth 811 root canal sealers where AH plus displayed deeper penetration than the zinc oxide eugenol (ZOE) based sealer which was in accordance with the present study.

Gharib et al. (2007)[4] assessed the resin dentin interface and compared the average depth of dentin tubule sealer penetration in the coronal, middle and apical third of anterior teeth obturated with Epiphany obturation system using Confocal microscopy and showed that there was significantly less percentage of sealer penetration in the apical sections than the middle or coronal section. The results of present study coincide with this study showing maximum penetration of the sealers at the coronal third, followed by the middle third and minimal in the apical third.

Regional variation in the depth of tubular penetration has been demonstrated by a number of authors.[17,19,22,34] The apical dentin displays less tubule density with some areas completely devoid of tubules exhibit sclerosis of dentin which may prevent penetration of irrigating solutions and root canal sealers.[16,42,43]

A primer is used to condition the walls of the root canal prior to the sealer application that opens the dentinal tubule by removing the smear layer, thus facilitating greater amount of penetration into the dentinal tubules. In the sealers that were tested Only Resilon-Epiphany is to be used with a self etching primer prior to the application of the sealer.[4,15] Therefore probably a greater penetration at all the three levels was seen with Group III-Resilon-Epiphany due to the application of self etching primers.

With the other sealers, primers are not to be used; therefore the penetration may be dependent on the smear layer removal by 17% EDTA and the physical properties of the sealer. AH –Plus and ZOE have a reasonable setting time and their flow properties enable them to penetrate into the dentinal tubules. The type, size and shape of the fillers may also play an integral role and influence the penetration of resin sealers.

Incorporating nanofillers into newer sealers may enhance their penetration into the radicular dentinal tubules and help in decreasing the sealer - dentin interface. However Further studies are required to substantiate these results.

Conclusion

The following conclusions were drawn from this study:

1. The maximum penetration of all the three sealers was seen in the coronal third, followed by the middle third and least or negligible in the apical third.
2. Among the sealers tested, the maximum depth of penetration in the radicular dentinal tubules was observed in Group III - Epiphany sealer.
3. Group – II AH Plus sealer had significantly greater penetration into dentinal tubules compared to Group I - Zinc Oxide Eugenol sealer but penetration was significantly less as compared to Group III - Epiphany sealer.
4. Group I – Zinc Oxide Eugenol sealer showed significantly minimum penetration compared to Group I – AH Plus sealer and Group III – Epiphany sealer.

Resilon is susceptible to alkaline hydrolysis by bacterial/salivary enzymes and endodontically relevant bacteria[21] that warrants further investigation in order to have further insight to the effectiveness of these materials.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Awareness about Oral Hygiene Habits in dogs among dog owners

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Abstract

Aim : To assess the awareness about oral healthcare in dogs and the status of current oral care provided to the dogs by their caretakers.

Materials and Methods : A questionnaire consisting of 9 closed ended questions were provided to 50 dog owners from various parts of Mumbai at random consisting of questions related to general health care, feeding patterns and type of oral hygiene practised. Results obtained from this data shall be subjected to statistical analysis. (Fig.I)

Results : More than half of the participants paid little to no attention about their dogs' oral hygiene and were unaware of the consequences of periodontal disease in their pets.

Conclusion : It is imperative that awareness must be raised about the need of oral hygiene in dogs and educate the owners about a proper diet and oral hygiene practices.

Key words : Dogs, Oral diseases, Pet dental care, Pet Oral Hygiene

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Introduction

Periodontal disease has been identified as major oral disease in domestic pets for at least 70 years [1]. It has been estimated, that by 2 years of age, 80% of dogs have some form of periodontal disease [2]. Dr. Jan Bellows, a Diplomate of the American Veterinary Dental College, believes good dental hygiene can increase a dog's lifespan by as much as a third. “When a client asks me how long their puppy will live, I usually respond 15-17 years if you brush their teeth daily... 11-13 years if you don't,” said Dr. Bellows.

As in humans, the disease often causes varying levels of discomfort to the affected animal [1]. Moreover, there is strong circumstantial evidence that a focus of infection in the oral cavity may cause disease of distant organs (DeBowes et al. 1996). Consequently, preventing periodontal disease is important for the general health and well being of companion animals [1]. As oral healthcare specialists, we should expand our horizons and take responsibility for the prevention of dental diseases in humans as well as their faithful companions. Many factors contribute towards the oral health status of a pet, and some of these may be influenced by the owner [3]. It is known that diet and level of oral home care are owner-controlled factors that play a role in determining the oral health status of dogs [4].

Since the sole responsibility of the pet lies with the owners, they should be made aware and educated regarding basic oral hygiene aids and healthy feeding practices for their pets. There is variability in the awareness of health consequences of feeding and dental hygiene within the society; therefore, constant monitoring of the situation is required [3]. Only then can we call these animals our pets in the true sense. Hence the present survey was conducted to evaluate the current status of oral health care provided for the dogs by the pet owners.

Material and Method

A pre-validated questionnaire was used containing 9 close ended questions (Fig 1), regarding general healthcare provided, oral habits, feeding practices, and degree of awareness. Dog owners participating in the survey were selected at random, from different areas in Mumbai and of different backgrounds. A sample size of 50 dog owners was selected. All the data obtained was subjected to statistical analysis. An informed consent was taken from the dog

owners before their participation in this study. The ethical certificate for conducting this survey was obtained from the ethics committee.

Results

Participant pet owners were asked about frequency of vet visits, 54% responded saying they only visited the vet as and when required, not following any routine or scheduled checkups. (Fig. II) 46% of participants fed their pets a mixture of home cooked and commercially available packed foods. (Table. I)

Figure I

Questionnaire:

- Name:
- Address:
- Contact:

Details of the pet:

- Name:
- Breed:
- Age:
- Sex: (M/F)
- General Appearance: (Healthy/Weak)

1. How often does your pet visit the vet? (Annually, Bi-annually, Only when Required)
2. What diet does your pet follow? (Kibble, Packed/Canned, Raw, Cooked)
3. Have you ever felt the need to examine your pet's oral cavity? If yes, why? (Yes, No, Stuck bone/toy, etc)
4. Do you take any measures to ensure your pet has good oral hygiene? If yes, what measures do you take? Describe. (Brushing, Gauze Cleansing, Chew Toys, etc)
5. Has your Vet ever recommended professional teeth cleaning for your pet? (Yes, No)
6. Does your pet often suffer from bad breath? If yes, what measures do you take? Describe. (Yes, No, Cleaning Oral Cavity, Veterinary Assistance)
7. Have you ever noticed any signs of oral disease such as swollen gums, bleeding, discoloration of teeth, accumulation of plaque and calculus, loose teeth, etc in your pet's oral cavity? (Yes, No, Never Observed)
8. Have you lost a dog in the past? What was the cause of death? Have you ever heard of death in dogs due to periodontal diseases? (Yes, No)
9. Are you aware of the importance of good oral hygiene in dogs? (Yes, No)

Figure II

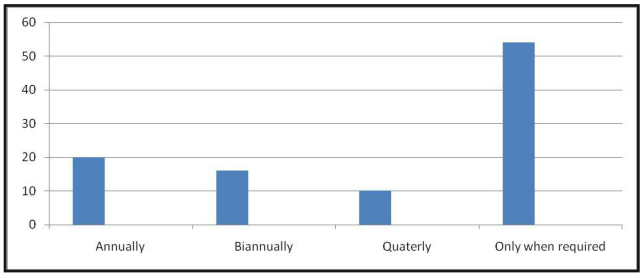


Table I

Diet followed	Mixed	Packed	Home cooked
	46%	24%	30%

80% of participants have never examined their pet's oral cavity. (Fig. III) About 1/4th of pet owners provided no form of oral care for their pets, while 40% provided more than one of the following methods: chew toys, gauze cleaning, tooth brushing once a week. (Fig. V)

Figure III

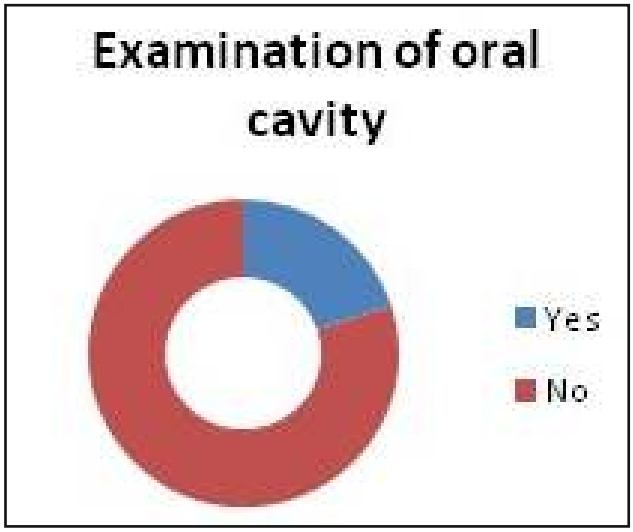
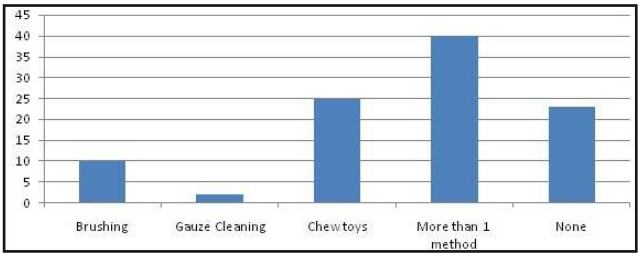


Figure V



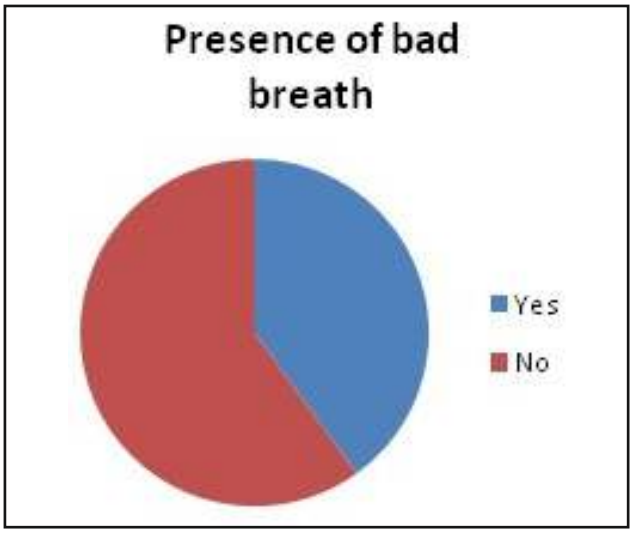
Only a meagre 12% of the participants had been recommended professional tooth cleaning by their vets. (Fig. IV)

Figure IV

40% of the participants complained that their pets suffered from bad breath (halitosis) on a regular basis.

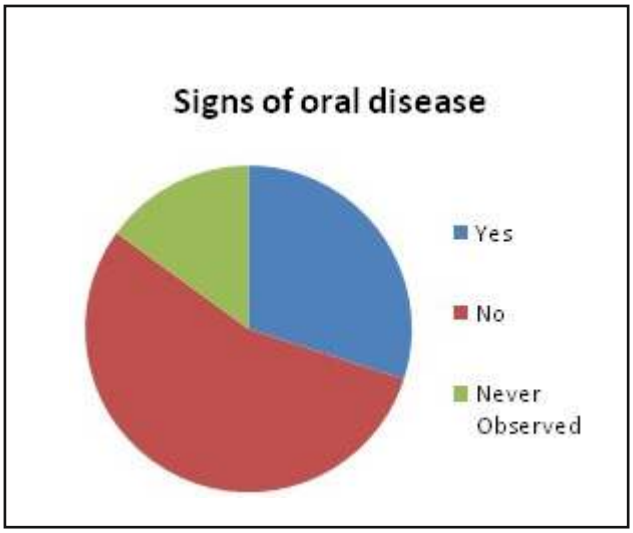
(Fig. VI)

Figure VI



15% of the participants confessed to having never bothered to observe for oral disease in their pet, while 30% reported deteriorating oral health. (Fig. VII)

Figure VII



More than half of the participants were not aware that periodontal disease can cause systemic disease leading to shortening of the lifespan and premature death of their most loyal companion animals. (Fig. VIII)

About half the participants confessed that they were not aware of the importance of oral hygiene in dogs. (Table. II)

Figure VIII

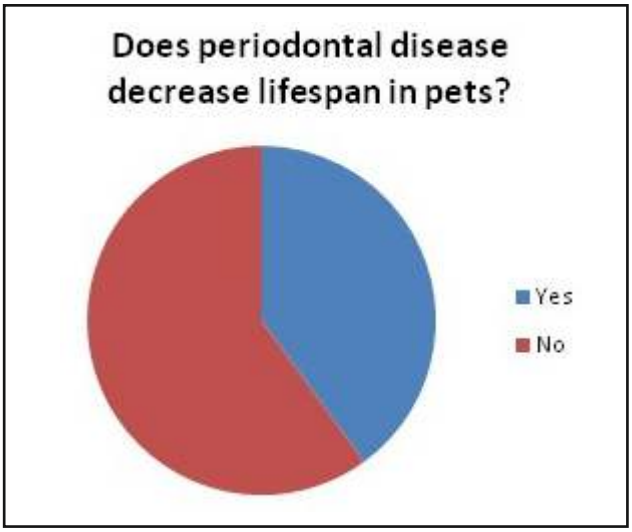


Table II

Would you say you are aware of oral hygiene importance in dogs?	Yes	No
	52%	48%

Discussion

It is fascinating to know that, like humans, dogs too have only 2 sets of teeth, i.e. they are diphodonts, having primary and permanent dentition. The primary teeth exfoliate by the age of 6 months, followed by eruption of the permanent successors which last a lifetime. Unlike humans, dogs are not affected by aesthetics and phonetics. However, like humans, reduced masticatory efficiency adversely affects our pets too, along with causing a generalized feeling of discomfort to the animal. Our pets are unfortunate, as once the tooth is lost, there are no provisions for restorative or rehabilitative treatments for them, like dentures or implants for us humans. Hence, it is solely the responsibility of the owners to provide for the wellbeing of their pets. The first step to fulfilling this responsibility is education and creating awareness in the right direction.

Through the survey, it was found that most pet owners did only take their pets to the vet when they felt it was required, and did not follow any scheduled or routine checkups. By the time the owner realises their pet is sick, the animal is usually suffering from a certain serious degree of debilitating illness. The veterinarian prescribes and treats the chief complaint, often overlooking the oral cavity because of the state of distress the animal is in. It is recommended that

all dogs be evaluated at least annually by a veterinarian to assess the need for preventive dental care performed under anaesthesia [5].

Periodontal disease shares the major burden of oral diseases in pets, and is mostly considered a diet related disorder [6]. A soft diet causes accumulation of bacterially colonized dental plaque [1]. While feeding soft diets has recently become very popular with dog owners, proper oral hygiene, which is proven to prevent effectively periodontal and other oral diseases, is rarely provided [1]. About 95% of the pet dogs fed either a homemade or commercial type diet showed heavy calculus deposition at the age of 26 months and the gingival inflammation became more severe with increasing age [1]. Appropriate instructions concerning dental hygiene to the pet owners should be helpful to lower the incidence of dental disorders in a dog population [1].

As evidenced by numerous studies, daily tooth-brushing remains the single most effective way of maintaining clinically healthy gingivae [1]. Daily tooth-brushing should be the recommendation to the dog owner irrespective of dietary regimen [4]. However, reduction of plaque by dietary texture is a useful adjunctive measure and should be recommended [1]. Food with greater kibble size and hard, dry texture is recommended. The use of chew toys should be encouraged as chewing mechanically disrupts the accumulating plaque, and is therefore a self-cleaning action (Hennet, 1995). Chewing also stimulates the flow of saliva, which contain antibacterial agents that help clean the mouth [7].

Canine periodontal disease unquestionably leads to halitosis [8]. The association of oral malodour with periodontal disease in dogs is an important issue, as this may be the first clinical sign of oral disease noticed by the owner [9]. When asked about oral malodour, significant percentage of participants confessed their pets suffer from halitosis, contrary to the percentage of participants actually knowing halitosis as an important indicator of oral disease, and also to the percentage of participants who actually get doctor's consultation.

An additional concern with periodontal disease is its association with an increased risk of developing systemic disease resulting from the release of inflammatory cells and by-products in response to bacteraemia. The most commonly cited secondary organ system affected by periodontal disease is the cardiovascular system [5]. Cross sectional, case control and longitudinal studies have shown this association is humans, while observational studies have pointed to the same association in dogs. The authors therefore concluded that greater awareness of the importance of canine dental health and routine preventive care would improve overall health [10].

The American Veterinary Dental Society cautions pet guardians that, “Oral bacteria will be filtered out by the kidney and liver, and can cause micro abscess within these organs. This leads to a decrease in function of these vital organs over time. In addition, it has been suggested that these bacteria can become attached to the heart valves and cause a disease called endocarditis.” [10]

The gold standard of preventive care is daily tooth brushing of the dogs teeth but this is not always practical and caretaker compliance is typically low. The second best option for preventive care is to feed approved dental diets and treats[5]. Dental snacks provide a convenient and enjoyable way of maintaining pet oral hygiene, while also helping to strengthen the pet-owner bond [3].

Another coincidental, but amusing finding of this study was that a few pet owners, who strictly adhere to a vegetarian diet, provided only plant sourced foods for their pets, thus compelling these canines to live like herbivores.

In other countries, major steps are being taken to address the problem of lack of awareness of oral hygiene in pets among pet owners. Some such measures are, the “Pet Smile Campaign” conducted in the United Kingdom, and the celebration of National Pet Dental Health Month, according to American Veterinary Medical Association, in February every year. Nowadays, such campaigns are starting to get the much required notice and encouragement in India.

We, the most evolved animal species, started with the domestication and adoption of dogs over 15,000 years ago. Therefore, it is solely up to us to make sure we aren't doing more harm to our most faithful companions, than good.

Conclusion:

It is apparent from the study that there is still a need to raise awareness of oral health problems in dogs and to educate owners in the benefits of a daily oral care regimen and an appropriate diet. This will, in the true sense, make us human beings the best friends of our beloved pets.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Review Article

Alternative therapies in management of orofacial pain: A literature review.

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Abstract

Orofacial pain is a debilitating condition involving the head, face, neck and is highly prevalent. Management of orofacial pain is a challenge for the clinician due to complexity of this region. Access to conventional therapy is limited due to lack of resources and high cost of treatment. Also problems like side effects and incomplete resolution of pain have been reported with traditional treatments. Therefore, there is a quest for introducing newer non-invasive, more economical and easily available management modalities. Numerous evidences and theories are emerging in this aspect, as a result of which treatment modalities are also diversifying. This article is a review on alternative therapies for orofacial pain.

Keywords: Orofacial pain, Alternative therapies, Acupressure, Laser therapy, Hypnosis, Reiki, Chiropracty.

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Introduction

Pain is one of the main reasons for seeking medical care. International Association for Study of Pain (IASP) has defined pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in term of such damage".[1] Pain is therefore a protective mechanism of body against injury.[2]

Orofacial pain is a condition arising from head, face and neck.[2] It is highly prevalent and distressing state that impairs numerous functions like chewing, talking, laughing and swallowing.[3] IASP and Okeson have classified orofacial pain in a detailed and descriptive manner considering all the possible etiologies and structures involved.[4, 5] Dental conditions remain the most common cause of orofacial pain.[6] Apart from the dental causes, numerous other conditions involving the temporomandibular joints, migraines, headaches and neuralgias are also termed responsible for pain in orofacial region.[2]

Accurate diagnosis becomes important for appropriate treatment planning. Orofacial pain has multiple etiologies, hence diagnosis of the exact cause is sometimes time consuming and challenging.[5] During this time gap between accurate diagnosis and treatment planning, the pain remains unrelieved which causes considerable suffering, physical limitations and emotional distress.[7] Even after treatment with conventional approach such as analgesics, the pain often persists. Also prolonged medicinal use for orofacial pain has its own disabling side effects. Patients prefer avoiding daily medication and are often in search of nonpharmacologic treatment modalities. These situations lead to development and utilization of Complementary and Alternative medicine (CAM) for pain control.

CAM was defined by the National Center for Complementary and Alternative medicineas a group of diverse medical and health care systems, practices and products that are currently not integrated into conventional medicine.[8] The National Institutes of Health has classified CAM in 5 ways as seen in [**Table I**.]

Table I : Classification of CAM therapies.

(1) Alternative medical systems	Traditional Chinese medicine (including acupuncture), naturopathic medicine, ayurvedic medicine and homeopathy.
(2) Biologic based therapies	Herbal, special dietary and individual biologic treatments.
(3) Energy therapies	Reiki, therapeutic touch, magnet therapy, qi gong and intercessory prayer.
(4) Manipulative and body based systems	Chiropractic, osteopathy and massage.
(5) Mind body interventions	Meditation, biofeedback, hypnotherapy and relaxation response.

This review focuses on various alternative therapies for orofacial pain conditions.

Acupuncture And Acupressure

Acupressure/acupuncture is the earliest medicine practiced in China. Acupuncture is defined by Traditional Chinese Medicine as the stimulation of certain points on and/or near the surface of the body through any technique of point stimulation with/without the insertion of needles, which include the use of electrical, magnetic, light, sound energy, cupping and moxibustion to normalise physiologic functions or to treat ailments or conditions of the human body.[10]

The theory besides this technique is that the body consists of 14 main channels which includes 12 paired "meridians" and two "vessel" systems that contain 700 to 800 acupuncture points. These channels are thought to be invisible networks in which energy flows from organ to organ, intercommunicating along meridian and vessel systems. Acupuncture therapeutic relief is believed to originate in the central nervous system and various organs.[11]In China, acupuncture analgesia is used in numerous surgical procedures with a reported success in 80% to 90% of cases.[12]

Pain control effects by acupuncture are usually explained by neural and humoral mechanisms. There is release of neurohumoral factors such as endogenous morphine-like-compounds, neuropeptide Y and serotonin which help in relieving pain by stimulating the nerves located in muscles.[13]For therapies in the orofacial region, most of the studies have recommended ST6, ST7, SI18, GV20, GB20, BL10 to be used as local acupuncture points. As a distal point, LI4 is recommended for face and neck.[14]

Acupuncture analgesia alone without local anesthesia was found successful in teeth extraction procedure by few studies.[15]Acupuncture also increased the pain-free postoperative period after surgery for lower wisdom teeth as shown in a study by Lao et al.[16] Shen et al performed a randomized controlled trial to evaluate the effectiveness of acupressure for myofascial pain of the jaw muscles. He concluded that acupressure lead to a reduction in jaw pain, jaw/face tightness and neck pain and also increased pain tolerance of the masseter muscle.[17] Acupressure minimizes TMJ clicking sound by relaxing the muscles and thereby reducing the anterior displacing force on the meniscus of the TMJ.[18]This way it finds its application for relieving orofacial pain.

