

Index Copernicus ID 5385

ISSN No. 0972-396X

KDJ

Kerala Dental Journal



Vol 43 | No. 2
April 2020

Quarterly Publication of Indian Dental Association, Kerala State Branch

kdj.idakerala.com



SIS Index ID 833



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Gingival enlargement associated with chronic periodontitis: a case report

Management of intracanal separated instrument with combined use of ultrasonic and Masserann kit: A Case Report

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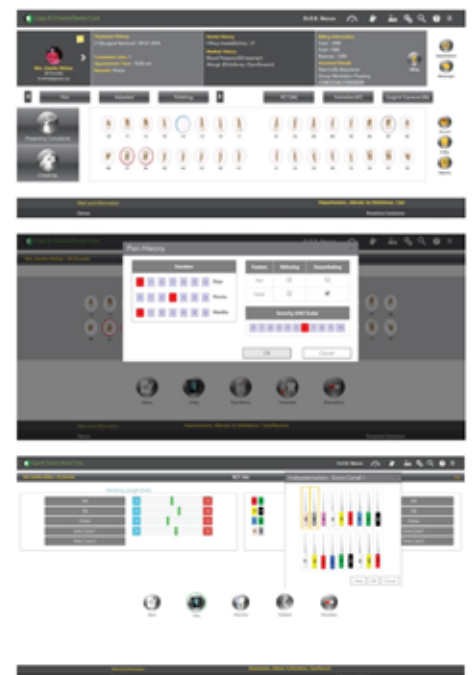


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Editorial



Dr. Anjana G.

COVID 19 and its impact on Dentistry

As the whole world is going through the Corona virus pandemic, dental profession is going through a dark phase. Many dental clinics have closed up and the functioning ones have less number of patients. A paradigm shift is in the wake on the way Dentistry will be practiced further.

Dental surgeons are at the highest risk of contracting and transmitting the virus, alongside paramedics, nurses, and other healthcare workers. It is difficult to predict the extent and severity of its long-term impact at this point of time, and the future of Dentistry and the sustenance of practices is a major concern. Significant monetary investments are required to continue safe dental practice, in procuring preventive gear including respirators, the installations of HVAC A/C filters, the single-use chair covers etc. Apart from this, there is also the equally important issue of proper training and following the protocols to ensure minimal risk to patients and dentists alike. There is a need for changes in the approach to dentistry like adoption of tele-mentoring, and shifting focus to preventive dental care and minimally invasive dentistry, in turn reducing aerosol generating procedures. The pandemic has given us an opportunity of educating the masses about preventive care which was sidelined earlier. Dental practitioners are adapting to the idea of tele-dentistry globally which can be incredibly useful for triaging and reducing face-to-face time with patients. However, this needs to be regulated and remunerated. This can help save time, effort and money significantly and can provide emergency dental access to the masses. Policies and standards need rewriting and restructuring in the new era and progressive adaptation is the only solution to tide over this difficult period.

Dr Anjana G.
Editor, KDJ

Message from the President

My dear colleagues,
Hearty greetings from IDA Kerala state

This is the 2nd issue of our Kerala Dental journal which reaches your hands amidst this situation of containment.

My sincere congratulations to our beloved editor Anjana G for the great efforts.

2020 has been a year that we have been looking forward with high hopes and expectations. But a microscopic organism has spread its virulence across the globe and taken up the lives of lakhs of people and locked the world in its boundaries.

We as dentists belongs to high risk group professionals and are struggling hard to contain this virus and cope up with new behavioural and social practices of life.

Our flagship project IDA Hope renewal is going through online mode. My sincere congratulations to our hope sec Dr Anver for untiring efforts to IDA hope.

Ever since the outbreak of COVID - 19 in our state the IDA Kerala State Office has been in constant touch with Kerala State Health Authorities and been furnishing members with all the vital information to help curtail the spread of this serious outbreak. We were also to put forward a Covid - 19 guideline for our members for post covid treatment protocols.

At this period of struggle when economy has undergone a major blow we were able to provide a supporting hand to all the local branches through financial assistance.

The state branch was in its forefront to enhance the clinical knowledge of our dental surgeons through informative sessions of online webinars which was under the co ordinated efforts lead by our CDE wing headed by Dr. Faizal C.P.