Advantages

- No irreversible effects have been noted with this approach.
- It proves to be an effective adjunct for treatment of painful conditions including orofacial pain.
- It serves as an effective alternative therapy where pharmacological treatment is contraindicated.[11]

Disadvantages

- Needle insertion at acupuncture points makes it an invasive approach.
- Also thought of needle insertion may induce fear and anxiety and further increase pain perception.
- Chances of contamination and transcutaneous lesions by use of metal needle puncture increases in this approach.[11]

Low-Level Laser Therapy

The word "Laser" is an acronym of "light amplification by stimulated emission of radiation". They can be broadly classified as high power lasers (>500mW), intermediate power lasers (250-500mW) and low power lasers (<250mW). Low power or low level lasers produce a reaction in cells through light, called photo biostimulation or photo

biochemical reaction.[19]They result in minor temperature increase of less than 0.1°C leading to minimal or no thermal effects on the tissues (soft/cold lasers).[20]For any laser to mimic stimulatory effect of low-level laser without causing any thermal effects it should have power density lower than 670 mW/cm^2. Lasers most commonly used for Low Level Laser Therapy (LLLT) are Helium Neon (HeNe) and Gallium Aluminium Arsenide (GaAlAs) lasers.[21]

Multiple actions are involved which leads to anti-inflammatory and analgesic effects of LLLT. These include

1. Inhibits release of pain mediators like histamine, acetylcholine, serotonin, H^+ and K^+.
2. Causes vasodilatation, which increases blood flow to tissues accelerating excretion of secreted factors and decreasing tissue swelling.
3. Decreases tissue edema by increasing lymphatic drainage.
4. Decreases cell membrane permeability for Na^+ and K^+ causing neuronal hyperpolarization, resulting in increased pain threshold.
5. Reduces oxidative stress in the tissues.[22,23,24]
6. Stimulates the release of beta-endorphin. It also increases the urinary excretion of glucocorticoids, which are inhibitors of the synthesis of beta-endorphins.[25]
7. Reduces inflammatory markers like prostaglandin E2 and cyclooxygenase-2 levels.[26]

LLLT have numerous applications in the treatment of orofacial painful conditions. This mode of therapy has extensive literature support stating its effectiveness in conditions like dentinal hypersensitivity[27, 28, 29], after surgical removal of third molars[30,31], pain experienced before and after activating orthodontic forces[32,33,34], trigeminal neuralgic pain[35, 36], topical therapy for relieving pain and inflammation due to mucositis[37,38,39,40], myofascial pain[41,42], TMJ disorder pain[43,44,45]. The dosage recommendation differs as per the condition.

Apart from above mentioned applications, LLLT has also been used in treatment of apthous ulcers[46] and post herpetic neuralgia[47].

These applications of LLLT have been evaluated in recent literature as well. Antonic et al in their study investigated the efficacy of different wavelengths of LLLT in the management of orofacial pain conditions by measuring the pain reduction using visual analogue scale. They found LLLT to be an effective intervention in reducing pain in trigeminal neuralgia, temporomandibular disorders and burning mouth syndrome.[48]A systematic review done in 2019 by Chen et al assessed the effectiveness of Low-Level Laser Therapy (LLLT) for pain management after root canal treatment or retreatment. They concluded that use of LLLT for pain control in post endodontic therapy may be promising. However no solid conclusions were drawn and more high quality randomized controlled trial are required to obtain conclusions.[49]Prasad et al conducted a randomized controlled clinical trial to evaluate the effectiveness of LLLT for relieving orthodontic pain after activation. They concluded that a single dose of LLLT at 980nm, 2.5 W/cm^2, and 600 J is effective in relieving orthodontic pain after activation and increased patient compliance with the treatment.[50]

Advantages

- Non-invasive approach for management of pain.
- Relatively harmless.[51]

Disadvantages

- Laser therapy is a relatively costlier approach.
- Long term relief is not achieved with this approach.
- Side effects like eye problems have been reported if proper safety precautions are not implemented while using this approach in the orofacial region.
- Lack of knowledge on the effects of laser on pregnancy limits its use in pregnant patients.[51]

Laser Acupuncture

Laser acupuncture is a technique involving stimulation of traditional acupuncture points with low-intensity, non-thermal laser irradiation. This technique has been applied clinically since 1970s. It combines the advantages of conventional acupuncture and recent laser medicine.[52] Although acupuncture is effective, it is not widely used due to fear of possible contamination or transcutaneous lesions by metal needle puncture. These limitations made room for laser acupuncture in treatment of various conditions.[53]

In general, conditions like fibromyalgia[54, 55], tendinopathy[56, 57], back pain[58, 59], acute neck pain[60], osteoarthritis[61, 62]have been effectively treated with an adjunctive laser acupuncture therapy. This technique also showed positive outcomes in managing orofacial pain conditions like myofascial pain[63] and headache[64]. TMJ disorders are also managed effectively by stimulation of following points: ST6, ST7, LI4, Ashi point by laser acupuncture as seen in previous studies.[65, 66]A review by Chopra et al in the year 2019 on laser acupuncture stated its

application and effectiveness in reducing pain and inflammation occurring in various conditions like dentinal hypersensitivity, oral surgical procedures.[67]

Advantages

Laser acupuncture combines the advantages of acupuncture and low level laser therapy.[52]

Diadvantages

Due to involvement of laser equipment, this approach is relatively costly as compared to traditional acupuncture.[52]

Hypnosis

Hypnosis is a process involving induction (which involves focusing one's attention) followed by a suggestion or set of suggestions to intervene a particular experience.[68]The hypnotic intervention consists of three important parts. First being progressive relaxation, which is followed by guided imaginary instructions of a nice safe place. Pain suggestions of controlling or changing the pain perception tailored individually are then provided to achieve ultimate goal of dissociation from the pain.[69, 70]During the trance state, it is attempted to improve the patient's individual coping with minor psychological problems and their stress-management skills in daily life.[71]Changes in activity of certain brain areas like anterior cingulated cortex, insula, amygdala are seen following hypnotic suggestions which lowers the pain experienced by an individual.[72]

Hypnosis has been evaluated by various studies for its pain control efficacy in numerous conditions like fibromyalgia[73, 74], multiple sclerosis[75], irritable bowel syndrome[76, 77], sickle cell disease[78], spinal cord injury[79], disability-related pain[80, 81]and cancer-related pain[82]. Hypnosis also has varied applications in reproductive health care like pain relief in labor and delivery.[83]Likewise, it is applied in management of orofacial pain conditions as well.

Hypnosis resulted in significant decrease in pain frequency, pain duration and an increase in daily functioning when used for temporomandibular pain disorders.[84, 85]Studies have shown hypnosis to be effective pain control approach in headaches.[86]Clinical hypnosis brings about reduction in anxiety, fear, phobia and gag reflex of an individual, which is of great help in dentistry. In pediatric dental patients, hypnosis makes behavior management easier and its use also decreases the dosages of sedative and analgesic agents to be used during sedation procedure.[87]

Glove anesthesia is a deep hypnosis state whereby brain's natural processes are utilized to create numbness in the hand. This is an extremely useful property in which the patient can be taught to transfer this numbness hypnotically to other parts of the body and thereby cause pain relief.[88]Despite of promising outcomes with hypnotherapy in the management of orofacial pain, continued research in this field is required.

Advantages

- Hypnosis activates a deep relaxation response, which accelerates healing.
- It is a natural healing remedy.
- It is relatively cost-effective.
- It has long term positive effects in the overall life of an individual.
- It can be used as a self care approach after proper training.[68]

Disadvantages

- Standardized protocol of hypnotherapy for management of orofacial pain is not yet formulated which limits its use as a universal approach.
- Hypnosis does not work on an individual who is not willing for it or not focused on healing himself. It requires patient compliance.
- Hypnosis healing is a slow process, which requires on an average four to six sessions.[68]

Reiki

Reiki therapy is a biofield energy healing modality. It is defined by the National Center for CAM as "a health practice in which practitioners place their hands lightly on or just above the person, with the goal of facilitating the person's own healing response."[8] Reiki therapy originated from Japan by a Zen Buddhist named MikaoUsui. Reiki therapy is a non-invasive, often comforting and relaxing intervention used to promote healing and overall wellness.[89]

Lee in 2008 conducted a systematic review of randomized controlled trials in order to evaluate whether Reiki is beneficial for management of pain.[90] Two out of five RCTs included in the review concluded statistically significant reductions in pain when Reiki was used in addition to opioid agents, rest or conventional nursing care.[91, 92] Reiki therapy has a contributory effect on the management of pain[93], anxiety[94] and depression[95] in chronically ill patients. Reiki has shown promising results as an adjuvant therapy for pain relief in cases of abdominal hysterectomy[96], fibromyalgia[97] and cancer[98].

Reiki has its applications in management of pain in the orofacial region as well. In a study of patients undergoing removal of impacted teeth, a significant reduction in pain perception and experience has been reported with the help of Reiki therapy. A combination of biofield energy therapies (Reiki and LeShan healing) when performed after unilateral operative extraction of lower third molar resulted in decrease in level of pain intensity and promoted significant degree of pain relief postoperatively.[99] A RCT by Kundu et al evaluated effectiveness of Reiki therapy on postoperative pain in pediatric patients undergoing dental procedures. The author did not find any contributory effects of Reiki therapy for pain management.[100] More research is required for supporting use of Reiki as an adjuvant therapy for pain control in orofacial region.

Advanatges

- Reiki is a non-invasive approach.
- It is a comforting and relaxing intervention used to promote healing.
- It improves overall lifestyle of an individual.[89]

Disadvantages

- There is no formal regulatory body for learning reiki and therefore the reiki practioners are not certified.
- Also like hypnosis; lack of standardization of protocol used for reiki healing limits its use universally.[89]

Physical Remedies

Physical therapy has widespread application in the management of pain.[101] The goals of this treatment approach for orofacial region include control of pain and discomfort, reduction of muscle tone, improvement of kinetic parameters and TMJ function.[102] Accurate diagnosis of the condition is prerequisite for advocating physical therapy. Physical therapy includes exercise therapy[103], heat and cold therapy[104], ultrasound treatment[105], electrical stimulation therapy[106, 107, 108], soft tissue techniques (massage)[109, 110], mobilization[111] and Osteopathic manipulative therapy[112].

Physical approach of treatment can be promising, if it is tailored towards the individual patient.[113] Also it is relatively simple, reversible, non-invasive, self-manageable and cost effective treatment. Studies have shown physical therapy to be effective in treatment of orofacial painful conditions like headache[114], TMJ disorders[115],myofascial pain[116] etc. Shimada et al in his review on exercise therapy for painful TMJ conditions such as myalgia and anthralgia, stated that physical exercises like manual therapy, passive jaw mobilization and voluntary jaw exercise are promising approach for pain relief.[117] Oral myofunctional therapy and occlusal appliances are also an effective approach for treatment of temporomandibular disorders.[118]

However, physical remedies should be used as an adjunct and not as a substitute to other better-validated approach

Advantages

- Physical remedy is relatively simple and reversible approach.
- It is non-invasive and cost effective approach.

Some forms of physical therapy are self-manageable.[101]

Disadvantages

- Improper physical therapy technique may cause more harm than cure. Hence care should be taken in this respect.
- Physical therapy regimen varies on individual basis.
- More time and effort is required for complete healing with this approach. Hence patient compliance and inclinement towards therapy needs to be assessed.[101]

Chiropracty

Daniel David Palmer of United States of America found the science of chiropractic in the year 1895.[119] According to the World Health Organization, chiropractic is defined as "a health care profession concerned with the diagnosis, treatment and prevention of disorders of the neuromusculoskeletal system and the effects of these disorders on general health".[120]The chiropractic approach considers human body as a neuromusculoskeletal system where disorders in one part of this system disturb other parts.[119] Numerous chiropractic procedures like spinal manipulation, myofascial therapies are available which have found applications in conditions like back pain, neck pain, asthma, gastrointestinal conditions, fibromyalgia and sport injuries.[121]

Chiropracty is been used for pain relief in orofacial region as well. A systematic literature review by Bryans et al in the year 2011 concluded that chiropractic care improves migraine and cervicogenic headaches.[122] Vernon et al in his literature review evaluated effectiveness of chiropractic manipulation in the treatment of tension-type and migraine-type headaches. He concluded that results with chiropractic therapy in both types of headache were encouraging, however further studies in this field were necessary.[123] Chiropractic procedures have also been found to be effective

in treating trigeminal neuralgia[124] and temporomandibular dysfunction[125].

Advantages

- Chiropracty is a non-invasive approach for managing pain.
- It leads to better range of physical movement smaking individual more comfortable.
- It reduces the muscle tension and stiffness in the treated areas thereby causing faster recovery.[119]

Disadvantages

- Spinal and joint manipulation done in this approach has chances of iatrogenic injuries. Hence, only experienced chiropractor should carry out the procedure.
- Also improper chiropracty can lead to compression of nerves in the lower spinal column which can lead to pain, weakness and more serious side effects.[119]

Others

Apart from the treatment approaches mentioned above, various other methods like behavioral therapy and counseling, meditation, biofeedback[126], herbal remedies[127], art[128] and music therapy[129] may be helpful while formulating individualized plan for management of orofacial pain.

Conclusion

Orofacial pain remains a challenge for diagnosis as well as management. The most suitable approach of managing this condition is multidisciplinary approach. Such combined efforts will help cure all aspects of an individual along with the primary illness. Moreover, there is limited evidence stating that a particular approach is superior than the other. This may be due to individualized nature of orofacial pain. Combination of therapies increases the chance of successful pain management. Thus, alternative therapies discussed in the article serve as an effective adjunct for treating orofacial pain. Further research is required in this aspect to widen its applications.

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Conflicts of interest

There are no conflicts of interest.

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Review Article

Food guide pyramid based dietary guidelines: A Global Update !!!

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Abstract

The WHO has proposed that health be promoted through the development of an environment that enables sustainable actions at individual, community, national and global levels. Indeed, food based pyramids, have been developed in numerous countries to disseminate nutritional information to the general population. However, wider recommendations are needed, with information on an active healthy lifestyle, not just healthy eating.

The objective of this review is to provide a concise, descriptive global review of current food based guidelines and to assess similarities and differences in key elements of a healthy diet articulated across world.

Keywords : Food guide pyramid, Dietary recommendations, WHO guidelines

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Introduction

The most commonly quoted definition of health was published by the WHO in the 1940s: "a complete state of physical, mental and social well-being, and not merely the absence of disease or infirmity".[1,2] At the end of the 20th century, Saracci[3] included the consideration of human rights, basic and universal, in the definition of health. In the present century, Bircher[4] related the term "health" to age, culture, and personal responsibility. Others consider the social, emotional, and spiritual wellness of the whole community in addition to the wellness of the individual[5].

In the Global Strategy on Diet, Physical Activity, and Health[6], the WHO has proposed developing an environment that enables sustainable actions at the individual, community, national, and global levels to promote and protect health and to reduce disease and death rates related to unhealthy diet and physical inactivity.[7-10]

Since 1992, when the International Conference on Nutrition established the need for the development of food based dietary guidelines as a new strategy to disseminate nutritional information to the general population, many countries have developed their own food guidelines. These guides promote sustainable foods and diversification of the diet through the production and consumption of foods that are rich in micronutrients [11-14]. Several pictorial representations, mainly in the form of food pyramids, have been developed in a number of countries; the first one was proposed by the Food and Nutrition Board of the National Academy of Sciences [12-13]. The European Food Information Council has reviewed the European food guidelines; most of these guidelines include recommendations on food consumption using a "triangle," usually referred as to "food pyramid," although others adopted other forms, such as circles mimicking a dish or truly three-dimensional figures[14]. On the basis of the USDA Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans 2010[15], the My Plate pictorial was created; later, the 'Healthy Eating Plate' was designed by nutrition experts at the Harvard School of Public

Health and editors at Harvard Health Publications to address deficiencies in the USDA's My Plate.[16]

Food-Based Dietary Guidelines (FBDG) are an attempt to translate a vast evidence base regarding relations between foods, diet patterns, and health into specific, culturally appropriate, and actionable recommendations. Such guidelines are intended to influence consumer behavior and, in some countries, also inform a range of national food, nutrition, and health policies and programs. Development of FBDG is both a scientific and political process, incorporating a range of evidence and stakeholder perspectives.[17] There have been several attempts to summarize FBDG, including globally; regionally for Europe[18-20], North America[21], Latin America and the Caribbean[22], the Spanish-speaking Caribbean[23], and Southeast Asia[24]; in selected countries[25]; and for the specific purpose of examining sustainability in FBDG[26]. The recent global review of FBDG by van't Erve et al.[27] is the only other examination of all current FBDG globally, and focuses on a description of which food groups are included and graphic design aspects, with the key concern of effectiveness and use by consumers.

Hence the objective of this review is to provide a concise, descriptive global review of current FBDG. The purpose is to assess the level and type of concordance and differences across countries existing guidance on key elements of a healthy diet.

Description of food guides

Food guides are intended to provide dietary guidance to the general public by conveying through pictorial images the concepts of variety, proportionality, and adequacy/moderation to meet population dietary needs. Among the 78 countries with food guides, with very few exceptions they include various food groups, usually illustrated with photographs or drawings of numerous example foods in each group. Rarely (e.g., Greece, Hungary), the food groups are identified by text only, with no example items shown. The majority are pyramids, plates, or cultural shapes, such as a basket, house, or pineapple. A few are other shapes, such as a diagram of individual plates or groups.

The concept of variety is embodied in all food guides. Nearly all (95%) convey the concept of proportionality, namely that different food groups should be consumed in differing amounts. Most graphics convey the concept of moderating or limiting consumption of some food types, such as sugars/sweets and fats/oils. Excluding fats/oils and sugars/sweets, more than half of countries encourage consumption of 5 food groups, with the most common set of 5 groups being: starchy staples (variously defined); fruits; vegetables; dairy foods; and other "protein foods" (also variously defined). The most common 4-group combinations: starchy staples; fruits and vegetables; dairy; and other "protein foods." The most common 3-group combination is: starchy staples; fruits and vegetables; and "protein foods." There is much consistency in the Latin America/Caribbean (LAC) region, with most countries identifying 5 groups (starchy staples; fruits; vegetables; legumes; and animal source foods [ASF]). There is wide variability in Europe; several Mediterranean countries present a larger number of food groups, including, for example, olive oil, fish and nuts as separate food groups. Globally, there is wide variability in the way foods are categorized, particularly for legumes, nuts, and ASF, and, to a lesser extent, for fats, oils, and oilseeds. Groupings for fruits and vegetables are relatively consistent, but there are some inconsistencies in classifications of potatoes and other roots and tubers, legumes, and fruit juice.[28-33] The following data provides details on classification of these food groups and also provide analyses of key messages related to food groups.

Starchy staples

All countries with food guides include starchy staples in their food guide. Few are quantitative, with 14% of countries providing a quantitative recommendation for either starches as a whole (e.g., "Eat cereal-based foods three times a day": Sri Lanka), or whole grains specifically (e.g., "Replace rice with wholegrains and other high-fiber starchy foods at least 3 times a week": Seychelles). Consuming starchy staples daily or as part of most meals is advised by 27% of countries; 11% recommend consuming "plenty," "mainly," or "more" ("Eat plenty of cereals, preferably wholegrain, and potatoes": Germany), whereas 6% recommend consuming "adequate," "enough," or "appropriate" amounts (e.g., "Eat enough grains such as rice and other cereals": Japan). In one-quarter of countries with a key message about starchy staples, the

message is exclusively about whole grains. Whole grains are mentioned explicitly by 44% of all countries, mostly in Europe (70%), North America (100%), and the Near East (75%). Ten percent of countries have key messages mentioning fiber, principally in relation to wholegrains. Many countries (29%) have key messages concerning starchy roots and tubers, such as potato and/or cassava, together with grains in a starchy staple message. There is regional variation, with a higher probability of a roots/tubers mention in Africa (57% of countries with FBDG) and in Europe (42%). [29-31]

Fruits and vegetables

Considering the food guides as well as key messages, all countries encourage consumption of fruits and vegetables. There are key messages specifically about fruits and vegetables in 93% of countries. Many countries convey multiple messages aimed to encourage consumption of fruits and vegetables. Some messages are simple and cover one dimension but others are multidimensional, such as "Eat various types of vegetables and fruits several times a day (at least 400 g/day) preferably fresh and locally produced" (Albania). The most common key messages concerning fruits and vegetables are to eat them daily (69% of countries); to consume a variety (42%); and to eat "plenty," "a lot," or "more" (38%). WHO guidance is to eat at least 400 g (5 portions) of fruits and vegetables per day.

One-third of countries recommend either five servings or more per day, or 400 g/d in their key messages; roughly half (51%) of countries give this quantitative recommendation through either key messages or food guides. Guidance to choose a variety of colors or particular colors is found in 19% of countries, with 10% of countries recommending consumption of green leafy vegetables, and 6% specifically recommending orange fruits and vegetables. Four countries (all in Europe) make a special mention of berries. Less common messages are to consume fruits and vegetables that are fresh (10% of countries), local (8%), or seasonal (7%). Special mention of whole, raw, or unprocessed forms of fruits and vegetables is made by 11% of countries, whereas only 3% of countries note that fruits and vegetables can be consumed in various forms (e.g., cooked ,part of sauce, etc.). Fruit and vegetable consumption is urged in terms of vitamin and mineral content in 8% of countries, for fiber content in 7% of countries, and for maintaining a healthy weight or preventing disease in 3% of countries.[30]

In the majority of countries where it could be determined, fruits and vegetables are pictured and/or described as separate groups. However, in a significant minority they are grouped together. This distinction is somewhat artificial, because, for example, in pyramid or inverted pyramid graphics, fruits and vegetables are often one "layer" with fruits on one side and vegetables on the other, and with or without a line between the two. Guidance on the consumption of fruit juice is mixed globally, and sometimes across documents within countries. Relatively few countries depict fruit juice visually as belonging in the fruit group on food guides, but a larger number of countries include fruit juice in the description of the fruit group or in portion size examples for the fruit group. Many countries include fruit juice but at the same time deliver messages on moderation in longer guidance, stating that fruit juice should not count for more than one serving per day of fruit, or that whole fruits should be preferred to fruit juice.[31-32]

Protein food

Although not all FBDG use the word "protein," 74% include a key message about protein foods, which could include meat (53% of countries), poultry (29%), fish (58%), eggs (31%), legumes (41%), and sometimes dairy (9%), nuts/seeds (8%), and insects (only Kenya). An additional 11% of countries do not have a protein foods key message per se, but encourage consumption within a general diversity message that refers to the food groups. Half of all countries with protein messages (34 of 67 countries; 38% of all countries) include a quantitative message, for example, "Eat five or six servings of fish a week" (Greece). Almost all of these refer to times or servings per week; note that the meaning of a "serving" is not always well defined. Of these quantitative messages, the mean amounts recommended are –

- Pulses/vegetable protein (n = 12): 6 times or servings per week (mode = 7 per week).
- Meat/egg/poultry/ASF (variously defined) (n = 15): 5 times or servings per week (mode = 7 per week). Of the 15 countries with quantitative recommendations, 11 specified it as a target, and 4 as a limit/maximum. The amounts quantified did not significantly differ whether they were implied as a limit or a target.

- Fish (n = 18) : 2.2 times or servings per week (mode = 2 per week).
- Red meat (n = 3) only appeared in terms of an upper limit amount, which was stated in 2 countries as <500 g/wk (Finland and Sweden), and in 1 country (Greece) as 4 times per month.

The most common themes within key messages about protein foods include - use of the term "lean meat" or suggesting removing fat from meat (34%); a positive message about consuming fish (27%); and limiting or moderating meat consumption (23%). Regarding specific types of protein foods, fish appears most frequently in key messages. More than one-quarter (27%) of countries have a special message about fish that is positive (e.g., "Eat more fish": Denmark), and in 17% of countries, key messages imply that fish is not substitutable ("To keep your heart healthy, eat baked or grilled fish twice a week": Chile). Only two countries include a moderation/limit message around fish: Canada by including advice about limiting mercury exposure from fish.