I would like to render heartfelt gratitude to my very supportive Hon State Secretary Dr. Deebu J Mathew all the office bearers of IDA Kerala State for their teamwork and support.

I take this opportunity to thank all the members and branches for conducting various activities in this special situation.

As Winston Churchill once said the pessimist sees difficulty in every opportunity while the optimist sees the opportunity in every difficulty. So lets join hands to turn our difficulties into opportunities.

Thanking you all
JAI IDA
JAI HIND

Dr. CC Joseph
President, IDA Kerala state



Dr CC Joseph

Message from the Secretary



Dr. Deebu Jacob Mathew

Dear friends,

Greetings to you all!

This year, 2020, till date, has undoubtedly been an apprehensive year. In addition to the challenges faced by the dental fraternity- the Corona Virus Disease- 2019 (COVID-19) has posed a very serious threat not only to us dentists, but also globally. We dental surgeons are vulnerable to COVID- 19 due to the nature of our practise. In these trying times, the IDA Kerala State Office has constantly been in contact with the Kerala State Health Authorities and has been providing us with information as to how to keep ourselves safe and also as to how to cut back the spread of this serious outbreak.

Post lockdown practise is going to be a lot more different than before. We will have to forgo our normal practise and inculcate a variant type of practise. Keeping this in mind, IDAKSB has prepared guidelines and recommendations for both the practitioners and the auxilliary staff, complying with all the government regulations. Risk assessment forms have been updated as and when was required. Masks and sanitizers procured through IDA MARK have been distributed to all the branches. Updates on the present milieu of COVID-19, will be furnished as and when the scenario changes.

Recently, we have also had a detailed meeting with the Honourable Minister for Health and Family Welfare Smt. Shailaja Teacher, to discuss the issues pertaining to the dental profession in the present situation and I am glad to say that there has been a favourable response. I am anticipating that the results be favourable too.

Friends, even though the situation is quite tensing, I suggest that we remain calm and not get panicky and make good use of the guidelines given by the State Office.

Wishing all of you good health.

THANK YOU!

STAY SAFE.

BREAK THE CHAIN.

Dr. Deebu Jacob Mathew
Secretary, IDA Kerala State



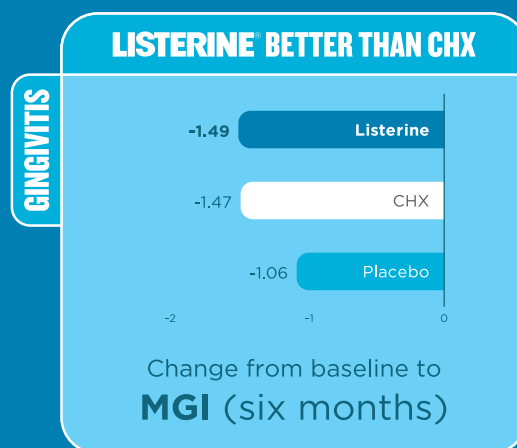
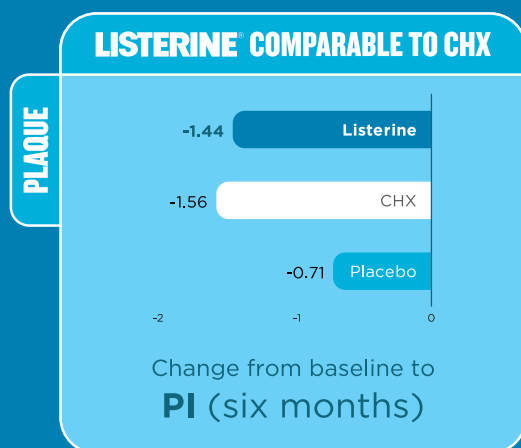
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1. Overholser CD, et al. J Clin Periodontol. 1990;17(8):575-579. 2. L.G. De Paola et al. J Dent Hygiene 2007, Supp: 13-25 3. Peridex (0.12% chlorhexidine gluconate) Oral Rinse [prescribing information]. Phoenix, Ariz: Zila, Inc; 2004 4. Barkvoll P, et al. J Clin Periodontol. 1989; 16:593-595

Changes in occlusal plane inclination after Orthodontic treatment with and without extraction

* Jithesh Kumar K, **Swathi T, ***Gopi Krishnan S, ****Panjami Marish, *Rizwana

Abstract

Aim: The aim of this study was to determine changes in the inclination of Occlusal Plane in skeletal class I subject after fixed orthodontic treatment with or without extraction using the pre adjusted edgewise appliance

Methods: A sample of 10 orthodontic patients with class I skeletal pattern was divided into two groups- Extraction and Non extraction- and their pre and post treatment cephalograms were evaluated.

Two different occlusal plane angles were measured. The changes of OP inclination within each group were compared with paired t test.

Results: The occlusal plane angles were increased in non extraction cases and decreased in extraction cases. Changes of both FOP and BOP were statistically significant in extraction cases but in non extraction cases only FOP showed statistical significance where as BOP became

insignificant.

Conclusion: In this study, it was found that the inclination of BOP and FOP were statistically significantly steeper in non extraction cases and these are decreased in extraction cases.

Key words: SN plane, FOP, BOP

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► Introduction

The form and inclination of the occlusal plane in an individual is connected with the function of the stomatognathic system and the esthetics of the face. The most important esthetic goal in orthodontics is to achieve a balanced smile, which can be best described as an appropriate positioning of the teeth and gingival scaffold within the dynamic display zone. The upper smile arc is the relationship of the curvature of the maxillary incisal and canine edges to the curvature of the lower lip during the social smile,

This is influenced by the OP angle. Changing the OP angle does affect relative smile attractiveness. There is a functional correlation between the inclination of OP and the masticatory closing path. This is an important determinant in occlusion and one of the contributing factors to masticatory movement

► Aim

The aims of this study was to determine changes in the inclination of OP in skeletal class I subject after fixed orthodontic

treatment with and without extraction using the pre adjusted edgewise appliance.

► Objectives

- To find out the changes in occlusal plane inclination after fixed orthodontic treatment in skeletal class I subjects with non extraction approach
- To find the changes in occlusal plane inclination after fixed orthodontic treatment in skeletal class I subjects with all first premolar extraction
- To compare the occlusal plane inclination after orthodontic treatment with extraction and non extraction approach

► Material and Method

The sample of 10 Orthodontic patients, aged above 13 years old, treated with fixed appliances were divided in to two groups (5 each)

*Head of the Department, **Post Graduate Student, ***Professor and former HOD, ****Reader, Dept. of Orthodontics, Mahe Institute of Dental Sciences, Chalakkara, Mahe
• Corresponding author: Dr. Jithesh Kumar

Group 1- patients treated with non extraction approach

Group 2- patient were treated with extractions of all first pre molars.

The sample was selected based on the following inclusion criteria:

- (1) Adolescents with class I skeletal pattern with no sexual discrimination
- (2) Non-surgical cases,
- (3) Patients with complete pre and post treatment records

The method was of pre-post design which compared

occlusal plane inclination obtained from tracings of lateral cephalograms before and after orthodontic treatment. The results were calculated with the paired t-test analysis

Parametric and measurements

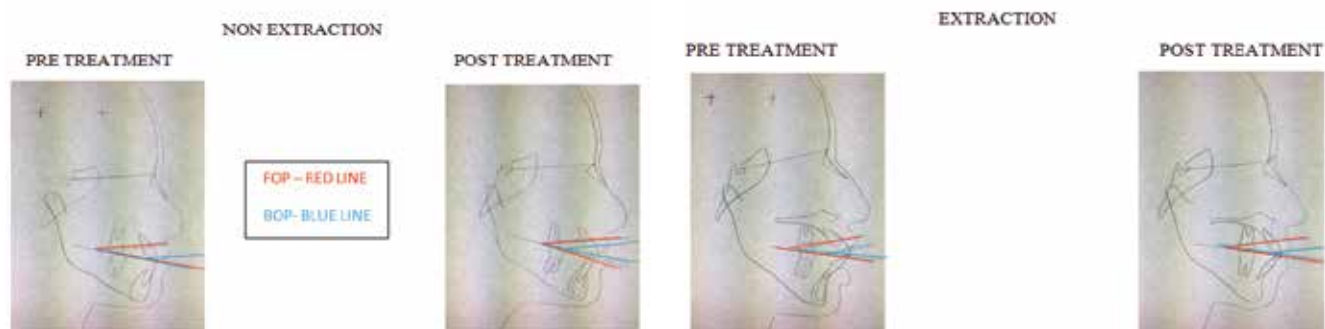
In this study, sella-nasion (SN) line was picked as the reference to study the change of inclination in the occlusal plane relative to the skeletal frame. This was because during general growth, the cant of SN line remains fairly unchanged. Additionally, the sella and nasion have good accuracy and repeatability in lateral cephalograms.