Half of countries with protein food key messages (33 of 67) include both animal and plant sources of protein. Only 5 countries (all in Latin America and the Caribbean [LAC]) imply that meat is non substitutable, on the basis of providing iron/preventing anemia ("Eat a piece of meat, chicken, liver or fish at least twice a week to avoid anaemia and malnutrition": Guatemala). "When there is no meat, fish or eggs in a given day, you can replace them with pulses, peanuts, soybeans, soya, cheese or peas. All these foods are rich sources of protein"(Benin).

ASF are depicted in 100% of food guides. In 54% of countries, food guides depict at least one protein group with only ASF (although legumes, with or without nuts, can also be another distinct food group in these countries). In 31% of countries, particularly in LAC, this ASF group includes dairy, whereas in most countries dairy is considered a separate food group. In 44% of countries, protein foods encompass both ASF (with or without dairy) and legumes (with or without nuts). Four countries have food groupings and key messages such that no ASF is technically required (i.e., a single protein group that includes legumes and dairy, no separate dairy group, and no key message about ASF); in most of the rest, meeting dietary guidelines would be possible through vegetarian (i.e., including milk and eggs) but not vegan diets.

Legumes and nuts

Legumes and nuts are often included in key messages with other protein foods, but they are also recommended as a unique dietary component and, less commonly, included in key messages related to vegetables or fats. There are key messages concerning legumes and/or nuts in 58% of countries. An additional 10% of countries have no key message about legumes or nuts per se, but imply encouragement to consume them via a message about consuming all food groups on the food guide, which includes legumes and sometimes nuts. Countries are much more likely to include key messages about legumes (56%) than about nuts (19%). Only 3 countries have key messages recommending "moderate" consumption of legumes together with other protein foods (Malaysia, Belgium, and Malta); all the other key messages encourage consumption of legumes. WHO guidance includes encouragement to consume both legumes and nuts as part of a healthy diet, but only 12% of countries include a similar positive message about both.[28]

Dairy

Dairy messages are, in most cases, distinct from other "protein foods" messages. This is the case in 59% of countries, which have a key message about dairy alone, which typically includes milk and milk products (63% of countries include dairy foods in any key message). In food guides, dairy is its own food group in 64% of countries, and grouped with protein foods in 31% of countries, whereas only 3 countries (4%) have no visual representation of dairy, and in one country (China), dairy and soy are grouped. Considering key messages and food guides together, 75% of countries include dairy in their FBDG. All dairy messages include mention of milk; 51% (comprising 46 of the 53 countries with dairy messages) include "milk products," yogurt, or cheese in addition to fluid milk; 11% (10 countries, distributed across various regions) include nondairy alternatives to milk such as soymilk or other calcium-rich foods; and in only 3 countries, all in LAC, does the dairy message also include eggs.[30]

Over half of the countries with dairy messages recommend dairy consumption "daily" (27 of 51 countries).

A quantitative message is conveyed in key messages of 14% of countries (n = 13, of which 8 are in Europe), recommending a mean of 2.4 servings per day (mode = 2); 3 of those countries recommend a specific volume of consumption, of 500 mL per day. Half of countries' dairy messages include a mention of "low fat" (29% of all countries, n = 26), whereas low salt and low-sugar dairy are mentioned by few countries. Six countries include calcium in their key message about dairy. Four countries guide consumers to consume "more" dairy, whereas few countries include guidance to limit or moderate dairy consumption.[28-31]

Fats and oils

Most countries (89%) have a key message on limiting fat. Fewer than half of all countries (44%) have a message on the quality of fats apart from limiting consumption. A minority (18%) of countries include key messages on healthy fats that should be consumed regularly, advice found only in North America (100%), Europe (33%), and 3 countries in Latin America (11%) (e.g., "Use olive oil as the main added lipid": Greece). The WHO Healthy Diet Fact Sheet advises that "unsaturated fats (e.g., found in fish, avocado, nuts, sunflower, canola and olive oils) are preferable to saturated fats (e.g. found in fatty meat, butter, palm and coconut oil, cream, cheese, ghee and lard)." This advice is echoed by 29% of countries having key messages that indicate preference for unsaturated over saturated fats (e.g., "Limit intake of solid fats and replace with vegetable oils": Lebanon).

In the food guides of 35% of countries, healthy and unhealthy fats are grouped together in the same "fat" group, and in 36% of countries there is a mixed or double visual message about the fat group. For example, the food guide might include clear examples of healthy fats (e.g., "olive oil" or "sunflower oil"), and also say "use sparingly." Healthy fats can be contained in a small slice of a circle graphic, similar to sweets, which are often also contained in an identically small, separate slice of a circle graphic. Some countries contain words on the graphic next to the fat group, to explain this dual-purpose graphical representation; for example, "Oils and spreads: Choose unsaturated oils and use in small amounts" (United Kingdom). Twenty-three percent of fat graphics include nuts, seeds, or peanut butter, and 24% include avocado or coconut. In the food guides of 18% of countries (not necessarily the same 18% with key messages about healthy fats), there is an explicit "healthy fats" group, which is clearly depicted as healthy by both the type of fat and its placement (such as a larger portion, or a yellow "traffic-light" indication). However, 33% of all food guides indicate the fat group as limiting, either with a red "traffic light" symbol, or by combining fats with sweets and other "junk foods." Eight percent of countries do not include fats in their food guides at all (e.g., the United States), despite some of those countries (including the United States) having key messages on consuming healthy fats.[27-28]

Foods and food components to limit

All countries have at least one key message to limit certain types of foods or components of foods. Several countries focus the majority of their key messages on types of foods to limit, as a complement to the food guide. The most common messages involve limiting salt, fat, and sugar. Ninety percent of countries have a key message about limiting salt; 89% have a key message about limiting fat of some kind; and 84% have a message about limiting sugar; 70% of countries have a message about all three. Considering food guides and key messages together, salt, sugar, and fat are each cautioned against in over 90% of countries. The fourth most common type of "limit" message is about highly processed foods, which are advised against in 28% of countries (e.g., "Consume less carbonated beverages and artificial juices because they damage your health": Paraguay).

Messages about limiting highly processed foods appear in all regions except North America, and are somewhat more common in LAC (44% of LAC countries). Nearly one quarter of countries globally (23%) have a message to limit or moderate consumption of meat of some kind; 13% concern meat in general, and 11% are specifically about red, processed, and/or cured meats. Such messages to limit meat consumption are absent in North America and Africa. In food guides, some European countries also identify red meats and/or processed meats in the tip of the pyramid, conveying a message of moderation in consumption of these foods. Other specific foods to limit are mentioned much more infrequently: animal foods in 3 countries, eggs specifically in

two countries, and refined grains in two countries. A small minority of countries (8%) cite metabolic factors or non communicable diseases as explicit reasons for limiting the types of foods mentioned.

The WHO Healthy Diet Fact Sheet recommends "less than 5 g of salt per day and use iodized salt". Whereas 89% of countries have a message consistent with the WHO recommendation to limit salt (sodium) consumption from all sources, only 8 countries have a quantitative message about salt intake limits consistent with the WHO ceiling of 5 g/d. A message to use iodized salt is included by 18% of countries. WHO recommends "less than 10% of total energy intake from free sugars". Limiting the intake of sugars generally is advised by 84% of countries; only 1 country (the United States) includes a quantitative message on limiting sugar (<10% of calories from added sugars, consistent with WHO guidelines). Key messages by 46% of countries mention a need to limit sugar-sweetened beverages specifically. WHO recommends "less than 30% of total energy intake from fats; unsaturated fats are preferable to saturated fats; industrial trans fats are not part of a healthy diet".[34-36]

Future Frontiers in FBDG

According to other analyses that have focused on sustainability in dietary guidelines, sustainability of diets is not addressed in most current FBDG, although it is an important issue that is likely to gain attention. Incorporating sustainability into guidelines often involves rethinking protein group recommendations away from meat, particularly red meat. Several countries (mainly in Europe) have done that, although it is not clear whether red meat limitation messages are motivated by concerns for health, sustainability, or both; the motivation for recommendations was outside the scope of this review. The general emphasis in key messages on fish as an important or even non substitutable food (in 17% of countries) could also need consideration from a sustainability standpoint. How to feed 9 billion people sustainably — requiring provision of foods to nourish without depleting natural resources — remains a pressing question for dietary recommendations globally.[33-48]

Although all FBDG incorporate sociocultural factors to some extent, greater attention in some FBDG could be paid to socioeconomic equity, inclusion of indigenous groups (e.g., through food examples commonly consumed), and greater attention to the nutrition transition and the rise in consumption of ultra processed or "junk" foods. Fewer countries (just over one-quarter) recommend limits on highly processed foods, but that guidance is more common in newer FBDG, particularly in LAC. For example, Uruguay's FBDG revision focuses on "ultra-processed foods" as a category of foods to limit.[47-48]

Proportionality is almost always suggested in FBDG, but in many countries is difficult to operationalize in exact terms. In food guides, proportionality is suggested as a pie chart in circle graphics. A small number of countries have recently relinquished a graphical approach altogether: Brazil's guidelines emphasize consumption of minimally processed and natural foods, and home-cooked meals. Sweden and Denmark are 2 countries that, in line with WHO guidance, focus simply on key foods to eat more of or less of, rather than giving a comprehensive description of a daily diet. A minority of countries convey servings or gram amounts in their key messages or food guides, and most often for fruits and vegetables—probably because WHO identifies a recommended minimum amount of fruits and vegetables per day (400 g). Clear proportions and quantities can be very helpful, however, for the purpose of monitoring cost or consumption of recommended diets.[49-51]

Regional guidelines could be a stepping stone between global and national FBDG in terms of facilitating both the FBDG process and comparisons of the cost or consumption of recommended diets across countries.

Conclusion

The question of "what is a healthy diet?" is pressing, at a time when poor-quality diets are increasingly recognized for their large contribution to malnutrition in all its forms. It is helpful to understand which elements of diet are commonly, or even universally, considered important for diet quality by country authorities responsible for FBDG. This review has concluded that there is some relatively simple guidance common to most FBDG: to consume fruits and vegetables and starchy staples as the bulk of the diet; to include ASF and legumes; to limit salt, sugar, and fat; and to consume a diversity of types of food in appropriate proportions.

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Conflicts of interest

There are no conflicts of interest.

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Burnout In Dentistry – A Bird's Eyeview !!!

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Abstract

Professional burnout is a psychological problem that occurs because of extreme exhaustion of physical or emotional strength or motivation, because of chronic stress that usually leads to development of a negative or cynical attitude towards one's patients or client and tendency to evaluate oneself negatively. The present review represents a bird's eyeview, focusing on the development of burnout, evaluating the contributing factors in dentistry, with an emphasis on its diagnosis, management and prevention.

Keywords: Burnout, Dentistry, Management and prevention.

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Introduction

Dentistry is a noble profession providing benevolent care and a great opportunity to meet new people on a regular basis.[1] The reactions to stress depends on the coping mechanisms, a person develops. One such mechanism is burnout,[2] a response to the chronic emotional strain of dealing extensively with other human beings.[3] The term 'Burnout' was introduced to the medical lexicon as a behavioral entity, in 1974 by a German psychiatry resident in the US, Herbert Freudenberger.[4,5] Freudenberger elaborated it as a state of exhaustion (emotional and mental) observed among volunteer workers with varied physical and behavioral outcomes.[6,7] In 1976, Cristina Maslach introduced the term "burnout" into the public domain at the Annual Congress of American Psychology Association. Over a stretch of time, these relations sum up to an extent leaving the professionals "burnt" out.[5]

Burnout was "in the air" after its "discovery," becoming a very popular topic in the USA - The home country of burnout. The first so-called pioneering phase marked the publishing of many articles and periodicals for professionals such as teachers, social workers, and nurses; with tremendous proliferation of workshops, training, and other interventions. The empirical phase marked the discovery of self-report inventories in the early 1980's - most notably the Maslach Burnout Inventory (MBI) and research pitched up. This means that already before the introduction of burnout, Dutch practitioners were trained to diagnose and treat "overstrain;" and burnout was labeled to indicate chronic and severe "overstrain."[8]

Definition of Burnout

Maslach defined it as "Emotional exhaustion, depersonalization and reduced personal accomplishment that can occur among individuals who do 'people work' of some kind".[9] Maslach and Leiter defined it as "Burnout is the index of the dislocation between what people are and what they have to do. It represents erosion in value, dignity, spirit, and will – An erosion of the human soul. It is a malady that spreads gradually and continuously over time, putting people into a downward spiral from which it's hard to recover."[10]

Burnout is the result of chronic interpersonal work related stressors. Emotional exhaustion (stress dimension), depersonalization (interpersonal dimension) and diminished personal accomplishment (self-evaluation dimension) comprise the three dimensions of burnout which could lead to depression, reduced work performance and fatigue[11]. A study

by Ahola and Hakanen[12] found a reciprocal relationship between burnout and depressive symptoms. Depersonalization can be considered a self-protection mechanism against emotional exhaustion, resulting in a negative and cynical attitude toward the patient as well as an attitude of detachment. Chronic exhaustion with consequent emotional and cognitive distancing leads to a perception of inefficacy[13,14]. According to Burke and Richardson[15] burnout often develops into a chronic condition, thus posing a significant threat to good dental care[16-17].

Burnout has often been mistaken for stress. Stress can intensify burnout with time although it may not be the main cause of burnout. The time aspect implicates that the two can be differentiated retrospectively. In addition, stress symptoms may be more physical rather than emotional. Stress produces urgency and hyperactivity. Burnout, on the other hand, produces helplessness. Stress leads to over reactive emotions; whereas burnout leads to a more blunted state. Stress refers to temporary adaptation to changing conditions which can be performed successfully, whereas burnout reflects a breakdown in adaptation, causing structural deviation from normal functioning.

Incidence of burnout among dentist

Several studies have reported a high prevalence of burnout among dentists. This can be largely ascribed to the interpersonal context of the job. As health care provider the dentist is subject to interpersonal stressors due to the demanding nature of the occupation and close proximity to the patient. Work-stress and long working hours may have a negative effect on the dentist's psychological well-being and family life. Peterson et al study on service workers (including dentists) showed an association between burnout and depression, anxiety, alcohol consumption, sleep and memory problems as well as musculoskeletal complaints.[19-23]

Causes of Burnout

Forrest[24] listed a few factors which would potentiate occupational burnout in the daily life of dentists: Confinement, patient anxiety, compromised treatment, stress of perfection, economic pressures, and low self-esteem. Cooper et al.[25] outlined stressors in dentistry such as: Time and scheduling pressures, pay related stressors, patient's unfavorable perception of the dentist, staff and technical problems and problems dealing with patients. Others have also[26] reported dissatisfaction in the relationships with the patients, problems relating to the physical environment, uncomfortable working posture, and unhappy marriages, as contributors to burnout in dentistry.

Burnout has been alternately described both as a condition and a process. As per Weber and Jaekel- Reinhard, it is a dynamic process on a continuum with various stages between hyperactivity and despair. In this process, a wide variety of symptoms ranges from fatigue, loss of cognitive function to psychosomatic disorders.[27-28] It is insidious, often developing as an adaptation to short-term stress, which becomes ineffective and harmful over the long-term. What may begin as protective emotional distancing may transform itself into Emotional Exhaustion (EE) and callousness. The result is the transformation of a previously committed professional to the one who is disengaged from one's work.[29]

The social-medical point of view describes burnout development at three levels. Micro-level discrepancies are explained by the job-strain model: "Negative stress" (accretion of stress i.e. psycho-social or psycho-mental with a decreased threshold of stress tolerance) can result in a high level of strain. Apart from psychological and social factors, biological and biochemical factors are also suggested to play a major role. Hormonal and endocrinological changes during burnout (increase in the cortisol level) are presently under research. The "person-environment misfit" concept explains the meso and macro level interactions that emphasizes the role of "social support" systems and "coping" strategies. Dentists pass through various stages in burnout development before reaching the stage of "pulpout" - The final stage **(Table I)**.[30-31]

Components of Burnout

Table I: Stages in Burnout development.

Stages	Description
Practice honeymoon	Where one overworks oneself due to enthusiasm and ambition to develop one's practice.
The drill and fill blahs	Where one's laboratory becomes boring due to monotonous work.
The operatory blues	Where depression sets initially as a result of monotonous work.
The crisis	Where agitation and frustration appear due to conflicting mental state.
The pulpout	'Burnout' the final stage.

There are mainly three components described in the literature [22]–

1. Emotional Exhaustion (EE) : Continuous interpersonal interactions might lead to emotional wasting and the progressive loss of energy.
2. Depersonalization (DP): Negative attitude and cynical responses toward the clients, reaching a point where the latter ones are considered as simple objects.
3. Reduced Personal Accomplishment (RPA): Reduced personal realization, associated with loss of self-confidence, development of negative self-concept and low self-esteem, all of which lead to a decrease in productivity on a job and poor or complete absence of personal realization.

Measurement of Burnout

Currently, a number of screening instruments are available that seem to "measure" burnout. Broadly, they measure burnout as one-dimensional construct (Burnout Measures; Shirom-Melamed Burnout Measure) and as dimensional construct (MBI;[32-33] Oldenburg Burnout Inventory;[34] Copenhagen Burnout Inventory; MBI-Students Survey[35]). Among these, MBI is the most commonly used among dental personnels.[36]

Diagnosis

As per the International Classification of Diseases - 10th edition, burnout is included in the residual category "problems related to life management difficulty" (Z73.0)[37] and discussed as a syndrome. **(Table II)**

Table II : Burnout signals at individual, interpersonal and organizational levels.[10]

Cognitive signals	Affective signals	Motivational signals	Behavioral signals	Physical signals
Signals at individual level				
Helplessness/loss of meaning and hope, feelings of powerlessness/feelings of being "trapped", sense of failure, poor self-esteem, guilt, suicidal ideas, inability to concentrate/forgetfulness/ difficulty with complex tasks	Depressed mood/ changing moods, tearfulness, EE, increased tension/anxiety	Loss of zeal/ loss of idealism, resignation, disappointment, boredom	Hyperactivity/impulsivity, increased consumption of: caffeine, tobacco, alcohol, illicit drugs, abandonment of recreational activities, compulsive complaining/denial	Headaches, nausea, dizziness, muscle pain, sleep disturbances, ulcer/gastrointestinal disorders, chronic fatigue
Signals at interpersonal level				
Cynical and dehumanizing perceptions of clients/service recipients/patients, negativism/pessimism with respect to clients/service recipients/patients, labeling recipients in derogatory ways	Irritability being oversensitive lessened emotional empathy with clients/service recipients/ patients, increased anger	Loss of interest, indifference with respect to clients/ service recipients/ patients	Violent outbursts, propensity for violent and aggressive behavior, aggressiveness toward clients/service recipients/patients, interpersonal, marital and family conflicts, social isolation and withdrawal	Not applicable

Signals at organizational level				
Cynicism about work role, distrust in management, peers and supervisors	Job dissatisfaction	Loss of work motivation, resistance to go to work, low morale	Reduced effectiveness/poor work performance/declined productivity, turnover, increased sick leave/ absenteeism, being over-dependent on supervisors, increased accidents	Not applicable

Management of Burnout

Burnout should be taken as an opportunity to revive oneself. The development of burnout itself states that massive emotional and psychological change is required. The first step in combating burnout is identifying the reason for its development. The reason might differ from one individual to another by taking out some lone time during which an individual can be in coherence with inner self would help in recognizing the cause of burnout. Connect can be developed by indulging in an individual's favourite leisure activity which might be taking a quiet walk alone; sitting at the favourite place and reading a book/journal. These activities would also aid in knowing what one actually wants by listening to the inner feelings.[38-42]

The second step comprises of taking appropriate and necessary actions to make the change possible. Continuous evaluation of oneself is to be done by asking pertinent questions; doing regular attitude check; seeking information to help via books, CDs and continuing education courses and networking with other dentists. Each dentist should reflect upon their work occasionally and stimulate themselves to actively include those aspects of work that they value in their practice.[43-47]

A recent development within burnout research is the shift from the traditional concept and scope to its opposite that is work engagement. Burnout is the negative pole of a continuum, with engagement representing the positive antipode. Another emerging trend for managing psychological problems is positive psychology that focuses on human strengths and optimal functioning rather than on weaknesses and malfunctioning. For that, one can get further help from a general practioner, a cognitive behavioral therapist, a psychologist or a psychiatrist.[48-51]

Intervention can be either etiological and /or symptomatic **(Table III)**.

Table III : Burnout Intervention[10]

Symptomatic intervention	Etiological intervention
Physical relaxation – simple solutions for fatigue.	Distinguishing and developing the rational ideas self- requests, to others/job/world [cognitive restructing]
Life program reorganization – highlighting your favourite activities	Management of emotions related to exhaustion/fatigue and irrational ideas.
Search and use external resources as social support	System values reorganization/reappraise.
Task reorganization	Self control training
Identify areas of interest/motivation of the person.	Rational training to frustration
	The training of active coping.
	The training of role playing simulation/scenarios and role playing.

Levels of prevention

As per the levels of prevention following measures can be considered.

- Primary prevention: Avoidance/elimination of the factors that make the patient ill.
- Secondary prevention: Early recognition/ intervention of manifest disease; and
- Tertiary prevention: Coping with the consequences of disease/rehabilitation and relapse prophylaxis.

Coping Strategies

Coping strategies, customarily being defined as specific methods, directed to specific objectives:[52]

- Coping oriented to the problem (by retorting to the stressful situation directly)
- Coping oriented to the emotion (to restrain the emotional response to stressful events)

Three categories of coping are identified

- Active-cognitive coping-management of assessing potentially stressful events.
- Active-behavioral coping-apparent efforts to manage a stressful situation.
- Coping by avoidance to face a problematic or stressful situation.

Conclusion

One should always remember the zeal and enthusiasm with which they had joined dentistry and start focusing on the brighter aspect of this career option rather than looking at its negative demeanor. Dentistry is a profession that holds many opportunities for those being part of it and one should never forget the hard work that was put in for acquiring the professional license. There is no uniformly agreed definition of burnout syndrome. Health professionals including dentists are particularly prone to burnout. Hence, there is need to discover innovative preventive strategies, to protect the dental workforce from the ravages of this sinister.

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Conflicts of interest

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Prosthodontic Perspective of Obstructive Sleep Apnea : A Review

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Abstract

Obstructive Sleep Apnea (OSA) is a sleep breathing disorder that affects a person's breathing during sleep. It is one such chronic condition of upper airway collapse during sleep characterized by repetitive episodes of cessation of respiration (apnea) or decrements in airflow (hypopnea), associated with sleep fragmentation, arousals, day-time sleepiness, fatigue and reductions in oxygen saturation. The present review discusses the etiology, diagnosis and different prosthodontic treatment options for dentulous and edentulous patients.

Keywords: Obstructive sleep apnea, Oral Appliances, Mandibular advancement appliances.

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Introduction

Obstructive Sleep Apnea (OSA) is a sleep breathing disorder characterized by repetitive episodes of partial or complete upper airway obstruction during sleep resulting in hypopneas or apneas, respectively. The episodes of upper airway obstruction results in exaggerated intrathoracic pressure swings, asphyxia (characterized by hypoxemia and hypercapnia), and fragmented sleep. The typical signs of OSA include loud and irregular snoring and disturbed sleep due to the multiple arousals and awakenings associated with non restorative sleep and daytime sleepiness and/or excessive sleepiness. However, patients may not willingly accept the symptoms. There is growing concern that OSA may contribute to several cardiovascular diseases, including hypertension and atrial fibrillation. OSA syndrome is a denomination reserved for patients that present with OSA plus associated symptoms, including sleepiness and/or cardiovascular disease. The repetitive episodes of apneas or hypopneas represent a stress that can result or contribute to cardiovascular and metabolic diseases. It is now recognized that severe OSA is independently associated with poor cardiovascular outcome, including myocardial infarction, stroke, and death from cardiovascular cause and usually seen in obese, middle age men with snoring and daytime sleepiness. Women frequently complain of depression like symptoms. There is growing evidence that patients with OSA may be at increased cardiovascular risk as it contributes to several cardiovascular disease, including hypertension, atrial fibrillation and congestive heart failure.[1,2]

Causes of OSA

The causes of OSA are old age (natural or premature), brain injury (temporary or permanent), obesity, decreased muscle tone that could be caused by drugs or alcohol, or it can be caused by neurological problems or other disorders (Neuromuscular diseases or Down syndrome), increased soft tissue around the airway (sometimes due to obesity) and anatomic anomalies that give rise to a narrowed airway and may include hypertrophic tonsils and adenoids, choanal atresia, respiratory tissue thickening.[3,4]

Obese adults show an increase in pharyngeal tissue which cause respiratory obstruction during sleep. Adults with normal Body Mass Indices (BMIs) often have decreased

muscle tone causing airway collapse and sleep apnea. Sleeping on the supine position is also a risk factor for OSA as mandibular retraction and tongue collapse may occur in this position which constitutes an anatomical basis for respiratory obstruction during sleep.

Diagnosis

Thorough history should be taken for initial diagnosis and tests should be performed to confirm the diagnosis. STOP survey and Epworth Sleepiness Scale are commonly used for initial diagnosis and categorization. The diagnosis of OSA syndrome is made when the patient shows recurrent episodes of partial or complete collapse of the upper airway during sleep resulting in hypopnea and apneas, both despite active efforts to breathe. To define the severity of the condition, the Apnea-Hypopnea Index (AHI) or Respiratory Disturbance Index (RDI) are used. AHI measures the mean number of apneas and hypopneas per hour of sleep and RDI adds to this measure the respiratory effort-related arousals (RERAs).[4,5]

1. Grading of sleep apnea:

Sleep apnea can be categorized by the number of events per hour:

AHI	Rating
<5	Normal
5-15	Mild
15-30	Moderate
>30	Severe

Table 1: Grading of sleep apnea

2. Criteria

According to the International Classification of Sleep Disorders, there are 4 criteria -

- Sleep - excessive sleepiness, nonrestorative sleep, fatigue or insomnia symptoms.
- Waking up with breath holding, gasping, or choking.
- Snoring, breathing interruptions or both during sleep.
- Associated with medical issues as hypertension, coronary artery disease, stroke, heart failure, atrial fibrillation, type 2 diabetes mellitus, mood disorder or cognitive impairment.

If the events are present less than 5 times per hour, no obstructive sleep apnea is diagnosed.[4]

3. Polysomnography

Polysomnography aids in diagnosing OSA characterizes the complete or partial cessation in breathing. An "event" can be either an apnea for at least 10 seconds or a hypopnea in which airflow decreases by 30-50 percent for 10 seconds if there is an associated decrease in the oxygen saturation or an arousal from sleep. To grade the severity of sleep apnea, the number of events per hour is reported as the apnea-hypopnea index (AHI).[2]

RATIONAL FOR TREATMENT

OSA is a relevant public health issue and has been associated with the development of cardiovascular events and has a negative impact on quality of life. The application of Continuous Positive Airway Pressure (CPAP) has been proven to beneficial undoubtedly for such patients. CPAP being not so cost-effective and has to be continued for life, other alternatives such as oral appliances can also be used.[4,5]

Treatment

Numerous treatment options are used in obstructive sleep apnea.

- Physical intervention

The most widely used current therapeutic intervention is continuous positive airway pressure whereby a breathing machine pumps a controlled stream of air through a mask worn over the nose, mouth, or both. The additional pressure holds open the relaxed muscles. There are several variants:

- Continuous Positive Airway Pressure (CPAP) **(Figure I)**
- Variable Positive Airway Pressure (VPAP)
- Nasal EPAP (Nasal Expiratory Positive Airway Pressure)
- Automatic positive airway pressure
- A 5% reduction in weight among those with moderate to severe OSA may decrease symptoms similarly to CPAP.

(Figure I) (Image Source: https://upload.wikimedia.org/wikipedia/commons/7/7f/CPAP.png)

- Surgery

There are a number of surgical procedures that may be performed including Septoplasty, Tonsillectomy and/or adenoidectomy, Laser-Assisted Uvulopalatoplasty (LAUP), turbinectomy, Hyoid suspension, Genioglossus advancement, Maxillomandibular advancement.

- Oral appliance (prosthesis/splint/device):

Oral appliances are increasingly being used for the treatment of Obstructive Sleep Apnea (OSA) and are a simpler alternative to Continuous Positive Airway Pressure (CPAP). The advantages of this form of therapy compared to CPAP are simplicity, portability, or need for a power source and a potentially lower cost. The last decade has produced a substantial evidence base validating their therapeutic use. Oral appliances are now recommended as a first-line therapy for OSA in selected patients.

Oral appliances can be categorized by design into two main types;

1. Mandibular Advancement or Mandibular Retaining Devices or Mandibular Advancement Splints (MAD/MRD/MAS)- or Mandibular Advancement Splints (MAD/MRD/MAS)-
   e.g., herbst appliance, Snoreguard. **(Figure II)**[6]
2. Tongue Retaining Devices (TRD), (tongue retaining/tongue stabilizing/tongue repositioning /tongue advancing).[7]
   e.g.- snor ex. soft palate lifter-and a combination of oral appliances

MAS attach to the upper and lower dental arches and mechanically protrude the mandible. Although all appliances of this type maintain the mandible in a protruded position, there are differences in how this is achieved between individual designs. Most broadly, MAS can be distinguished by their configuration as either a one-piece appliance (monobloc) or a two-piece appliance (duobloc) consisting of separate upper and lower plates. Apart from this design distinction, appliances differ in size, type of construction material, the amount of occlusal coverage, degree of customization to a patient's dentition, amount of vertical and lateral jaw movement permitted, allowance of oral breathing by incorporating an anterior open window[7] **(Figure III)**, and degree of titratability of advancement. The coupling mechanism between the plates of two piece appliances differ in location and type, from elastic or plastic connectors, metal pin and tube connectors, hook connectors, acrylic extensions to magnets. Two-piece appliances have the advantage of greater adjustability and therefore allow a greater range of mandibular protrusion to be achieved more comfortably; however, one-piece splints are sometimes indicated due to dental conditions or the occlusal relationship.

(Figure II) Herbst Appliance for treatment of OSA[6]

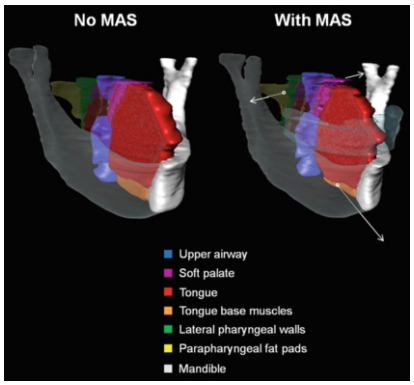
(Figure III) Monobloc Appliamce with anterior open window[7]

All Tongue Repositioning Devices feature a flexible bulb, which upon insertion of the tongue, can be squeezed to generate negative suction pressure by the displacement of air. The suction retains the tongue in a forward position, preventing its collapse back into the oropharyngeal airway. In original TRD designs, the anterior bulb is fixed to a covering of the upper and lower dental arches, similar to a mouth guard. Customized TRDs can be fabricated from impressions of the upper and lower dental arches of individual patients or be preformed "boil and bite" type appliances which the patient can fit themselves. A more recent commercially available pre-fabricated design eliminates the need for any dental coverage as the bulb is held forward by external vertical flanges placed outside the lips. This appliance is not dependent on the teeth. Furthermore it may contribute to enlarging other dimensions of the upper airway. Moreover, it is possible for TRD to counteract the effect of gravity on the tongue in the supine position.[6,7]

Mechanism of action

Upper airway volume is increased with MAS. This change in airway structure is associated with movement of surrounding soft tissue structures **(Figure IV)**.[2] Analysis of the movement of soft tissue centroids (a point analogous to the center of mass of a 3D structure) shows anterior

displacement of the tongue base muscles and lateral movement of the parapharyngeal fat pads away from the airway with MAS wear for OSA. A subsequent investigation has shown improved endothelial function after 2 months of MAS treatment, to the same extent as that seen with CPAP in this crossover study.



(Figure IV) Mechanisms of action of MAS.[2]

Review of oral appliance therapy in complete and partially edentulous OSA patients

- Mucosa supported oral appliances for completely edentulous patients

Meyer & Knudson (1990) described clinical and laboratory technique to use in the fabrication of a prosthesis to prevent sleep apnea in the edentulous patient. The objective of the treatment is to establish a comfortable protrusive and vertical posture of the mandible that prevents or minimizes obstruction of the airway during sleep. During fabrication of the prosthesis, cephalograms are used to assess spatial changes between the base of the tongue and the posterior pharyngeal wall.

Robertson (1998), described "combination appliance" wherein increase in vertical dimension and mandibular advancement prevented obstructive sleep apnea in an edentulous patient. Giannasi et al (2008), reported an adjustable PM Positioner, a mandibular repositioning appliance was fitted on to maxillary complete denture. Kurtulmus & Cotert (2009), described a method of fabricating an acrylic monobloc functional splint combining a tissue borne Mandibular Advancement Splint (MAS) and a tongue retaining device with custom-made tongue-tip housing for an edentulous patient with obstructive sleep apnea.[6,7]

- Oral appliances in partially edentulous patients

Ogawa et al (2009), reported a study on fabrication of a monobloc oral appliance with a denture base as a promising tool for the treatment of OSA patients with multiple missing teeth. Giannasi et al (2010), reported that oral appliances such as the PM Positioner are an alternative for treating obstructive sleep apnea in partly edentulous patients.[8,9]

Side effects of oral appliance treatment and management

Side effects can be grouped into:

1. Temporomandibular joint-related side effects: transient morning jaw pain, persistent temporomandibular joint pain, tenderness in muscles of mastication, joint sounds.
2. Intraoral tissue-related side effects: soft tissue and tongue irritation, gingival irritation, excessive salivation/drooling, dry mouth
3. Occlusal changes: altered occlusal contacts/bite changes , incisor changes, decreased overjet and overbite , alterations in position of mandibular canines and molars, interproximal gaps.
4. Damage to teeth or restorations: tooth mobility, tooth fractures or damage to dental restorations
5. Appliance issues: appliance breakage, allergies to appliance material, gagging, anxiety.

Management

The management of side effects should be of wait and watch phenomenon, palliative care which is supportive in nature and intended to manage patients discomfort during the healing phase such as reassurance, rest, ice, soft diet, topical or systemic pain relief products or anti-inflammatory medication, massage and physiotherapy. Jaw stretching exercises such as asking patients to move the mandible against resistance both vertically and laterally and to stretch the mandibular range of motion assisted by the fingers, targeting the masticatory muscles. Patients can be asked to move the mandible against gentle resistance applied with finger pressure to stretch the muscles of mastication.[10]

Conclusion

As the current gold standard for OSA treatment, CPAP is highly efficacious and cross-over trials comparing MAS to CPAP consistently find that MAS is less efficacious in improving the polysomnographic measures of OSA. However, although CPAP is superior in reducing AHI and improving oxygen saturation, similar improvements in health outcomes suggest MAS may not be inferior to CPAP in clinical practice. TRD's are used less commonly than MAS

and investigations into their efficacy as a treatment for OSA remain limited. Side effects such as excessive salivation, muscle and tooth discomfort are common during the initial treatment stages but are most often minor and abate with continued use. Longer term effects of MAS wear, such as tooth movement and malocclusion, occur in a significant number of patients but are usually minor in nature and do not require cessation of treatment.[2,10,11]

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Conflicts of interest

There are no conflicts of interest.

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Review Article

Giant Cells : An Overview !!!

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Abstract

Giant cells are large mononucleated or multinucleated cells that are seen in a variety of physiological as well as pathological conditions. Multinucleated giant cells (MGCs) are important mediators of tissue remodeling and repair and also for removal of foreign materials and various pathogens. Depending upon the tissue where fusion occurs and the inflammatory result, multinucleated giant cells assume distinctly different phenotypes. Present review aims to concisely explain giant cells with its significant role in different physiological and pathological conditions which would be helpful in diagnosis and treatment plan of various entities which shows giant cells.

Keywords: Giant Cells; Macrophages; Phagocytosis; Multinucleated cells.

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Introduction

"**Giant**" is the English word coined in 1297 commonly used for such beings which are very large when compared to normal.[1] According to The American Heritage Medical Dictionary Giant cell is defined as "an unusually large cell, especially a large multinucleated phagocytic cell. A giant cell is a mass formed by the union of several distinct cells (usually macrophages) which undergo a defined set of intercellular interactions that ultimately result in a multinucleated cell with a single cytoplasmic compartment. There are two types pathologic and physiologic giant cell. (Creighton).[2]

Muller J[2] had discovered giant cells. Virchow and Langhans[3] discussed their nature. Lambert A[3] observed the formation of multinucleate giant cells from wandering mononuclear cells, while Lewises reported the transformation of the mononuclear blood cells of lower vertebrates into giant cells in hanging drop cultures. However giant cells are not always multinucleate they may be also uninucleate, its just their large size which designates them as giant cells. This review presents concise information of classification, formation, cell of origin and description of different types of giant cells which would be helpful in diagnosis and treatment plan of various entities which shows giant cells.

among which the most recent classification is as follows -

Based on type: Mathew et al 2016[5]

i) Epithelial-derived viral - induced multinucleated giant cell containing lesions

   tzank giant cells – herpes simplex

   tzank giant cells – herpes zoster

ii) Monocyte/ multinucleated giant cell containing lesions

   A. Inflammatory granuloma associated giant cells

      - Langhans giant cell containing pathologies : infections – tuberculosis, leprosy, late syphilis, deep fungal infections;

      unknown antigenic stimuli – sarcoidosis and orofacial granulomatosis

      - Foreign body giant cell containing lesions : foreign body granuloma

   B. Osteoclastic giant cell containing lesions

Various classifications has been proposed **[Table I]**,

Author	Basis of proposed classification
Chattopadhyay (1995) , Chatterjee et al (2015), Varghese and Prakash (2011)	Etiopathogenesis
Gupta et al (2014)	Origin
Chattopadhyay (1995)	Origin and etiology
Sankari et al (2014)	Functional characteristics
Mathew et al (2016)	Type of Giant cells
Haythron et al (1929), Quinn and Scheptkin (2009)	Arrangement, composition of organelles and function
Enneking and Campanacci (2016)	Radiographic appearance
Lucas (1976), Rosenberg et al (2001)	Pathology involved

Lesions with osteoclastic giant cells being the primary pathologic cells – Paget's disease

iii) Lesions with reactive osteoclastic giant cells formed secondarily by the activation of lesional stromal cells - Peripheral Giant Cell Granuloma (PGCG), Central Giant Cell Granuloma (CGCG), Cherubism, Aneurysmal Bone Cyst (ABC), Fibrous dysplasia, Brown tumor of hyperparathyroidism

iv) Touton giant cells Xanthoma, xanthogranuloma, fibroushistiocytoma.

v) Tumor giant cells [6] Tumors where giant cells are pathognomonic - Giant cell fibroma, Hodgkin's lymphoma, other anaplastic malignancies.

Cell Of Origin: [1,2]

Over the years a number of research has been done over the cell of origin of various giant cells and they are as follows:

1. Proliferating giant cells associated with tooth eruption (Geschicter and Copeland)
2. Endothelial cells
3. Proliferating mononuclear cells
4. Monocytes (Arnold Postlethwaite et al)
5. Mitotic/amitotic division & monocyte nuclei.

Formation Of Giant Cells:

Various theories of Giant cell formation[1,2] have been proposed

1. Multiple Nuclear Division Without Cytokinesis :

According to Harris[1,2,] nuclear division in a polykaryon is normally followed by the formation of a single mitotic spindle, leading to the production of a single hyperdiploid nuclei. He also stated that formation of giant cells (e.g. tumour giant cells) occurs by the nucleus of the dividing cell, while the body of the cell fails to divide. These giant cells are not derived from the macrophages but from the cells of the tumour either connective tissue or epithelial in nature. [7]

2. Macrophages Fusion:

Gorden and Cohen[1,2] in 1970 suggested that macrophages can fuse with other macrophages to form a giant cell in vivo. Three suggestions have been put forward to account for macrophage fusion in vivo.

i. Fusion Mediated by the Immune System

Macrophage polykaryons are commonly found in areas containing poorly removable foreign material. Frequently the foreign body is antigenic (fungi, tuberculosis, etc). Even when the foreign material itself has no antigenicity (e.g., glass) it is possible that inflammatory process itself produces antigens. It has been stated that immune system is probably responsible for macrophage fusion. It has been suggested phagocytosing macrophage fuse under the influence of lymphokines and the membrane changes associated phagocytosis may facilitate the adherence and fusion of macrophages initiating the formation of the giant cell.

ii. Fusion Resulting from the Recognition of an Abnormal Macrophage Surface by Young Macrophages.

Mariano and Spector showed that by enclosing a population of macrophages in diffusion chambers; in vitro giant cell formation was prevented. On leaving the chambers open, they found that the fresh in coming macrophages fused with those already inside the chamber to form giant cells. It was seen that being

enclosed within the chamber, the macrophages underwent mitosis, [8] which revealed many chromosomal abnormalities. These chromosomal abnormalities lead to the formation of an abnormal cell surface on aging population which is recognized by the fresh incoming cells leading to fusion. Contradicting Mariano and Spector's hypothesis later in the year 1977, Chambers[1,2] tested this hypothesis by exposing macrophages cultured in inflammatory exudates to fresh macrophages. It was observed that no fusion took place between two populations.

iii. Fusion as a result of Endocytic activity

Chambers[1,2] suggested that if the foreign material gets attached to the surface of the macrophages, it meets the phagosomic margins of the other cell. Attachment of any variety of substances (foreign material) to the macrophage surface is followed by formation of endosome margins, which then approach each other and fuse to complete the endosome formation. It was seen fusion occurred in between the margins of the two cells.

3. Formation of Giant Cells induced by Viruses:

Hernandez et al[1,2] suggested that fusion may be caused by large numbers of inactivated viruses or by much small infective virus. With the inactivated virus, the viral envelope attaches and leads to a reduction in the cell coat thickness. When the virus is in contact with more than one cell, it results in cell fusion. Antigens from the virus get incorporated into the polykaryon membrane, indicating that the fusion results from the viral envelope leading to a "bridge" between the two cells, which enlarges into complete cell fusion. The mechanism by which enveloped viruses enter cells has very well defined by Hernandez et al under molecular basis. It says binding and fusion of viruses with host cells is mediated by viral proteins and host cell surface molecules that are used as viral receptors.

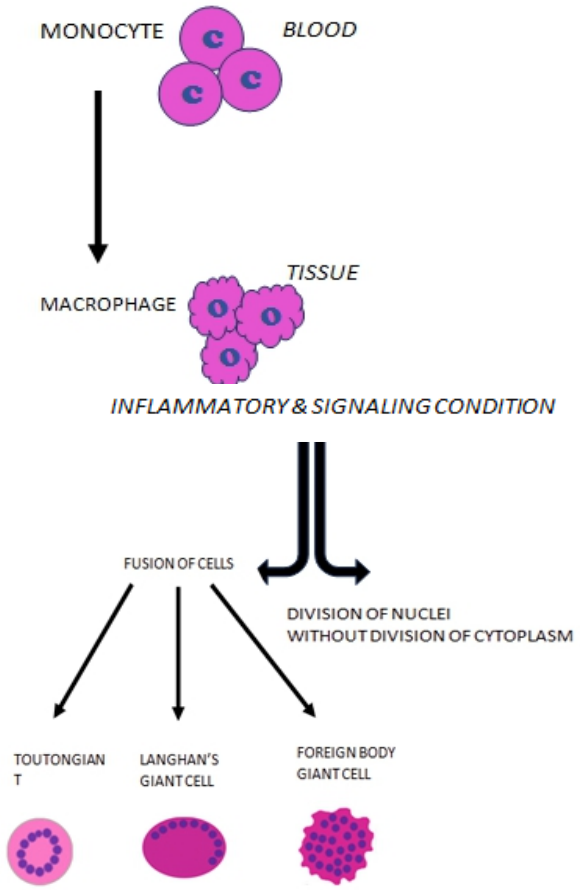
Molecular method of fusion:

For cells to undergo fusion a number of events need to occur sequentially to form a favourable environment for the same, the sequence of those events are as follows: 6

I. Induction of a Fusion-Competent Status
II. Chemotaxis
III. Cell–Cell attachment
IV. Cytoskeletal rearrangements
V. Fusion

Types of Giant Cells:

Multinucleated giant cells can be classified into several morphological variants **[Figure 1]**



Formation of multinucleated giant cells and its morphologic variants.

depending on the arrangement and composition of their organelles, as well as their functional characteristics.[7] Osteoclasts, odontoclasts, skeletal muscle fibers, syncytiotrophoblasts and megakaryocytes are the physiologically present multinucleated giant cells. Few of these also have a role to play in various pathological processes.[8]

Osteoclasts, as named by Kolliker[9] are bone-resorbing cells that play a pivotal role in bone homeostasis and remodeling. Osteoclast precursors are derived from bone marrow as early mononuclear macrophages, which circulate in blood, and bind to the surface of bone. Osteoclast formation is driven mainly by two cytokines, Receptor Activator of Nuclear Factor Kappa β Ligand (RANKL) and macrophage - colony stimulating factor (M-CSF).[9] In addition a wide variety of factors like systemic hormones and growth factors influence the formation and function of osteoclasts.[10]

Morphologically, osteoclasts are similar to foreign body giant cells, although they have considerably fewer nuclei. They usually contain 10 to 20 nuclei per cell and are found on bone surfaces; on the endosteal surfaces within the haversian system; and on the periosteal surface beneath the periosteum[1]. The osteoclastic giant cells show positivity to cathepsin K, alkaline phosphatase, RANKL, osteoprotegerin & Cluster of Differentiation 68 (CD68).[9] The calcitonin receptor is found to be a more specific marker of differentiation for osteoclasts from other giant cells derived from monocyte/ macrophage cell lineage .