Measurements	FOP		Difference	BOP		Differences
	Pre	Post		Pre	Post	
Patient 1	17	19	2	14	16	2
Patient 2	18	20	2	14	16	2
Patient 3	15	19	4	15	16	1
Patient 4	18	21	3	16	15	1
Patient 5	16	19	3	14	15	1

Table 1 Non Extraction

Measurements	FOP		Difference	BOP		Differences
	Pre	Post		pre	Post	
Patient 1	20	15	-5	23	21	-1
Patient 2	18	12	-4	15	14	-1
Patient 3	20	14	-6	18	16	-2
Patient 4	20	16	-4	17	17	0
Patient 5	23	18	-5	16	15	-1

Table 2 Extraction



Figs. 1 and 2

The position and angulation of maxillary (U1) and mandibular central incisor (L1) and maxillary (U6) and mandibular first molar (L6) were measured from pre and post-treatment lateral cephalograms to evaluate the changes in the occlusal plane.

The planes used in this study were

- Sella-nasion plane (SN), the line passing from the center of Sella Turcica to Nasion
- Bisected occlusal plane (BOP), the line that bisects the vertical distance between the upper and lower incisal tips (U1 tip, L1 tip) and the upper and lower first molar occlusal surfaces (U6 occlusal, L6 occlusal)
- Functional occlusal plane (FOP), a line joining the point bisecting the U6 occlusal and L6 occlusal with the mid-point bisecting the intercuspation of the first premolars

► Results

The angular measurements from pre-treatment and post-treatment cephalograms of each group are listed in Table 1 and 2

The result showed that in extraction cases both the OP decreased after treatment but in non extraction cases the OP increased.

From the paired data t-test, the p value of FOP and BOP before and after treatment in non extraction cases was 0.002 and 0.142 respectively. The results showed that changes of FOP is statistically significant ($p < .005$) and BOP is statistically insignificant ($p > .005$) in non extraction cases. In extraction cases the p value of FOP and BOP is .001 and .033 respectively. In these cases, changes in both FOP and BOP were statistically significant ($p < .005$)

► Discussion

In this study, it was attempted to determine if there were any differences in the inclination of occlusal plane in subjects with class I skeletal malocclusion treated with or without extractions. The study was of a pre and post design method analyzed from 20 lateral cephalograms of 10 patients with class I skeletal pattern treated with and without extraction. The occlusal plane angle measured in this study was based on the S-N plane. There were two occlusal planes angles used in this study. One is Bisected occlusal plane angle (BOP) derived by the line that bisects the vertical distance between the upper and lower incisor tips and the upper and lower first molar occlusal surface with the S-N plane. The second one was the Functional occlusal plane angle (FOP), derived by the line bisecting the upper and lower occlusal surfaces with the midpoint bisecting the intercuspation of the first premolars with the S-N plane.

The result showed that in non extraction cases changes in BOP increased by a mean of 1.40 and FOP increased by mean of 2.80. In all first premolar extraction cases the BOP became smaller by a mean of 10 and FOP decreased by a mean of 30. From the paired t test it was found that in extraction cases the occlusal plane- FOP and BOP- change was statistically significant ($p < .005$) but in non extraction cases only FOP shows statistically significant variations ($p < .005$) and BOP change was not significant ($p > .005$).

The position of OP is determined largely by the vertical control of the maxillary and mandibular molars, mesial molar movement and extrusion and intrusion of incisors. In non extraction cases the amount of mesial molar movement is minimal so the other two factors were considered as reason for the steepening of occlusal plane. In all premolar extraction cases the occlusal plane became smaller after treatment; this might be due to extrusion of incisors and intrusion of molars. The occlusal plane was rotated anti clockwise after treatment. Although the inclination of FOP was closely related to the inclination of BOP, the inclination of FOP was greater than that of BOP in both groups.