Odontoclasts are responsible for resorption of dental hard tissues in various physiological and pathological oral conditions. These cells are usually studied and compared with osteoclasts because of some overlapping morphological and biochemical characteristics. However, there are still some differences. Some studies had shown that, similar to osteoclastogenesis Receptor activator of nuclear factor K.B. (RANK), RANK-Ligand (RANKL) and Osteoprotegerin (OPG) are involved in odontoclastogenesis. Also, similar pathways [alphavbeta3 integrin pathway and c-Fms pathway] seem to operate during activation of both odontoclasts and osteoclasts. According to certain contradictory studies response of odontoclasts to parathyroid hormone extract and certain drugs was found to be different from that of osteoclasts. Thus, it can be proposed that there might be additional pathways involved in formation and activation of odontoclasts. Physiological root resorption is seen only during shedding of deciduous teeth. Whereas pathologic root resorption can be due to various causes like trauma as in orthodontic treatment, hormonal imbalance, various cysts and tumors affecting jaw bones and periodontal disease. Pathways for formation and activation of odontoclasts can vary slightly among these pathologies.[10]

Tumor giant cells :

Many epithelial and mesenchymal neoplasms contain tumor giant cells.[11] The nuclei of these giant cells are pleomorphic, often diploid, shows abnormal mitosis and resemble those of mononuclear tumor population. Tumor cells are known to possess an abnormal surface and are predisposed to fusion in different ways.[12] Many tumors have been shown to release extracellular enzymes 13 which may reduce the surface coat thickness and cause close approximation of lipid bilayers leading to fusion. Some tumors have been found to be associated with passenger viruses, which are known to cause cell fusion. Josten M & Rudolph R12 have differentiated the giant cells in canine and feline neoplasia using Mindbomb homolog 1 (MIB1) & tartrate resistant acid phosphatase (TRAP). The study showed that the neoplastic giant cells showed positivity for MIB1 but not for TRAP, suggesting that neoplastic giant cells have a different phenotype than osteoclasts.[14]

Reed Sternberg Cells :

Reed–Sternberg cells (also known as lacunar histiocytes for certain types) are different giant cells found with light microscopy in biopsies from individuals with Hodgkin's lymphoma (also known as Hodgkin's disease; a type of lymphoma) primarily due to Epstein Barr Virus, and certain other disorders. They are usually derived from B lymphocytes. The Reed-Sternberg cell is typically binucleated ('owl eyenuclei'), although it may be multinucleated ("pennies on a plate"), with prominent nucleoli. Immunophenotypically, Reed - Sternberg cells are positive for CD15/CD30 and negative for CD45/CD20 both in nodal and extra nodal disease.[15]

Touton giant cells : [12]

Touton giant cells are characterized by multiple nuclei that cluster together in the cell and are surrounded by foamy cytoplasm. These cells were originally known as xanthelasmatic giant cells and are formed by fusion of macrophage derived foam cells.[16] These Multinucleated giant cells (MGCs) are most frequently found in lesions containing cholesterol and lipid deposits, and are associated with various pathologic processes, such as xanthomas and xanthogranulomas.[17] Touton types of giant cells are appreciated in cases of fibrous histiocytoma.[18] The lipid droplets in the cytoplasm of these cells can be demonstrated in frozen section by special stains.[19] Lysozyme, α1 antitrypsin, CD68 & factor XIIIa can be used as a marker for differentiation of these multinucleated giant cells.[17]

Langhans' giant cells :

Langhans' giant cells are characterized by the presence of few nuclei (< 20) arranged peripherally, within the giant cell. They are commonly found in immune granulomas and granulomatous inflammations in the presence of indigestible particles of organisms, eg: the tubercle bacillus. The presence of MGCs in the tuberculous granuloma was first described by Langhans in 1868. Interferongamma (IF-γ) plays a central role in inducing Langhans' giant cell formation. These cells

show positivity to CD68.20 It has also been seen that larger the size and more the number of nuclei in MGCs, the virulence of disease increases. Lay et al21 have shown that high virulence mycobacterium, i.e., Mycobacterium tuberculosis, induces large MGCs with more than 15 nuclei per cell, whereas low virulence mycobacterium species, Mycobacterium avium and Mycobacterium smegmatis, have low number of nuclei per cell, less than seven. Of special note is that the high-virulence mycobacterium species resulted in granulomas where the MGCs phagocytic activity was absent, as opposed to the low-virulence species that produced MGCs where phagocytic activity was present.[2113]

Foreign body giant cells :

Foreign body giant cells (FBGCs) are generated by macrophage fusion and serve the same purpose as osteoclasts: degradation/resorption of the underlying substrate. Unlike osteoclasts, which adhere to bone, FBGCs, together with their macrophage precursors, adhere to markedly different synthetic surfaces that display distinct differences in hydrophilic/hydrophobic character as well as chemical and physical properties.[9] FBGCs contain many nuclei (up to 100 - 200) that are arranged in a diffuse manner throughout the cytoplasm. Foreign body giant cells are observed at the tissue-material interface of medical devices implanted in soft and hard tissue and remain at the implant-tissue interface for lifetime, of the device in vivo. In addition, FBGCs have also been implicated in the biodegradation of polymeric medical devices. FBGCs and macrophages constituting the foreign body reaction at the tissue-device interface are surface area dependent. Fabrics utilized as vascular grafts show high densities of FBGCs, whereas flat surfaces such as those found on breast implants exhibit only one to two cell layer.[9]

Human Immunodeficiency Virus-1 (HIV-1) mediated syncytium formation, Warthin Finkeldey cells, Reed Sternberg cells are the other multinucleated giant cells associated with HIV, Rubeola and Hodgkins lymphoma; respectively .[22,23]

Conclusion:

Inspite of recent advances in understanding the molecular and cellular basis of different types of giant cells formation and function, major challenges remain in appreciating the molecular and cellular similarities and differences of different giant cells. Continued research is essential, not only for its theoretical value, but also for its important potential clinical implications. Better knowledge of giant cells will both help to elucidate the pathology and diagnosis of various diseases, such as, central giant cell granuloma, fibrous dysplasia etc and also improve opportunities for therapeutic intervention.

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Conflicts of interest

There are no conflicts of interest.

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Oral Manifestation of Secondary Hyperparathyroidism : A Case Report

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Abstract

Systemic diseases have been frequently known to cause a variety of signs and symptoms in oral cavity. One such systemic disease causing bony changes in the oral cavity is secondary hyperparathyroidism. This disease occurs in any condition that causes chronic hypocalcaemia; commonest causes being vitamin D deficiency and chronic kidney diseases. This article will be discussing a case of a 25 year old male with chronic renal failure and presenting with bony changes in maxilla and mandible.

Key words: Secondary hyperparathyroidism, Chronic renal failure, Oral manifestations of renal disorder.

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Introduction

Serum calcium and phosphorus levels are regulated by parathyroid glands and kidneys. Low levels of serum calcium, stimulates the release of Parathyroid hormone which causes an efflux of calcium ions from the bones and facilitates calcium reabsorption by the kidneys thereby maintaining levels[1].Hyperparathyroidism [HPT] is a disorder characterized by an excessive production of parathyroid hormone. Depending on the cause, HPT can be characterized into primary, secondary, tertiary and quaternary forms[2].Secondary Hyperparathyroidism results when there is increase in secretion of parathormone in response to lowered serum calcium level, due to some predisposing systemic condition, most commonly renal failure and Vitamin D deficiency[3].

Here, we present a case of secondary hyperparathyroidism as a corollary to chronic renal failure with emphasis on its oral manifestations.

Case Report

A 25-year-old male reported to Department of Oral Medicine and Oral Radiology, Government Dental College and Hospital, Mumbai, with the chief complaint of gradually enlarging, painless swelling on both sides of the upper jaw since 2 - 3 months. The patient had h/o hypertension since 8 years for which he was taking beta blockers-Metoprolol 25mg once daily. He was also suffering from chronic renal failure and was under regular dialysis since 2 years. He had no habits, and his family history was unremarkable.

GENERAL EXAMINATION: The patient had a normal built and gait. There was absence of lunula on all his finger nails.

EXTRA-ORAL EXAMINATION: Slight midfacial expansion was noted bilaterally extending from outer canthus of the eyes upto the ala-tragus line on both sides. **[Figure I &II]**.

Figure I : Mild mid-facial expansion of the face

Figure II : Absence of lunula of nails

INTRAORAL EXAMINATION: A bony hard, non-tender, expansile swelling was noted bilaterally in the palatal region extending from behind the naso-palatine foramen upto the mesial aspect of the first molars. Mandibular arch showed slight expansion of the buccolingual cortical plates in posterior regions bilaterally **[Figure III].**

Figure III : Showing expansion of maxillary palatal region (right) and mild expansion of mandibular posterior region(left)

After evaluating the history and clinical examination, provisional diagnosis of benign tumor/cyst was made and following differential diagnosis were considered - Secondary hyperparathyroidism and Central giant cell granuloma.

Radiographic Findings

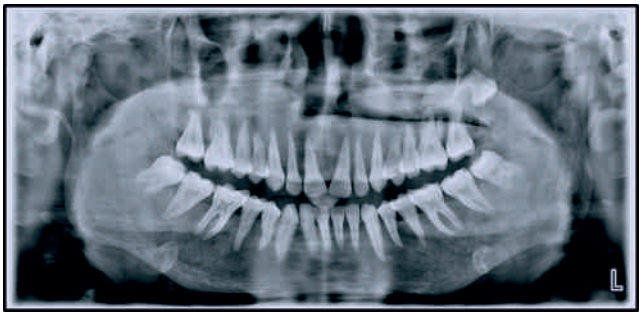

Figure IV : Orthopantomogram showing generalized loss of lamina dura and generalized haziness due decalcification

The orthopantomogram revealed generalized loss of lamina dura**[Figure IV]** reduced bone density, haziness and alteration of normal trabecular pattern ('ground glass appearance'), loss of cortication of the inferior border of the mandible, thinning of cortical boundary of inferior alveolar nerve canal, loss of cortication in the medial and posterior walls of maxillary sinus and floor of the maxillary sinuses was not traceable bilaterally.

The posterior- anterior skull view revealed typical, 'salt and pepper' appearance over calvarium. Hand and wrist radiograph revealed subperiosteal erosion over tips of phalanges **[Figure V]**.

Figure V : Hand and wrist radiograph showing erosion of terminal phalanges (left) & PA skull view showing 'Salt and pepper' appearance (right)

Cone Beam Computed Tomography [CBCT] examination revealed generalized resorption of the visualized skull bones **[Figure VI &VII]**, bicortical

Figure VI : Coronal section of CBCT showing buccolingual expansion of mandible (left) & Axial section showing altered trabecular pattern (right)

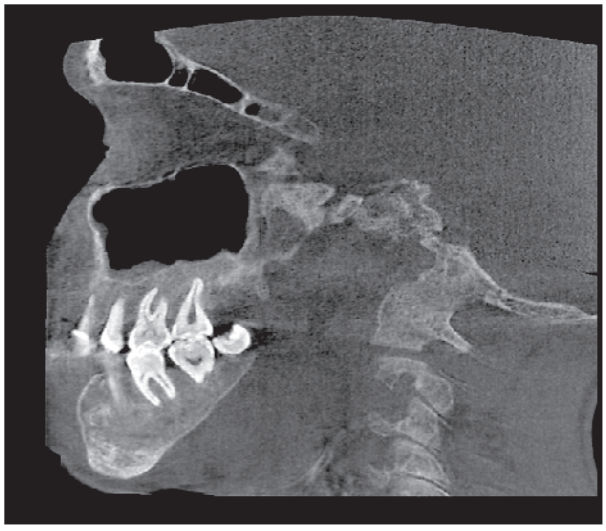

Figure VII : Sagittal section showing loss of lamina dura and osteoporotic changes of bone

expansion of mandibular posterior region with thinning of the cortical outlines, interior of the lesion showed mixed radiodensity and sagittal section showed generalized osteoporotic changes in the base of the skull, vertebrae and mandible.

After correlating history of systemic condition of renal failure with clinical and radiographic examination, a provisional diagnosis of secondary hyperparathyroidism was made. The following radiographic differential diagnosis of secondary hyperparathyroidism, polyostotic fibrous dysplasia and Paget's disease were considered.

The laboratory investigations confirmed blood biochemistry changes **[Table 1]**, which could be correlated

Tests	Normal values	Patient's values	Interpretations
Serum Calcium (mgs%)	8.5-11	9.20	Normal
Serum Phosphorus (mgs%)	2.3-4.7	5.40	High
Alkaline Phosphotase (IU/L)	25-147	566	High
Paratharmone levels (pg/mL)	10-69	>2500	Significantly increased
Vitamin D levels (ng/ml)	30-100	19.7	Insufficiency

to those associated with secondary hyperparathyroidism. The patient was referred to department of Endocrinology for further management and currently is under follow-ups.

Discussion

Hyperparathyroidism was first described by Von Recklinghausen in 1891, presenting its systemic effects. Its oral manifestations were reported in 1945 by Weinmann in the mandible[4]. Hyperparathyroidism occurs due to increased activity of the parathyroid glands, either from an intrinsic abnormal change or due to extrinsic factors affecting calcium homoeostasis. Depending on the cause, it can be characterized into following forms – a] Primary Hyperparathyroidism- Usually caused by a tumor (adenoma in 85% of all cases) or hyperplasia of the gland[5], b] Secondary Hyperparathyroidism- Low serum calcium levels in different physiologic or pathologic conditions like renal failure, intestinal malabsorption syndrome, decrease of Vitamin D production, trigger release of PTH[6], c] Tertiary Hyperparathyroidism- When long-standing secondary hyperplasia becomes autonomous in spite of correction of the underlying stimulant[3] and d] Quaternary Hyperparathyroidism- When long standing primary adenoma after surgical removal relapses again with adenoma formation[2].

HPT is generally seen in middle-aged patients (30–60 years) with female predominance and male: female ratio of 1:1.7. In the present case, the patient was a 25-year-old male. Symptoms and clinical signs often relate with chronic hypercalcaemia rather than to increased PTH. Signs and symptoms are classically described as abdominal groans, kidney stones, tender bones, psychic moans, and fatigue overtones[7]. In the systematic review done by Palla et al including 254 patients, facial asymmetry was the primary presenting feature in 78.0% of the cases. 40.8% of the cases presented with bony pathologies in the mandible, while in the maxilla it was 29.4%, and 29.8% included both the jaws[8]. This case presented with chief complaint of gradually enlarging swelling leading asymmetry of face.

Radiographic changes commonly observed includes osteopenia, loss of cortication of mandibular canals and blurring of normal trabecular pattern causing ground glass appearance[7]. All of these features were appreciated in the presented case. In a study by Silverman et al of 42 patients with HPT, only five cases were found with partial loss of lamina dura and not a single case with a complete loss[9]. Lamina dura was completely absent in the present case.

Brown's tumor, also called osteitis fibrosa cystica, was observed in the present case and is seen in approximately 13% cases of (renal osteodystrophy) secondary HPT caused by end-stage renal disease[7,10] Diagnosis of secondary Hyperparathyroidism was confirmed and differentiated from its primary variant by blood chemistry analysis which showed elevated PTH and Alkaline phosphatase with normal or low serum calcium levels[11].

Treatment is generally aimed at reducing the level of PTH by various medical and surgical means. Treatment of the underlying renal disease or kidney transplantation has been shown to produce marked improvement in the condition. Regression or resolution of Brown's tumour occurs following either oral/iv administration of vitamin D supplements such as calcitriol and paricalcitol[12,13].

Conservative surgical debridement of Brown's tumour though not common has also been shown to yield acceptable results. Parathyroidectomy can also be considered as a viable option in extreme and recalcitrant cases.

Conclusion

In patients with chronic renal failure the likelihood of developing secondary hyperparathyroidism is very high which further increases the complications and morbidity in such patients. Osseous changes in the jaw bones can be the first presenting signs in such cases and this places a dentist at an unique position to be the first one to identify and diagnose the condition thus, it is imperative for a dental practioner to familiarize himself with the variable clinical and radiological features of hyperparathyroidism and therefore facilitate prompt and optimum treatment of such patients.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Case Report

Comprehensive Endodontic, Surgical and Esthetic Management of Amelogenesis Imperfecta Associated with Infected Radicular Cyst – A Rare Case Report

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Abstract

Radicular cyst is the most common odontogenic cyst comprising about half of the entire jaw cysts. It is usually asymptomatic but may exhibit pain and swelling when secondarily infected. Management of the radicular cyst involves non-surgical root canal treatment of affected teeth or surgical enucleation when the lesion is non-responsive to conventional root canal therapy. This article presents successful management of a patient diagnosed with Amelogenesis Imperfecta (AI) associated with infected radicular cyst by conventional endodontic and surgical approach as well as its esthetic rehabilitation.

Keywords : Amelogenesis Imperfecta, Mineral Trioxide Aggregate, Periapical Surgery, Radicular Cyst.

Introduction

Radicular cyst is the most common odontogenic cyst derived from the Epithelial cell rests of Malassez.[1] It occurs as a consequence to inflammation usually caused by trauma to the upper anterior teeth. It is primarily asymptomatic and discovered as an incidental finding during routine radiographic examination.[2] Management of radicular cyst is done either by non-surgical or surgical approach. Though, nonsurgical endodontic treatment is highly predictable and a proven successful treatment modality in most of the cases, surgical approach is required in cases of large true cysts or persistent inflammatory cyst non-responsive to the nonsurgical approach.[1,2] Besides trauma, radicular cyst may also be associated with carious teeth having chronic periapical lesion of endodontic origin.

Amelogenesis Imperfecta (AI) is a rare, congenital developmental defect of enamel formation which presents with discoloured or pitted, yellowish appearance of the teeth. This case report describes the successful management of infected radicular cyst in a patient associated with amelogenesis Imperfecta AI by conservative and surgical approach.

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Case Report

A 30-year-old female patient was referred to the Department of Conservative Dentistry and Endodontics Government Dental College & Hospital, Mumbai from a private dental practitioner with a chief complaint of pain and swelling in the upper left front teeth region since 2 months. Pain was dull and intermittent in nature. She visited a local dental practitioner for the same and underwent root canal treatment of teeth #21 and #22. Unfortunately, even after initiation of root canal treatment of teeth #21 and #22, there was continuous pain and pus discharge through the same teeth and a fluctuant palatal swelling was observed in the maxillary left incisor region. Thus, the patient was referred to our tertiary care center for opinion and further treatment.

Clinically, the teeth #21 and #22 showed increased response to percussion and palpation test. The overlying palatal bone in this region appeared to be expanded without any defined border. The teeth exhibited no response to electric pulp testing. Her medical history was non-contributory and she gave no history of trauma to the affected teeth. Intraoral examination showed generalized loss of enamel and dentin with generalized yellowish discoloration affecting almost all the permanent teeth **[Figure I]** .

Figure I: Clinical photograph showing generalized yellowish discoloured teeth.

Clinically, the enamel structure was lost leaving behind the residual crown structure composed mainly of the dentin. Translucency of enamel could not be demarcated and generalized attrition with loss of proximal contacts and vertical dimension was also observed, suggesting AI. She gave a history of similar kind of yellowish dentition in her family members suggestive of hereditary AI.

Intraoral periapical (IOPA) radiograph showed presence of well-defined, non-corticated, periapical radiolucency (approximately 18mm x15mm) in the region of tooth #21 and #22 **[Figure II]**.

Figure II : Preoperative IOPA radiograph showed well-defined periapical radiolucency associated with tooth #21, #22.

Aspiration of the swelling was performed using 20-gauge needle with 10cc syringe assembly. The collected yellowish discharge was sent for the histo-pathologic examination. Histo-pathological evaluation showed that the smear comprised predominantly of neutrophils admixed with lymphocytes, clusters and sheets of hemosiderin laden macrophages in a background of few RBCs, cholesterol crystals and proteinaceous material. Biochemical analysis revealed total protein: 359 mg/dl, Sugar: 34 mg/dl, Cholesterol: 238 mg/dl. From clinical, radiographic and histologic findings the diagnosis of infected radicular cyst associated with teeth #21 and #22 was made.

The differential diagnosis of infected radicular cyst involve periapical granuloma, periapical abscess or suppurative osteomyelitis. Usually, acute apical abscess manifests severe pain, swelling, tooth mobility and radiograph may show ill-defined radiolucency with hazy borders. In contrast, radicular cyst shows a well-defined radiolucency with the corticated border. But, if the cyst becomes secondarily infected, inflammatory reaction of surrounding bone may result in loss of cortication. This case presented with well-defined radiolucency, loss of cortication and palatal plate expansion suggesting the infected radicular cyst.

Root canal treatment of all sensitive and affected teeth was planned and after explaining the treatment procedures the informed consent was obtained from the patient.In the first visit, the access was modified in tooth #21 and #22. Pus discharge was observed through the root canal of tooth #21. Cleaning and shaping was performed. Irrigation with 5.25% sodium hypochlorite followed by saline and final rinsing with 2% chlorhexidine was done. Calcium hydroxide intra-canal dressing was given in both teeth #21and #22 and the patient was recalled after 7 days. In the next visit, the patient was symptomatic but showed pus discharge through the root canal of tooth #21. Intra canal irrigation was done with chlorhexidine and calcium hydroxide dressing was given. Patient was recalled again after a week.

In the subsequent visit, the tooth #22 was asymptomatic; but tooth #21 still showed the pus discharge. In this visit the tooth #22 was obturated. After irrigation, Triple Antibiotic Paste (TAP) comprising of combination of ciproflaxacin, metronidazole and cefixime (1:1:1 with saline) was placed in the root canal of tooth #21 and patient was recalled after 14 days. Two weeks later, slight pus discharge was still observed from the root canal of tooth #21 and the patient also presented with a palatal swelling. As, the lesion was non-responsive to the conservative approach, surgery was planned which include surgical enucleation, apicectomy and retrograde filling with Mineral Trioxide Aggregate (MTA). The root canal treatment of teeth #21 and #22 was completed one day prior to the scheduled surgery **[Figure III].**

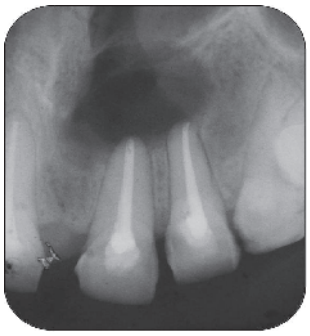

Figure III: Post obturation IOPA radiograph of teeth #21 and #22 before surgery.

Pre-surgical blood investigations were performed to check general fitness of the patient. All the procedures were described to the patient and her informed consent was obtained. Infra-orbital nerve block, naso-palatine nerve block and local infiltration of surgical site was done using 2% lignocaine containing 1:80,000 epinephrine. After securing profound anaesthesia, two vertical incisions and one horizontal incision extending from left maxillary canine to right maxillary lateral incisor were given using No.15 blade. Full thickness muco-periosteal flap was elevated with the help of periosteal elevator. A large bony defect was observed, perforating the labial cortical plate. Surgical SS white bur was used along with the coolant to widen the bony window and remove the defective margins.The granulation tissue was removed using the curette after enucleation **[Figure IV].**

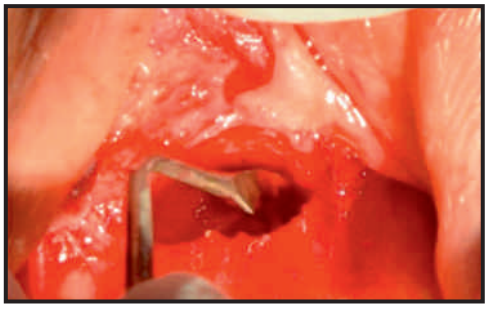

Figure IV : Surgical curettage followed by enucleation.

After complete curettage of cystic lesion, it was sent for the histo-patholgic examination; which confirmed it as the "Infected radicular cyst" **[Figure V].**

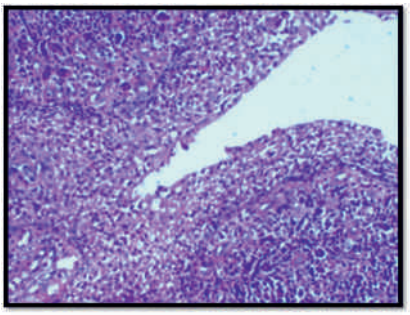

Figure V: Histologic photograph of infected radicular cyst.

The apex of the tooth #21 was resected **[Figure VI]**

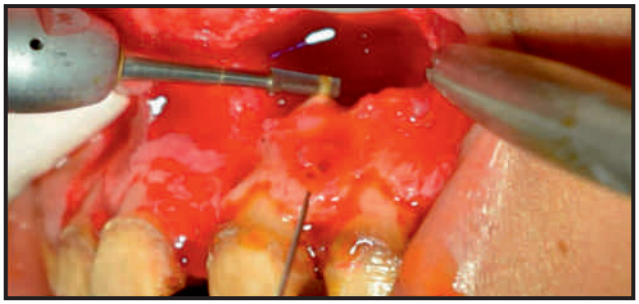

Figure VI : Root end resection and retro-grade cavity preparation in tooth #21.

and root end cavity was prepared with ProUltra ultrasonic tips No. 1 and No.2 (Dentsply Maillefer, Switzerland) to a depth of 3 mm and retrograde filling was done using MTA (Angelus) **[Figure VII].**

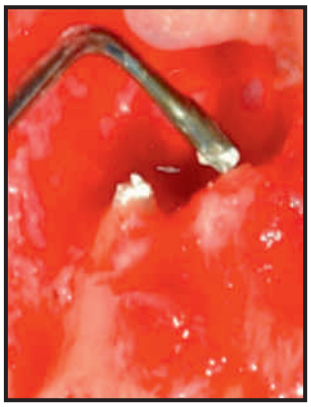

Figure VII: Retrograde filling with MTA in teeth #21 and #22.

Immediate post-surgical IOPA radiograph was made. **[Figure VIII]**.

Figure VIII: Immediate post-surgical radiograph of teeth #21 and #22.

After proper approximation, flap closure was done with polyester suturing material using simple interrupted suturing technique. Post-operative instructions were given and the patient was recalled after 7 days for the suture removal. As per the patient's esthetic demand, esthetic rehabilitation of patient was done after root canal treatment of all teeth, followed by esthetic crowns **[Figure IX].**

Figure IX: Esthetic rehabilitation of all teeth

Patient was advised to report back every 3 months for regular follow up in which IOPA showed satisfactory healing **[Figure X].**

Figure X: 3 months follow-up IOPA radiograph of teeth #21 and #22 showing satisfactory healing of the lesion.

Discussion

Radicular cyst is the most common odontogenic inflammatory jaw cyst, also known as periapical cyst. Its prevalence is about 52% to 68% of all the jaw cysts.[1] It arises from epithelial remnants in the periodontal ligament as a result of inflammation.[2] It is always associated with a non-vital tooth. Dental caries or trauma to the teeth causes inflammation of the pulp and leads to pulp necrosis.[3] However, in this case, patient neither presented with caries, nor gave any history of trauma. The occurrence of a radicular cyst here can be attributed to the early loss of enamel owing to AI exposing the dentinal tubules to bacterial invasion causing the pulpal inflammation and the necrosis. The infection then spread to the apex of the tooth, causing periapical periodontitis; which may have lead to proliferation of epithelial rest cells in the periodontal ligament leading to formation of the radicular cyst.[4]

Radicular cyst is of two types "pocket cyst" (attached to the apical foramen) or "true cyst" (no attachment to the root structure).[5] The presented case demonstrate a classic true cyst. It is usually asymptomatic and discovered incidentally on radiographic examination. It may cause swelling or pain in cases when the cyst is large or secondarily infected, as seen in our case.[6] Radiographic presentation of radicular cyst includes, corticated pear-shaped, unilocular radiolucent area in the periapical region of the involved teeth. The cortication, in this case was lost owing to inflammatory reaction of the surrounding bone due to secondary infection. The cyst often displaces the adjacent teeth or cause root resorption, but neither have been exhibited in this case.[7]

Histologically, it shows cystic cavity lined by non-keratinized stratified squamous epithelium supported by connective tissue capsule. The connective tissue capsule consists of dense bundles of collagen fibres with interspersed fibroblasts, dense inflammatory cell infiltrate chiefly consisting of lymphocytes, plasma cells and extravasated red blood cells.[8] This case presented with infected radicular cyst in a patient with AI. AI is a congenital defect of enamel formation, which is characterized by presence of small, yellow, brown teeth that are prone to damage and breakage.[9,10] AI is of three types hypoplastic, hypocalcified, and hypomaturation. In this case, the patient presented with hypocalcified AI affecting enamel in colour, thickness and resistance and manifesting as small, yellowish brown teeth. This patient had no history of trauma. So in this case, exposed dentine might have provided pathway for bacterial entry into periapical area that resulted in apical periodontitis and subsequent cyst formation that was detected when patient came with palatal swelling in maxillary front teeth region.

The choice of treatment of radicular cyst may be determined by factors such as the extension of the lesion, relation with anatomic structures, origin, and clinical characteristics of the lesion, and co-operation and systemic condition of the patient.[11] Treatment is directed at eliminating the etiology which most often is the presence of bacteria and other microbial irritant in the root canal system. Various treatment options for management include conventional root canal treatment without any adjunctive therapy or use of intracanal medicament as an adjunct to the root canal treatment, surgical treatment like decompression, apex, enucleation or marsupialization. Various studies have reported 85% success rate after non surgical endodontic treatment of teeth with periapical lesion.[12]

In this case, one of the involved teeth was non-responsive to the non-surgical root canal treatment. So, surgical approach was planned which included enucleation and retrograde filling with MTA. Enucleation involves complete removal of cystic lining with healing by primary intention.[13]

MTA is a widely accepted retrograde filling material which is biocompatible, has better sealing ability and is resistant to displacement.[14] Follow-up was taken after three months which showed expected healing of the cystic lesion with bone formation.

In cases of AI due to loss of enamel, the teeth may become sensitive and become susceptible to infection due to open dentinal tubules. In our case, considering the esthetic demands of the patient and overall clinical condition of the patient's teeth as AI, root canal treatment of all teeth was planned and esthetic full coverage restoration were given to the patient.

Conclusion

Radicular cysts are usually associated with trauma and often detected as incidental findings during routine dental radiographic examination. Small cystic lesions though frequently heal simply after proper endodontic therapy; some true lesions are non-responsive to conventional root canal treatment and may need additional surgical treatment. Patients with developmental defects of teeth must be treated according to its clinical and radiographic presentation for their optimum functional and esthetic outcome.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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Orthokeratinized Odontogenic Cyst (OOC) : A rare entity

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Abstract

Orthokeratinized Odontogenic Cyst (OOC) has been recognized as new entity in the recent past. However, it is justifiable to label this as a separate entity, as the histopathological and biological behaviour differs. Its clinical and radiographic presentation resembles to dentigerous cyst and odontogenic keratocyst (OKC). Approximately, up to 15 % of keratinizing cysts in jaw bones are OOCs. Rare recurrence is noted after the removal of the OOC as compared to OKC. Therefore proper diagnosis is essential as surgical management and prognosis differs amongst OOC, OKC and dentigerous cyst.

Key words : Orthokeratinized odontogenic cyst, Dentigerous cyst, Nevoid basal cell carcinoma syndrome, Case report.

Introduction

A rare developmental Orthokeratinized Odontogenic Cyst (OOC) was initially termed as the uncommon orthokeratinized type of Odontogenic KeratoCyst (OKC) by World Health Organisation in 1992[1]. OOC was first described as orthokeratinized variant of OKC (Odontogenic keratocyst) by Schultz in 1927[2]. In 1946, Philipsen considered it to be a type of OKC [1]. Wright in 1981, stated its clinicopathological aspect and suggested it as an independent entity [3]. The term OOC is the most satisfied terminology as coined by Li et al in 1998[2]. According to most of studies, the OOC is epithelial in origin and developed from remnants of dental lamina [4].

Clinically OOC is present with asymptomatic, slow growing, soft tissue swelling and expansion of bone. It appears predominantly in males between third to fourth decade. Most common locations of the lesions is posterior mandible and molar region. The size of the lesion varies from less than 1 cm to larger lesion greater than 7 cm in diameter[5]. The incidence of OOC is 7-17% of all keratinising jaw cysts [5]. Prevalence of orthokeratinized variant ranges from 3.3 to 12.2% [6].

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In most of the cases, OOCs are associated with impacted teeth. It can be detected incidentally during routine radiographic examination. Radiographically cyst appears a unilocular or multilocular, well-circumscribed radiolucency. The purpose of this article is to report a rare case of OCC in left posterior mandible region, to understand the comprehensive knowledge of OOC, and to differentiate this lesion from the other similar cystic lesions.

Case Report

57 year old male patient came with a complaint of swelling in lower left back tooth region of jaw since 3 months to the department of Oral Pathology and Microbiology, Government Dental College and Hospital, Mumbai. The swelling grew progressively in size with dull, intermittent pain. On extraoral examination, there was facial asymmetry as diffused swelling was observed in left side **[Figure I]**

Figure I : Extraorally - Diffuse swelling on left mandibular region

extending from body of mandible to lobe of ear **[Figure II]**.

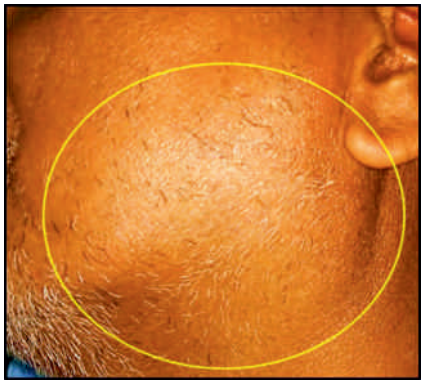

Figure II : Extraorally - Swelling extending from body of mandible to ear lobe

Externally, the measurement of swelling was 4.5 X 3 cm. On intraoral examination, impacted left lower third molar was seen with restricted mouth opening **[Figure III]**.

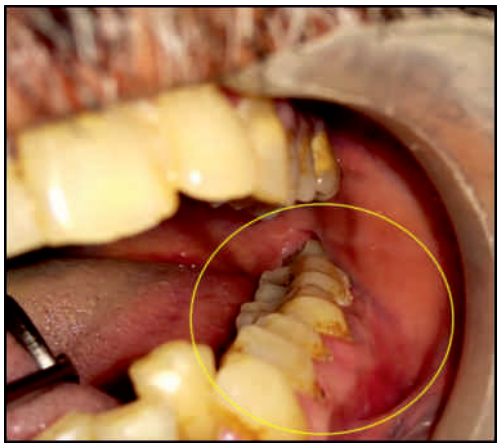

Figure III : Intraorally - Impacted 38 with Buccal and lingual cortical plate expansion

Buccal and lingual cortical plate expansion was also noticed. On palpation swelling was firm and tender. Radiographically, multilocular, thin border, well corticated radiolucency was noticed, extending from distal of third molar to sigmoid notch of mandible **[Figure IV]**.

Figure IV : Orthopantomogram - multilocular, thin, well-corticated radiolucency extending from distal to 38 to sigmoid notch area

Based on clinical and radiographic findings, provisional diagnosis of dentigerous cyst was made. Enucleation of cyst was done along with extraction of third molar and sent for histopathological examination. The gross specimen under the stereomicroscope showed onion skin appearance on luminal surface **[Figure V]**.

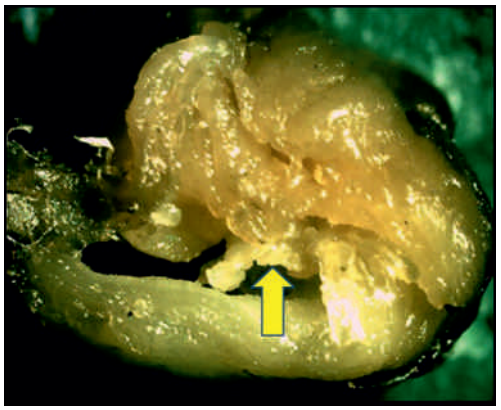

Figure V : Stereomicroscopic image (0.65X) of grossing specimen showing onion skin appearance on luminal surface

Histopathologically, cystic lumen was noted which was lined by orthokeratinized stratified squamous epithelium of variable thickness. Basal cells were made up of low cuboidal or flatten cells which lacked the palisading appearance. Epithelium and connective tissue interface was flat**.** **[Figure VI]**.

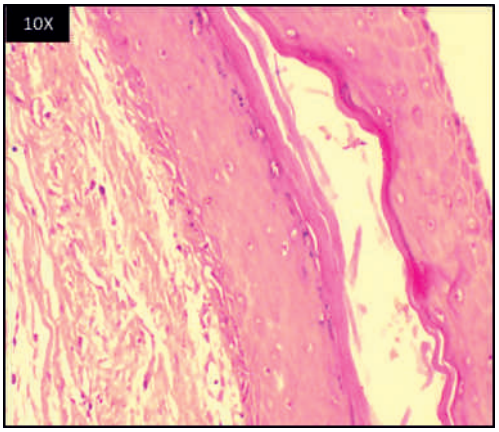

Figure VI : Cystic lumen lined by orthokeratinized stratified squamous epithelium of 6-10 cells thick. Low cuboidal to flat basal cells. Flat interface between epithelium and connective tissue. (H & E X10)

Connective tissue capsule was predominantly fibrous consisting of parallelly arranged collagen fibre bundles interspersed with fibroblast. Based on this histopathological finding, final diagnosis of OOC was made.

Discussion

Orthokeratinized odontogenic cyst is a separate entity which shows propensity to occur in posterior mandible and

associated with an impacted tooth. The dental lamina is said to be still more active in posterior mandibular area at the age of third to fourth decade of life, when most of the patient develop cyst [7]. Male predominance with male : female ratio of 2:1[5]. The above clinical finding are coinciding with this present case such as predilection in male and third molar area, association with impacted tooth. Its clinical and radiographic features, are similar to dentigerous cyst hence often can be confused with it. Therefore, definite diagnosis of OOC is made with the help of histopathological finding.

There is also a close resemblance of OOC and OKC in relation to age of occurrence, location of cyst and histochemical profile[8]. Distinct features between OKC and OOC includes, the multiple location of OKC and association with NBCCS (Nevoid Basal Cell Carcinoma Syndrome)[9]. Whereas mainly OOC is present at single site and not associated with NBCCS. Recurrence rate of OKC are more than 30%, on the other hand, OOC has recurrence rate of 2%[5]. Radiographically OOC expands buccolingually and OKC expands anterio-posteriorly[8,10].

Histopathologically, lining epithelium of OOC is thin, uniform and consists of orthokeratinized stratified squamous epithelium of 6-10 cells layer thick. Orthokeratin in the luminal surface has onion skin appearance[11]. Stratum granulosum is prominent. Basal cells is made up of low cuboidal to flattened cell with little tendency to nuclear palisading [11]. All these histopathological finding are nearly similar to the present case.

The clinical differential diagnosis of OOC mainly includes dentigerous cyst, paradental cyst, OKC, ameloblastoma and enlarged follicle[12,13]. Radiographic features of OOC are similar to OKC and ameloblastoma i.e., multilocular, well-corticated border and tendency to involve mandibular angle. Dentigerous cyst and OKC shows relation to impacted tooth as noted in OOC. The characteristic features of OKC and ameloblastoma is the root resorption of adjacent tooth whereas it is not found in OOC[13].

Treatment of choice for OOC is usually conservative because of its less aggressive behaviour and low recurrence rate. Conservative treatment includes enucleation with curettage along with removal of the impacted tooth[14].

Acknowledgment

Grateful to Dr. J. V. Tupkari, Ex. Jt. Director DMER, Ex. Dean and Ex. Prof. and Head, Dept. of Oral Pathology and Microbiology, Government Dental College and Hospital, Mumbai for imparting his knowledge and expertise.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Irritational Fibroma - A Case Report

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Abstract

Oral fibroma is the most common soft-tissue neoplasm occurring in the oral cavity, caused due to trauma or local irritation by plaque, calculus and overhanging restorations, that may cause interference in normal functioning and aesthetic appearance. The present case report discusses a case of irritational fibroma in a male patient.

Key Words: Gingiva, Irritational fibroma, Fibrous hyperplasia.

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Introduction

Irritation/traumatic fibroma, peripheral ossifying fibroma, focal fibrous hyperplasia, pyogenic granuloma, inflammatory hyperplasia, and peripheral giant cell granuloma are common intraoral localised reactive lesions occurring on gingiva.[1] A fibroma may occur at any oral site, commonly it is seen on the buccal mucosa along the plane of occlusion.[2] Irritational fibroma can occur at any age from almost at any soft tissue site including gingiva, buccal mucosa, the tongue, lips and palate.[3] It is a well-defined, slowly growing lesion of oral cavity. Irritational fibroma are painless overgrowth sometimes may even show superficial ulceration or hyperkeratosis. Females are affected twice as frequently as males.[2] Furthermore, it occurs commonly in the anterior maxilla, more precisely in the interdental papillary region.[4]

Case Report

A 33 years old male had reported to the Department of Periodontics, Government Dental College & Hospital, Mumbai with the chief complaint of overgrowth in the gums in the lower front region of jaw since 7 months. The patient was apparently all right 7 months back, when he noticed small overgrowth in lower anterior region of jaw. The growth was painless, slow progressing and with time had increased to present day size. There was no associated bleeding and pain. There was no relevant systemic history and family history.

On intraoral examination, a 10 mm x 9 mm x 5 mm roughly oval gingival growth was seen on lingual side in the interproximal region of 31 and 32 apico-coronally from gingival margin till the incisal third of the crown and the growth also had a labial extension. The growth was pale pink in colour, soft and firm in consistency, well defined, mobile, pedunculated, non-pulsating and smooth surfaced **[Figure. I].**

Figure I: Intraorally- a 10 mm x 9 mm x 5 mm roughly oval gingival growth seen on lingual side in the interproximal region of 31 and 32 apico-coronally from gingival margin till the incisal third of the crown which was pale pink in colour, soft and firm in consistency, well defined, mobile, pedunculated, non-pulsating and smooth surfaced.

There was spacing between the 31 and 32 teeth with plaque and calculus deposits.

On the basis of clinical evaluation provisional diagnosis of irritational fibroma was made. Irritational fibroma can also produce migration of teeth with destruction of the interdental bone.[5,6] Differential diagnosis includes pyogenic granuloma, peripheral giant-cell granuloma, and peripheral ossifying fibroma, which may also arise as a result of irritation due to plaque microorganisms and other local irritants.[5,7]

Routine haematological examinations including haemogram, bleeding time and clotting time were found to be within normal physiologic limits. IOPA of the region revealed no significant radiographic findings with respect to 31, 32

Treatment

Phase I therapy-

Consisted of a thorough scaling and root planing and oral hygiene instruction were given to the patient. Patient was advised 0.2% chlorhexidine mouthrinse 10 ml, 1:1 dilution, twice daily for 15 days. The patient was recalled after 1 week and there was no reduction in the size of the growth.

Phase II therapy -

After phase I therapy, surgical excision of the growth was planned under local anaesthesia following localised full thickness flap and thorough debridement with 31 and 32 region on lingual and buccal aspect **[Figure II]**.

Figure II: Surgical excision of growth and localised flap

After suturing, the periodontal dressing was placed and antibiotic and analgesic were prescribed for 3 days. **[Figure III, IV].**

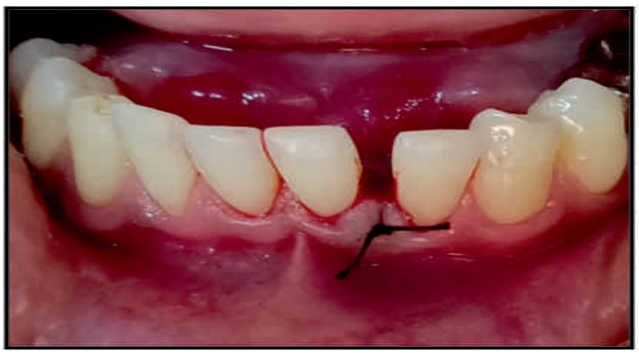

Figure III: Suture given

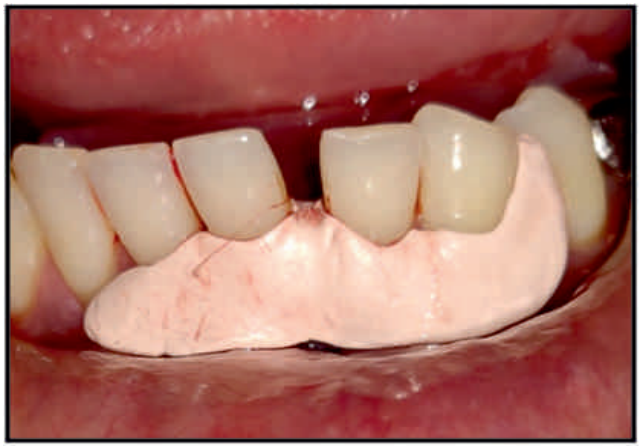

Figure IV : Periodontal dressing given

Post-operatively at 1 week, the surgical site had healed uneventfully. The patient was kept on maintenance therapy and proper brushing technique (modified Bass technique) and oral hygiene instructions were given. Patient was recalled after 3 months and examined for recurrence, there was no recurrence of the lesion seen post-operatively **[Figure V]**.

Figure V : 3 months post surgery evaluation.

The patient was then referred to the Department of Orthodontics, Government Dental College & Hospital, Mumbai for correction of the spacing of mandibular anterior teeth, to prevent the recurrence of the gingival growth.

Discussion

Irritational fibroma is a clinical term for fibrous hyperplasia. As the oral mucosa is constantly under the influence of various internal and external stimuli, it exhibits a variety of developmental disorders, irritation, inflammation and neoplastic conditions.[5,8]

The frequency of irritational fibromas is found to be more in maxilla than the mandible and more often in incisor cuspid region, ranging between 55-62%.[9] Buccal mucosa is the most common site for oral fibroma . In present case,

lesion was present in relation to 31 and 32 tooth region on lingual aspect . Diameter of these lesions usually measures less than 1.5cm and more than 3 cm in rare cases. In very few cases lesions of 6 cm and 9 cm have also been reported. The surface of lesion may be ulcerated in 66% of cases and intact in 34% of cases.[10] In our case diameter of lesion was 1 cm x 0.9 cm in diameter **[Figure VI]**.

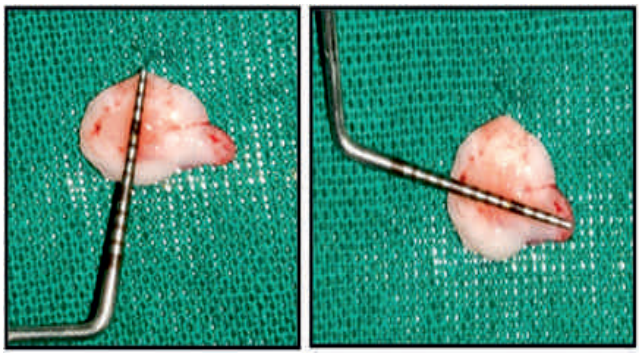

Figure VI : Diameter of lesion was 1 cm x 0.9 cm in diameter

In our case, the etiological factor was plaque and calculus. All other oral lesions such as pyogenic granuloma, peripheral giant cell granuloma, and peripheral ossifying fibroma have a similar clinical appearance.

Histopathologically, under low power view shows proliferative parakeratinised stratified squamous epithelium of variable thickness. The underlying connective tissue shows collagen fibres and bundles interspersed with fibroblast, patchy distribution of moderate inflammatory cells and lymphocytes throughout connective tissue stroma. Endothelial lined vascular channels are noted suggestive of fibrous hyperplasia **[Figure VII] .**

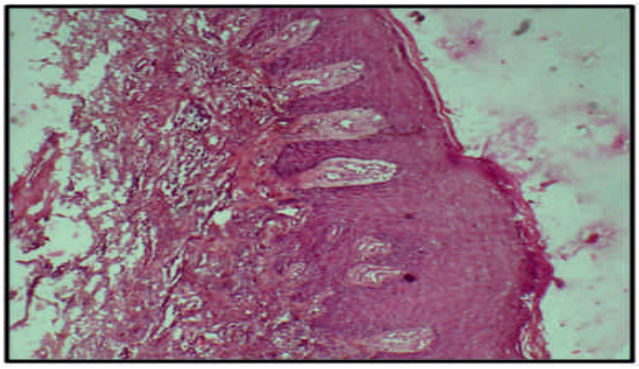

Figure VII : Parakeratinised stratified squamous epithelium of variable thickness. The underlying connective tissue shows collagen fibres and bundles interspersed with fibroblast, patchy distribution of moderate inflammatory cells and lymphocytes.

Treatment of irritation fibroma aims at elimination of etiological factors followed by scaling and root planing of adjacent teeth and total surgical excision of fibroma along with localised flap reflection and thorough debridement which minimize the chances of recurrence after removal.

Conclusion

Irritational fibromas/fibrous hyperplasia are one of the most common oral soft tissue neoplasm. To arrive at an accurate diagnosis a thorough history, clinical, radiographic and histologic examination should be carried out to differentiate it from other oral lesions. Early detection, elimination of the local irritation factor and the appropriate treatment of the lesions is important to reduce the chances of dentoalveolar complication.[11]

Conflict of Interest

Nil

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Nil.

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A Mystic Mandibular Premolar !!!

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Abstract

Every tooth presents occasional aberrations from normal canal anatomy. Thorough knowledge of the root canal anatomy is critical for successful endodontic therapy. Additional canals, if failed to recognize and treat, may pose a constant source of irritation thereby compromising a favourable outcome. The present case report presents the clinical management of mandibular first premolar which trifurcates at the mid root level.

Keywords: Anatomical variations, Radiograph, Premolar

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Introduction

Meticulous knowledge of root canal morphology with anatomical variations eases a clinician's approach towards the treatment and reduces the possibility of failure due to missed canals. Mandibular premolars typically present with a single root and a single canal. Although Type I canal configuration (single canal and a single apical foramen) is most prevalent in both first (72.6%) and second premolars (83.65%) [1] they also exhibit wide variations in the form of extra roots and root canals making them enigma to the endodontist. Slowey reported the mandibular premolars being most difficult teeth to treat endodontically with high flare-up and failure rates due to extreme variations in root canal morphology.[2] The variations of the root canal systems have been reported by many authors. In a literature review by Cleghorn on the root and root canal morphology of mandibular first premolar about 98% of teeth were single rooted, whereas incidence of two, three and four roots were 1.8%, 0.2% and less than 0.1% respectively. [3] A comprehensive insight of canal morphology, a meticulous radiographic interpretation, and an appropriate access cavity are necessary for predictable endodontic treatment of these teeth.

The present case report describes the detection and endodontic management of a mandibular first premolar with a rare occurrence of three roots and three root canals.

Case Report

A 16-year-old male patient reported to our department of Conservative Dentistry and Endodontics, Nair Hospital Dental College, Mumbai, India, with the chief complaint of pain in the lower left back region of mouth since one week. Pain was moderate, intermittent which aggravated on cold food and continued for few hours. Patient gave history of taking medication for pain relief. Medical history was non-contributory.

Intra-oral examination revealed deep occlusal carious lesion in left mandibular first premolar. The tooth was non tender to vertical percussion with no evidence of swelling or sinus tract. Periodontal probing was within physiologic limits. Cold vitality test gave an intense lingering painful response in comparison to contralateral tooth that was clinically sound.

Intraoral periapical radiograph revealed occlusal radiolucency involving enamel, dentin, and pulp with respect to the premolar. The radiograph also showed the presence of two roots with a shadow of a third root in between the two **[Figure I].**

Figure I - Preoperative radiograph.

Based on clinical and radiographic evidences a diagnosis of symptomatic irreversible pulpitis was made. A two-session endodontic treatment was planned and explained to the patient and his consent was obtained. On the first visit following the delivery of local anaesthesia (2% lignocaine and 1:80,000 adrenaline) and isolation with rubber dam the access to the pulp chamber was gained. A main canal orifice which split into three different canal orifices; mesio-buccal, disto-buccal and lingual at the mid root level was identified on exploration with DG 16 explorer and loupes (3.0X, Zumax) and confirmed under a dental operating microscope. (Karl Kaps, Germany) The access was refined in a way that it was wider mesio-distally with Endo access bur in brushing motion to obtain straight line access to all the three canals. The patency was ascertained with a #10 K-file and working length of all the three canals was determined using electronic apex locator (Root ZX, J. Morita) and confirmed on radiograph **[Figure II]**.

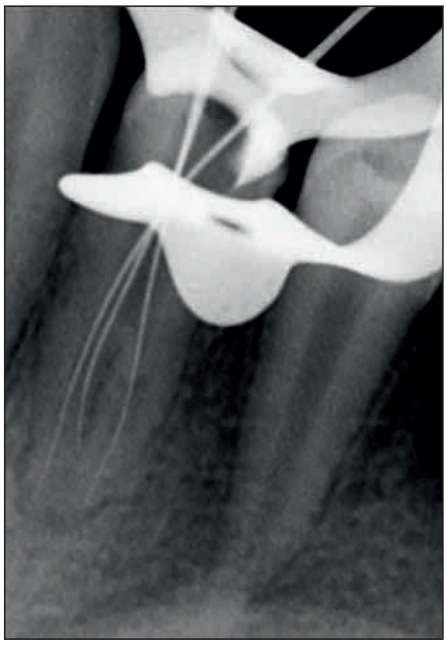

Figure II - Radiographic working length

The canals were initially prepared with #10, 15, 20, and 25 K hand files, shaped and finished upto F3 Protaper Universal (Dentsply) rotary files till working length. The canals were irrigated with 2.5% sodium hypochlorite during instrumentation which was activated using an EndoActivator and the access was closed with a temporary restorative material until next visit.

On the second visit, the canals were flushed with 17% EDTA, dried with sterile paper points and obturated with non-standardized gutta percha cones and AH plus sealer using cold lateral condensation technique. The access cavity was then filled with glass ionomer restorative material **[Figure III & IV].**

Figure III - Master cone radiograph

Figure IV - Post operative radiograph.

Discussion

Anatomical variations of mandibular premolars are well documented in literature both in terms of anatomic studies and clinical cases. Ethnicity has a significant influence on anatomical aberrancies with two and three canal premolars being frequent in black populations.[4] Mandibular first premolar is one of the most difficult teeth for endodontic

treatment due to wide variations in the morphology of its root canal system.[2] Good quality radiographs are important in determining both external and internal root morphology. Fast break of canal in parallel radiographs can suggest presence of more than one canal.[5] In addition, using CBCT is very helpful to detect such variations if conventional radiograph fails to provide obvious information and more details are required.[6] Altering the horizontal angle by either 20 or 40 degrees, the number of root canals seen in a mandibular first premolars coincides with the number of canals actually present.[7]

Mandibular first premolar with three roots and three canals have been previously reported by Pooja K et al, [8] Sunandam M et al , [9] Mrunal S et al, [10] YH Al-Dahman et al, [11] etc. Scott and Turner described the accessory root of mandibular first premolar as TOME'S ROOT which is evolution from single root to multiple roots.[12] Rodig and Hulsmann reported that the presence of triangular shaped pulp chamber is the characteristic of mandibular premolars with three root canals.[13] Magnification in the form of loupes or operating microscope is essential to enhance visualisation and locate canal orifices which was followed in the present case.[14] A study which assessed the results of endodontic therapy of mandibular premolars showed the failure rate as 11.45% in first premolar due to missed canals.[15] Such an enigmatic bicuspid which poses a challenge at every step from access to locating, shaping and finally obturating the canals should be managed with proper use of pre and intra operative diagnostic tools for unhindered and acceptable treatment outcome.

Conclusion

Presence of extra roots and canals in the biscuspids may occur frequently than one can expect and the clinician should be insightful enough to identify their presence. This case report emphasizes on the importance of knowledge of the anatomic variations of root and root canals along with radiographs and magnification as adjuncts in diagnosing and treating such complicated cases.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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Interdisciplinary management of diastema in maxillary anterior aesthetic zone with ceramic laminates – A case report

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Abstract

An esthetic smile is considered to be an asset to an individual's personality. Any deviation from the natural appearance compromises the facial aesthetics and diastema is one of the common deviations. Diastema not only distorts the pleasing smile by accentuating the observer's attention on it but also, deviate their attention from the rest of the dental composition. An unesthetic smile may cause self-consciousness, low self-esteem and repeated attempts to conceal perceived dental defects. Diastema may also change the airflow between the teeth leading to phonetic problem. Diastema closure is one of the challenging tasks and the treatment for its correction of may include periodontal surgery, orthodontic corrections, restoratives such as direct or indirect composite, partial or full crowns or ceramic laminate veneers or a combination of several therapies. The presented case report describes the procedure for diastema closure in the maxillary anterior region with an interdisciplinary approach using periodontal and restorative treatments.

Keywords: Crown lengthening procedure, Laminates, Multidisciplinary approach, Spacing in teeth.

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Introduction

In today's world of health awareness, every individual demands esthetic appearance. An esthetic smile is one of the factors which adds a positive impact to the subject's personality. Any deviation from the natural may compromise the facial aesthetics in the form of the spacing, Midline Diastema (MD), discoloration or the proclination etc. MD not only diverts observer's attention but also accentuate the their observation on the defect.[1]

MD psychologically affects the self-consciousness, causes low self-esteem and tends the patient to attempt to conceal the anatomical defect with lips. Diastema may also change the airflow between the teeth which results in difficulty in phonetics.[2] Various treatment modalities are available to correct the MD depending upon the dimensions of space, cause of spacing and occlusion etc. Sometimes, it may also require periodontal surgery or orthodontic correction.

Restorations such as direct or indirect composites, partial or full crowns or ceramic laminate veneers or combination of several modalities are available to correct the diastema.[3] This article presents a case report of diastema closure in maxillary incisors i.e. esthetic zone, using porcelain veneers with an interdisciplinary approach in which orthodontic therapy was not feasible. Superior aesthetics, biocompatibility, high strength, polishability and insolubility of ceramics are added advantages over the conventional composite esthetic restorations for correction of diastema.

Case Report

A 21-years-old healthy female patient reported to the Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Mumbai, with a chief complaint of spacing between her upper anterior teeth and visited the department for correction of the same to have an aesthetic smile. The patient also exhibited a high smile line. **[Figure IA]** On examination, there was spacing between maxillary central incisors and high frenal attachment along with short clinical crowns **[Figure IB].** For clinical evaluation, extraoral and intraoral photographs were taken and diagnostic casts were made.

Figure IA : Extra-oral photograph showing midline diastema.

Figure IB : Intraoral clinical photograph showing diastema in the maxillary anterior teeth.

The patient was referred to orthodontic consultation but unfortunately, orthodontic approach was not advised as the arch length was longer compared to the total width of the teeth. Also, all teeth were present in the arch and the patient was not willing to undergo any orthodontic treatment. Thus, esthetic rehabilitation of the patient using laminates was planned with indirect restoratives.

Considering the clinical examination and photographs and after consultation with the patient, it was decided that the diastema would be closed after correction of gingival disparity i.e. high frenum attachment and high gingival line. Porcelain laminates were opted as the treatment of choice, due to their natural esthetic appearance, ability to augment the length of incisors and longevity without constant maintenance.

After scaling and polishing, the patient was appointed for surgical crown lengthening and frenectomy due to high frenum attachment and short clinical crowns. Study mode was made and surgical stent was prepared for esthetic crown lengthening **[Figure IIA].** A surgical stent was prepared by marking the desired gingival contour on the study model. The margins of the stent simulated the gingival margin of the finish restoration. Local anesthesia was secured using 2% lignocaine with 1:200000 adrenaline. Gingivectomy was done with respect to teeth #13 to teeth #23 region after placement of the surgical stent using a no.15 surgical blade **[Figure IIB** and **IIC].** The periodontal flap was elevated with a periosteal elevator and maintaining the biologic width the required osseous reduction was done. Frenectomy was performed by giving two incisions one above the frenum and one below the frenum; followed by removal of a thick band of a frenum **[Figure II D].**

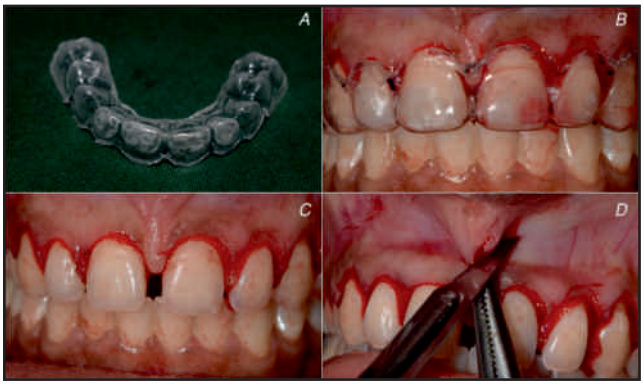

Figure IIA :Photograph showing surgical guide.
Figure IIB :Surgical guide in position to mark the gingival contour.
Figure IIC: Clinical photograph after crown lengthening procedure .
Figure IID :Clinical photograph showing frenectomy procedure.

The flap was approximated and sutured with 3-0 mersilk followed by covering it with periodontal pack (Coe-pak, GC, Europe). The patient was recalled after 7 days exhibiting satisfactory healing with no clinical symptoms. Clinically, adequate crown length was established with teeth #13 to teeth #23 region. The patient was recalled 15 days after the surgery for porcelain laminate preparation **[Figure III].**

Figure III: 2 weeks post surgical clinical photograph.

A mock-up restorative was prepared on the diagnostic cast and it was then transferred to the patient's mouth to evaluate the position of the final restoration. Three putty indices were made prior to tooth preparation for laminates. The teeth #11, #12, #21 and #22 were then prepared with the bevel type standard preparation for porcelain laminates. Preparation was done using 0.5 mm depth cutting bur and a chamfer bur. Proximal preparation was done up to palato-proximal line angle such that, the final restoration i.e. ceramic would cover the entire spacing. The buccal and the proximal preparation was done to 0.5mm with a chamfer finish line on the buccal surface and feather edge finish line

on palato-proximal line angle. To achieve desired translucency in the incisal edge area, 1mm of incisal preparation was also done. Preparation for tooth #22 was also modified to correct the rotation. A bevel type of incisal laminate preparation was followed on all the prepared teeth **[Figure IV].**

Figure IV : Clinical photograph showing bevel type laminate preparation in teeth no. # 21, #22, #11 and #12.

Putty indices were used as a guide, in which one of the putty index was cut along the long axis of the prepared tooth; to examine the depth and amount of preparation required. Another index was cut horizontally to examine the overall laminate preparation **[Figure VA , VB].**

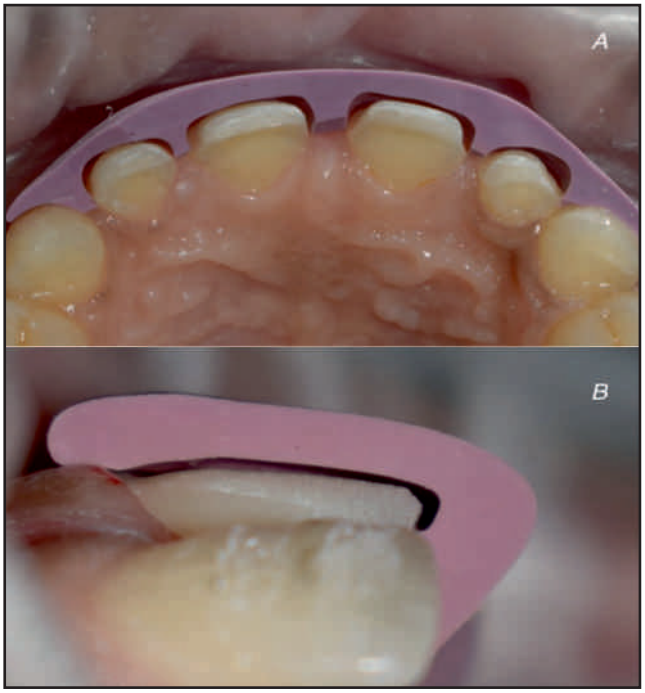

Figure VA : Occlusal view of customised putty index to visualise the tooth preparation.
Figure VB : Lateral view of customised putty index to visualise the tooth preparation.

After completion of the preparation, the gingival retraction cord (no.000) was placed and the impression was made using a two-stage impression technique with addition silicone material. Temporization was done using Luxatemp temporary crown material (DMG America LLC, Eaglewood) after spot etching and spot bonding the enamel surface.

Porcelain laminates were prepared by ultrasonic cleaning followed by etching the impression surface with 10% Hydrofluoric acid (HF). Tooth enamel surface was etched with 37% phosphoric acid followed by washing and drying. The dentin bonding agent was applied to the etched tooth surface. The silane-coupling agent was applied on the etched inner surface of the laminates without curing. Clear composite luting agent was then applied on the inner surface of laminates and the veneers were then placed on the tooth and cured. Curing was done first on the palatal side to reduce the polymerization shrinkage, followed by all other sides **(Figure VI A,B,C,D).**

Figure VIA : Clinical photograph showing labial view after cementation of porcelain laminates.
Figure VIB: Clinical photograph showing occlusal view.
Figure VIC : Clinical photograph showing right lateral view.
Figure VI D: Clinical photograph showing left lateral view.

Six months follow up of the patient revealed intact porcelain laminates with desirable healthy tissue response. **(Figure VII).**

Figure VII: Post operative extra-oral photograph after laminate cementation.

Discussion

In today's world of health awareness every individual desires to be fit and healthy. Oral health being an integral part of the general health, it is considered as a mirror to a good health. A pleasing smile not only affects the individual

socially but also influences psychologically. Tooth as a prime element of the smile, is the most influential factor to determine the overall appearance of an individual. The colour, size, shape and position of the maxillary central incisors play a vital role in the dental esthetics of an individual.

In order to appear pleasing, the maxillary central incisors must be in proportion to the facial morphology and be consistent to the arch.[4] In dentistry the term "Golden proportion" is used which is a mathematical theorem concerning the proportions of the dentition.[4, 5] According to this rule, if the width of each anterior tooth is approximately 60% of the size of its adjacent anterior tooth, then it is considered aesthetically pleasing.[6-9] It follows logically that if the width of the lateral incisor is 1, the central incisor should be 1.618 times wider and the canine should be 0.618 times narrower.

With the increasing demands for esthetic restorations, it becomes necessary to introduce new esthetic restorative materials, possessing the combination of the strength and esthetic qualities when used in the anterior esthetic zone. For restorative correction of MD, various treatment options are available such as; direct composite veneer, indirect composite veneer, laminates, full-crown restorations, or porcelain laminates etc. Among these, composites may show discoloration, marginal leakage or frequent breakdown. Thus, porcelain laminates opted as the choice of material because it possesses both the strength and the resistance along with its esthetic qualities desired in anterior region.[7-10] Porcelain Laminate Veneers (PLVs) have become the esthetic alternative to the ceramic or the traditional porcelain-fused-to-metal crowns. Porcelain laminates have several advantages like; it requires conservative preparation, has life-like appearance and excellent tissue response. On the other hand, the full crown preparation would have been more invasive and require removal of additional healthy tooth structure.

In the present case, esthetic rehabilitation of MD and rotation was done with porcelain laminates using a minimalistic approach. Due to the presence of short clinical crowns and high smile line crown-lengthening procedure was also employed keeping in mind the width of the attached gingiva. Dealing with MD, is also associated with soft tissue challenge, because the teeth being treated are "mesialized."[8] In this case, the labial frenum was thick, fibrous and its attachment was high thus, required frenectomy. The gingival zeniths of the teeth were also moved mesially using customised surgical guide to provide the correct axial inclination of the final restoration.

In this case, three putty indices were made; out of which two were used as guide to check the amount of tooth preparation and to keep it as minimalistic as possible whereas; the third index was used for temporization purpose. These customized putty indices were acted as a guide for conservative laminate preparation. Tooth #22 also has minor rotation, which was corrected by including it in laminate preparation.

Conclusion

MD is a common dental malformation, which not only affects the facial aesthetics but also affects the individual socially and psychologically. Its correction is a matter of vital importance to the patient especially young adults which requires meticulous diagnosis, definite tooth preparation and sometimes surgical intervention. Porcelain veneers may be the choice of the treatment in the correction of MD due to their life-like appearance, strength and longevity.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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Non-surgical endodontic management of an apically separated instrument in the root canal of mandibular first premolar - A case report

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Abstract

In routine endodontics, a clinician may encounter a procedural error at any stage during the treatment; which may alter the desired outcome. Instrument separation within the root canal is one of the most common errors during the root canal preparation. It often hinders the complete cleaning and shaping, thereby may result in treatment failure. Various approaches for the management of separated instrument have been described in the literature but; the treatment outcome is favorable only if proper cleaning of the canal could be performed. This article reports a successful retrieval of the separated instrument at the apex of mandibular first premolar using dental loupes and sonic endodontic activation.

Keywords: Bypass, Fractured instrument, Irrigation, Retrieval, Sonic activation.

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Access this article online

Introduction

The success of the endodontic treatment depends on thorough cleaning and shaping and three-dimensional obturation of the root canal space. However, at times the desired outcome may not be achieved due to some unforeseen procedural error. One of the most commonly encountered procedural errors is the separation or the breakage of the endodontic instrument inside the root canal. The term broken or separated instrument may imply to the hand or rotary files, Gates Glidden drills, pesso drills, lentulospirals, thermo-mechanical gutta-percha compactor, tips of spreader or plugger etc. which breaks inside the pulp space.

Various factors are identified as a the cause of separation of endodontic files such as canal curvature, anatomic variations, practitioner experience, co-operation from the patient, frequency of instrument use, torque and speed of rotation of rotary files. Studies in literature reported that the separation rate of the Nickel-Titanium (NiTi) rotary instruments has been in the range between 1.3-10.0%, whereas the separation rate of Stainless Steel (SS) instruments ranges between 0.25-6%.[1-4] The separated instrument fragment may block the further apical access to it and thereby compromises the treatment outcome. Thus, to gain the access apical to the instrument; the removal of the fractured instrument or at least bypassing the fractured instrument becomes necessary for the complete debridement. In case when a patient is asymptomatic and these modalities have failed or not feasible; then the preparation and obturation of the accessible remaining part of the canal is advisable.[5,6]

Retrieval of the broken instrument is considered as one of the most challenging procedures requiring the highest skills and specialized armamentarium. The management of broken instrument at the coronal or the middle one-third of the canal is known to be easier as compared to those which have broken in apical one third. Limited access, moderate to severe curvature, narrow and tapering canal diameter, embedment of the broken instrument, chances of pushing it beyond the apex and possible vulnerability for lateral root perforation, makes the retrieval of apically broken instrument a more difficult task. Conversely, when the preparation of the root canal is completed and after that, if the instrument has broken; it may act as an alternative obturating material if its fit and seal achieved is proper. But, when it does not provide a good apical seal, it may allow the apical ingress

and cause the endodontic failure. Thus, proper case selection and careful attempts should be made for its retrieval in cases when it appears possible. This article presents a case where an apically broken instrument was bypassed and then retrieved using sonic endodontic instruments.

Case Report

A 45 years old healthy female patient was referred by a private dental practitioner to the Department of Conservative Dentistry and Endodontics, Government Dental College and Hospital, Mumbai, for the management of broken rotary endodontic instrument in the mandibular left first premolar i.e. tooth #34. Clinically, the tooth #34 was tender to percussion. Intra Oral Peri Apical (IOPA) radiographic examination revealed the presence of a radiopaque object suggestive of a broken instrument in the root canal **[Figure I].**

Figure I: IOPA of tooth # 34 showing separated instrument in the apical third of the root canal.

The tooth #34 appeared to have a single canal with 3 mm of a separated instrument at the apical third and the tip of the instrument was 1mm short of the radiographic apex. IOPA also showed the widening of the periodontal ligament space, loss of lamina dura and periapical rarefaction. The case was diagnosed as Symptomatic Apical Periodontitis (SAP) with fractured instrument in the apical third in the root canal of tooth #34.

After explaining the clinical situation along with the treatment options and prognosis to the patient; it was decided to bypass the instrument followed by an attempt for its retrieval. The patient's informed consent was obtained and local anesthesia was administered. Tooth #34 was isolated under a rubber dam and no. #10 K-file (Mani, Japan) was gently introduced into the canal where a hard stop was felt at 13 mm. Tooth length was estimated to 16mm from the preoperative IOPA. Using no. #6, no. #8, no. #10 K-files sequentially along with copious use of lubricants; the separated instrument was bypassed from 13 mm to 16 mm length in the root canal. After reaching the working length, a glide path (besides the broken instrument) was prepared by successively enlarging the canal using no. #10, no. #15 and no. #20 K-files. Then no. #20 H-file was used gently in pulling and rasping motion in an attempt to retrieve the bypassed instrument. Unfortunately, the retrieval attempts were failed. Considering the required preparation of the root canal, it was planned to prepare the canal with rotary NiTi instruments i.e. Protaper Gold files (Dentsply, Sirona). The insertion of every instrument in the canal was preceded and proceeded by copious irrigation using a negative pressure device PATS (Pro-Agitator Tip System, sonic activation). After canal preparation till the working length with F1, the broken instrument was felt loosed and came out to the orifice of the canal during negative pressure irrigation **[Figure II - IV].**

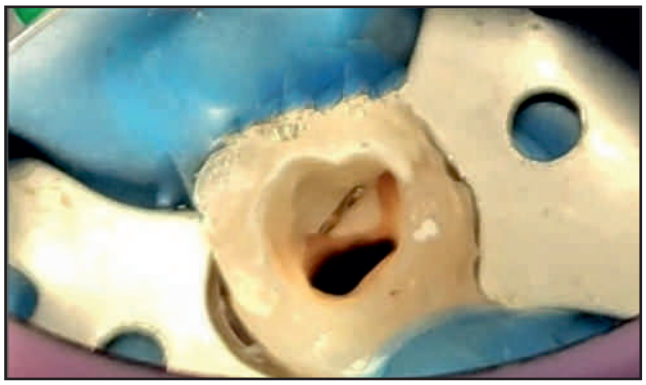

Figure II: Post-instrument retrieval clinical photograph of tooth #34.

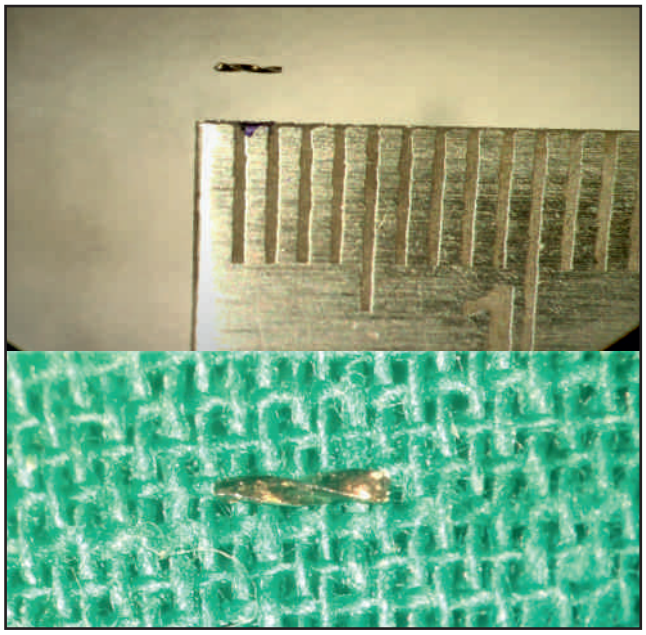

Figure III: Retrieved separated instrument (3mm).

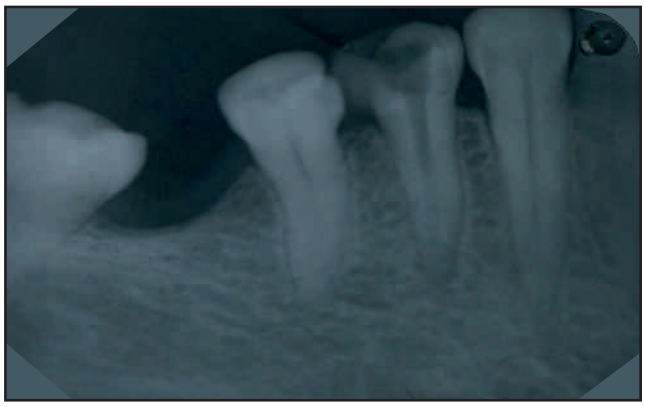

Figure IV: Post-instrument retrieval IOPA of tooth #34.

The root canal was finally prepared using F3 finishing file. After confirming the apical tug back of the corresponding size master cone and after its radiographic verification, the obturation was done using AH plus sealer and thermoplaticized obturation technique followed by its post endodontic restoration **[Figure V- VII]**.

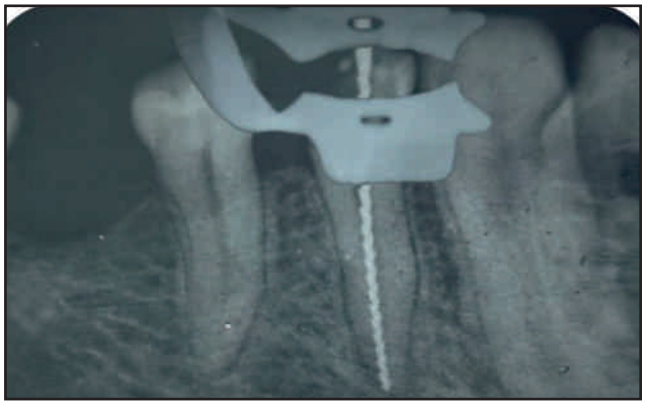

Figure V: Working length IOPA of tooth #34.

Figure VI: Master cone IOPA of tooth #34.

Discussion

Success of the endodontic treatment depends on knowledge of root canal anatomy and its variations, proper access cavity preparation, thorough cleaning and shaping of the root canal and three-dimensional obturation of the canal.

Figure VII: Post obturation IOPA of tooth #34.

Shaping is considered as the most critical step in the root canal treatment; as improper cleaning may lead to harboring of microorganisms and endodontic failure.

During cleaning and shaping various endodontic instruments are inserted for intracanal usage. These instruments may break in the root canal at any stage during the canal preparation leading to the endodontic mishap. Various factors are responsible for the instrument breakage in the canal such as atypical root and canal anatomy, canal calcifications, improper usage or excessive use of the same instrument, etc. When such an instrument breaks in the canal, it may lead to inadequate preparation of the canal apical to it and may cause the failure. It may also have legal implication when its breakage has not been informed to the patient and the patient was not referred to the specialist in time.

During the preparation of the root canal, the instrument may break in the root canal or beyond the canal. The probability of its bypass or the retrieval depends on several factors such as its position in the canal, accessibility, size of the canal, size of the instrument broken and the remaining dentin thickness around the instrument etc. In case when an instrument breaks in the canal, then an initial attempt must be made to retrieve it and when it is not possible, at least try to bypass it. But, in an attempt to retrieve or bypass the instrument, excessive root dentin should not be removed as it may compromise the prognosis of the tooth. Similarly, when the instrument separates at the apical third after hand instrumentation and thorough cleaning-shaping; and when can not be retrieved it can be made as a part of obturation.

Separated instrument may alter the prognosis of the endodontic treatment in an indirect way when it obstructs the complete debridement of the root canal. In the present case, the radiograph showed a wide root canal having an instrument separation 1mm short of the apex, periapical rarefaction and persistent pain as complained by the patient. Thus, it was decided to gain the access to the area 1mm apical

to the separation so as to achieve complete cleaning. This can be achieved by either retrieval or bypassing a separated instrument.

Successful orthograde retrieval of the fractured instrument depends upon various factors like tooth factor (length, curvature etc.), equipment and instrument factor, clinician factor and patient factor.[4,6] Variety of instruments and techniques are available for instrument retrieval like Masserann kit, Ultrasonics, Gates-Glidden drills, Brasseler Endo extractor kit, Cancelliers, Wire loop technique, Mounce extractor and Tube technique etc. However, with all the available techniques of the retrieval of the separated instrument; excessive removal of root dentin coronal to the instrument is a major disadvantage.[7] Also, it may result in root perforation[8] or predispose the teeth to vertical root fracture.[9] Therefore, bypassing the separated instrument can be an appropriate treatment option with a good success rate.[10] In this case, instrument bypass was successfully completed up to no. # 20 K-file and it was decided to further enlarge this newly created glide path; as the diameter of the canal is the most significant factor in the removal of debris and for obtaining maximum results in root canal irrigation.[11] Root canal preparation using NiTi rotary should be done with utmost care and precaution; so as to prevent the separation of another file next to the already separated instrument. For complete chemico-mechanical preparation, copious irrigation along with instrumentation and sonic activation of irrigants was done. As in Endodontics, active irrigation plays an important role to initiate fluid hydrodynamics, that results in shear wall forces which cleans the canal surfaces.[12] All the efforts of bypassing the instrument and activated irrigation ultimately resulted in loosening of the broken file and it was retrieved without compromising much of the sound root dentin.

Conclusion

Instrument separation is considered as an endodontic mishap and prevention of the instrument breakage is the best strategy to avoid any stress and anxiety associated with it. Straight-line access, glide path preparation, use of chelating agents like Ethylene Diamine Tetra Acetic Acid (EDTA), avoid forcing of the file, timely and vigilant discarding of instruments, etc. prevents the instrument separation. But, in case if mishap occurred, every attempt should be made to either bypass or retrieve the separated instrument utilizing the most conservative approach without jeopardizing the sound dentin and overall prognosis of the tooth.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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Oral Mucocele: A Case Report

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Abstract

Mucocele is a common lesion of the oral mucosa that results from an alteration of minor salivary glands due to a mucous accumulation. Two histological types exist - extravasation and retention. Mucoceles can appear at any site of the oral mucosa where minor salivary glands are present. Lower lip being the most common site of occurrence of these lesions in the oral cavity due to trauma or habit of lip biting. Diagnosis is made clinically, and confirmed by histopathology. This article presents a case of mucocele diagnosed on routine examination and managed surgically.

Key words: Mucocele, Mucous, Salivary glands

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Introduction

Mucocele is defined as a mucus-filled cyst. They are basically "mucus filled cavities". The term mucocele was derived from a Latin word, mucus, and cele or cavity. They are second most frequent benign soft tissue tumour of the oral cavity, following irritation fibromas[1]. Mucocele is seventeenth most common salivary gland lesion in the oral cavity.[2]

Mucocele appearing in the oral cavity are of two types; extravasation and retention type. Extravasation mucocele results from a broken salivary gland duct causing spillage into the soft tissues around the gland. Whereas retention mucocele occurs due to blockage of the salivary gland ducts causing decrease or absence of glandular secretion. Former are commonly seen in minor salivary glands while later in major salivary gland.[3,4,5,6.]

The extravasation type is a pseudocyst without defined walls and are caused due to mechanical trauma to the excretory duct of the gland leading to transection or rupture, with consequent extravasation of mucin into the connective tissue stroma and are seen frequently on lower labial mucosa, buccal mucosa and retromolar area; they are not lined by epithelial lining.[4] The retention type is less common than extravasation, usually affects older individuals and is seen frequently on upper lip, hard palate, floor of mouth and maxillary sinus.[7,8]

Mucoceles present as bluish, soft, and transparent cystic swelling that frequently resolves spontaneously. Blue colour is due to vascular congestion, cyanosis of the tissues above, and accumulation of fluid below. However, coloration may vary depending on the size of the lesion, proximity to the surface, and elasticity of overlying tissue. It is a self-limiting mucous containing cyst of salivary glands commonly occurring in the oral cavity, with relatively rapid onset and with fluctuating size.[9] The decrease in size is attributed to rupture of the lesion and subsequent mucin accumulation or re-absorption of saliva deposits may cause the lesion to reform.[8]

Mucoceles are usually asymptomatic but sometimes can cause discomfort by interfering with speech, chewing, or swallowing. Treatment options include surgical excision, marsupialization, cryosurgery, laser vaporization, and laser excision.[10]

Case Report

A 23 years old male patient reported to the Department of Periodontics, Government Dental College and Hospital, Mumbai, with the chief complaint of swelling present in the lower lip since the last 3 months **[Figure I].**

Figure I : Preoperative swelling seen on mucosa of lower lip

The patient was apparently all right three months back when he noticed a small swelling in the lower lip initially, which then gradually increased to the present size. He gave the history of lip biting habit. There was no pain associated with the swelling. His past medical and dental history were not relevant. On examination, a round, solitary, fluctuant swelling was seen on the inner aspect of the lower lip at the left lateral incisor and canine region. Swelling was 4 mm in diameter. Colour of the swelling was the same as that of the adjacent mucosa. No other oral anomalies were detected.

Literature search reports that oral habit such as lip biting is one of the etiologic factors for the oral lesions such as irritation fibroma and mucocele.[11] Habitual lip or cheek biting usually occurs as an unconscious psychogenic habit as a response to wide range of emotions and stress. Management of underlying psychological cause with methods like biofeedback, relaxation, counseling and fabrication of mouth guard or lip bumper has been advised for chronic cases, in literature.[12] However in the present case, patient gave a history of occasional lip biting which was not chronic. Also there was no difficulty in speaking or chewing. Hence the above treatment for the etiology of lip biting was not considered. As patient also complained of dry lips, lubrication with petroleum jelly, was advised for the same.

Patient was investigated for complete blood count including bleeding time, clotting time. Routine haematological examinations were found to be within normal physiological limits.

Provisional diagnosis was made as Mucocele. Differential diagnosis included fibroma, lipoma, mucus retention cyst, sialolith, phlebolith, haemangiomas benign and malignant salivary gland neoplasm.[13]

Phase I therapy was executed. Scaling and root planing was done and oral hygiene instructions were given. The patient was instructed to brush teeth twice a day using medium bristled toothbrush and toothpaste by Modified Bass technique.

In Phase II therapy surgical excision of the lesion under local anaesthesia was carried out **[Figure II & III].**

Figure II : Surgical excision of mucocele.

Figure III : Sutures placed

The patient was explained about the procedure and informed consent was obtained. The site was anaesthetised by local infiltration around the lesion. First a circumferential incision was made around the lesion to prevent spilling of the cystic content, which could be responsible for recurrence and also to decrease the extent of mucosal tissue loss, decrease the incidence of formation of large fibrous scars. Dissection was performed with a haemostat separating the lesion and associated minor salivary gland. Lesion was resected from the base. All the surrounding glandular acini were excised, and damage to the adjacent gland and duct were avoided while placing the suture. Intermittent sutures were placed. Resected lesion was sent for histological analysis. Post-operative instructions were given and analgesics were prescribed

Figure IV : 15 Days post-operative presentation

Patient was recalled after 1 week for the removal of sutures and a satisfactory wound healing was seen [**Figure IV].**

The histopathological report showed para-keratinized stratified squamous epithelium with underlying connective tissue showing collagen fibres. One area showed extravasated mucous spilling with intense chronic inflammatory cells. Low power view showed salivary gland tissues predominantly consisting of mucous acini. Mucous acini showed ballooning and appear engorged due to extravasation of mucin. These histo-pathological features were suggestive of mucous extravasation cyst confirming the diagnosis of mucocele **[Figure V & VI].**

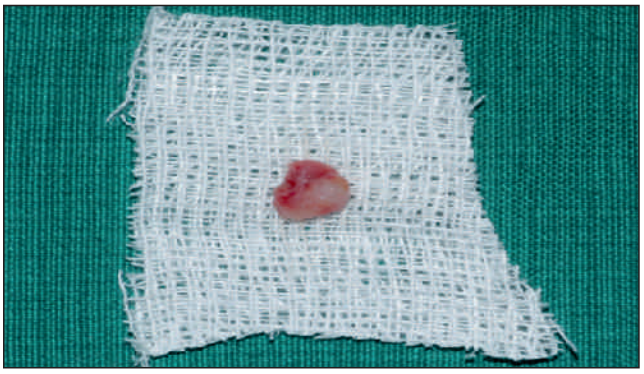

Figure V: Excised mucocele

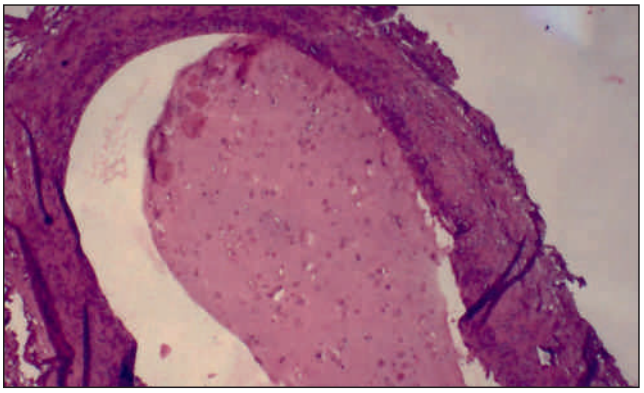

Figure VI : Histopathology confirming diagnosis of mucous extravasation cyst. (4X MAGNIFICATION)

Discussion

Oral Mucoceles [OMs] are believed to affect patients of all ages, with the highest incidence in the second decade of life. Teenagers and children are most commonly affected by mucoceles.[7] Menta et al.[14] , Yamasoba et al.[15] and Oliveira et al.[16] reported that more than 65% of their patients with OMs were less than 20 years of age.

Palpation of the lesion may aid in developing the differential diagnosis. Fibromas vary in consistency from soft to very firm. Cysts, mucoceles, abscesses, hematomas, lipomas and salivary gland tumours may exhibit fluctuance. However, a mucocele that has ruptured would not be fluctuant, and a chronic mucocele that has developed fibrosis may lose some degree of fluctuance.[17] Sialoliths and Phleboliths, usually present as firm, movable nodules, most often in the fifth to seventh decades.[18] Vascular malformations such as hemangiomas and varices are usually blue in colour, blanch under digital pressure.[19]

Mucocele is generally determined by a traumatic event that can cause the rupture of an excretory duct of salivary gland and usually appears as solitary fluctuant non-tender swelling in canine-bicuspid area with a normal pink or bluish colour. In the present case, the patient gave a history of occasional lip biting habit in the 32-33 area, which ultimately lead to mucocele formation at the site. The history and the clinical features are pathognomic leading to the diagnosis of mucocele.

Histopathologic examination of mucocele often reveals hyperplastic para-keratinized stratified squamous epithelium, small cystic spaces containing mucin and mucus-filled cells, areas of spilled mucin surrounded by a granulation tissue and sebaceous cells in the connective tissue, formation of well-circumscribed, cyst-like space surrounded by granulation tissue and the presence of mucinophages in the collapsed wall of granulation tissue.[20] Presence of salivary gland tissue and sialomucin is diagnostic. The present case was diagnosed as mucus extravasation cyst histopathologically.

Several techniques have been proposed for the treatment of a mucocele, such as cryosurgery, marsupialization, surgical excision and laser ablation. Marsupialization has resulted in considerably higher recurrence rates.[21] Giraddi et al compared micro-marsupalization with scalpel technique for mucocele. The author concluded that it was as efficacious as scalpel

technique, with less patient discomfort and less invasive. However proper case selection is important for micro-marsupalization as it does not enable a biopsy to be conducted. Furthermore, this technique should be discontinued if the extravasation of mucous does not occur during the procedure.[22]

A comparative study on excision of mucocele by scalpel and CO_2 laser was conducted by García et al. CO2 laser resulted in rapid operating time of 3 to 5 minutes required for excision. Also, it offered a better esthetic outcome, with less postoperative bleeding and paresthesia than conventional surgical removal of the lesion.[23] Vaporization with argon and Nd:YAG lasers has been described as a new technique for the treatment of mucoceles. Both lasers procedures presented satisfactory results with low recurrence rates and were well tolerated by the patients, whose discomfort was the main complaint reported. However high cost could be one of its drawbacks for making it a conventional technique.[24,25]

Cryosurgery has resulted in complete excision with no recurrence however oedema and irritation were reported.[26] A case report by Aulakhst al evaluated cryosurgery for excision of mucocele which resulted in absence of postoperative discomfort, bloodless surgical site, minimal to zero scarring, and excellent cosmetic results. However it presents with certain disadvantages such as unpredictable degree of swelling, lack of precision of depth in area of freezing, slight degree of necrosis, and sloughing which may result in delayed healing.[24] Having discussed various procedures for mucocele excision, conventional surgical removal remains to be the most common method used to excise mucocele.[26,27] A proper execution of the scalpel procedure would result in decreasing the extent of mucosal tissue loss, decreasing incidence of formation of large fibrous scars, and also help to prevent spilling of the cystic content, which could be responsible for recurrence.

Conclusion

The non-neoplastic diseases of salivary gland poses a diagnostic and therapeutic challenge to the clinician because of its resemblance clinically. Hence a sound knowledge of etiopathogenesis is must before arriving at a diagnosis and choosing the right treatment modality.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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- Actual numbers from which graphs drawn, provided
- Figures necessary and of good quality (colour)
- Table and figure numbers in letters (Arabic)
- Figure legends provided (not more than 40 words)
- Patients' privacy maintained (if not permission taken)

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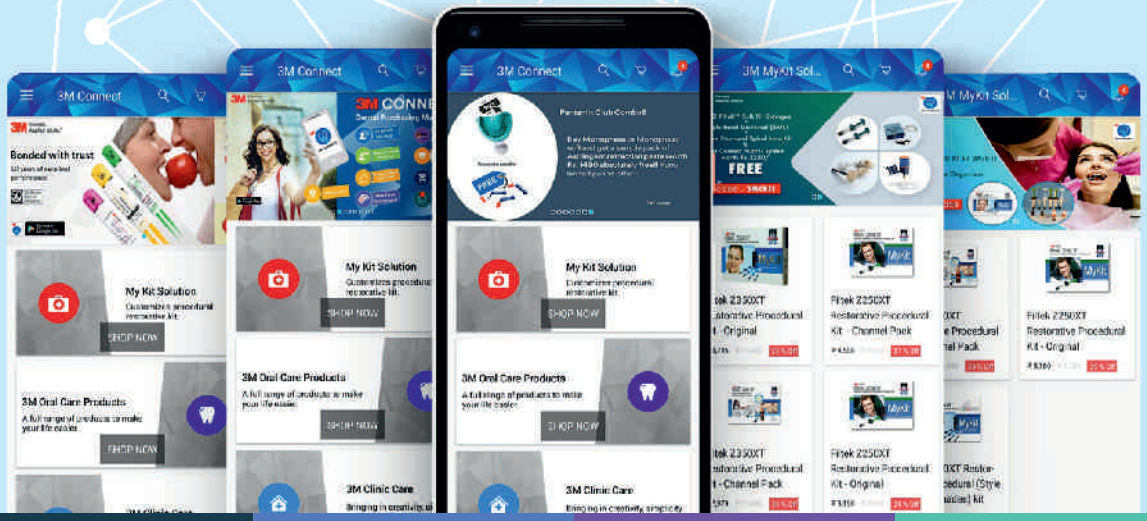

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