This study provides a predictive framework for the potential changes of occlusal plane during orthodontic treatment. Further studies are required for the study of changes in occlusal plane inclination of patients with TAD based therapy.

► Conclusion

In this study, it was found that the inclination of BOP and FOP were significantly steeper statistically in non extraction cases and the inclination of BOP and FOP were decreased in extraction cases.

► References

1. Jin-le Li, Chung How Kau and Min Wang. Changes of occlusal plane inclination after orthodontic treatment in different dentoskeletal frames. *Progress in Orthodontics* 2014; 15:41.
2. N.R. Yuliawati Zenab, Tono S. Hambali, Jono Salim, Endah Mardiaty. Changes of occlusal plane inclination after orthodontic treatment with four premolars extraction in dento-alveolar bimaxillary protrusion case. *Padjadjaran Journal of Dentistry* 2009;21(2):100-103.
3. Lamarque S. The importance of occlusal plane control during orthodontic mechanotherapy. *Am J Orthod Dentofacial Orthop.* 1995; 107:548-58.
4. Batwa W, Hunt NP, Petrie A, Gill D. Effect of occlusal plane on smile attractiveness. *Angle Orthod* 2011; 82:218-23.
5. Braun S, Legan HL. Changes in occlusion related to the cant of the occlusal plane. *Am J Orthod Dentofacial Orthop.* 1997; 111:184-88.

Human blood mercury level in relation to dental amalgam usage and other environment sources in Kerala, South India

*Anitha Jose, **Geogi Cherian, ***J G Ray

Abstract

Mercury is a highly toxic heavy metal which has multiple ways of access to humans. Mercury amalgam used in conservative dentistry could be a direct source of blood mercury level to ordinary people and dental professionals. Fish consumption is also one of the major sources of mercury contamination among others, in humans. Human blood mercury level in relation to dentistry is assessed in this study. In order to identify the exact impact of dental amalgam usage in blood mercury levels of both professionals and patients, blood mercury

level in relation to fish consumption is also compared. The three mercury exposures considered include occupational exposure to dental professionals, to patients from mercury amalgam restorations and to ordinary people from fish consumption alone. The sample population included dental professionals and the general population from four representative districts of Kerala, which in turn were categorized into vegetarians, fish eaters and people with dental amalgam restorations. Mercury analysis was done by Inductively Coupled

Plasma - Mass Spectrometry. Blood mercury levels were found lower than the reference values. Fish consumption and dental occupational exposure were found significant sources of blood mercury levels in humans whereas mercury amalgam restoration was found insignificant.

Keywords: dentistry; dental amalgam; mercury in fish; mercury contamination; blood mercury-level

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► Introduction

Mercury is a very potent neuro, nephro, and immunotoxic substance with no physiological benefit and has multiple pathways of access to humans¹ which include food, industrial, medical² or other sources. Toxicity and mortality from mercury exposures are reported from countries such as Japan, Iraq, Ghana, Seychelles, and the Faroe Islands³. However, mercury is still used in a number of products and processes owing to its special properties, which include fluorescent light bulbs, batteries, switches, thermostats, many other industrial processes and healthcare facilities such as dentistry⁴. Mercury compounds are used as antifungal and antibacterial components in several cosmetics and vaccines, whereas elemental mercury is used in dental amalgams in dentistry. In such healthcare products or facilities, exposure may occur through inhalation, ingestion, or skin contact. Mercury exposure, either from elemental mercury or its mono and bivalent inorganic compounds and also organic

mercury derivatives⁵⁻⁶ contributes to the total mercury body burden in humans.

Mercury amalgam used in conservative dentistry for management of caries is a direct source to ordinary people and professional dentists. The adverse health effects of mercury exposure from dental amalgam to people are a subject of debate among researchers⁷. Dentists work with mercury amalgam on a regular and prolonged basis and might have high risk of elevated mercury levels⁸. Apart from occupational exposures, dentists also have non-occupational exposure sources such as amalgam restoration in their own teeth or from fish consumption or other environmental sources. Since oceans, in general, are mercury-contaminated, consumption of sea fish is considered a significant source of mercury exposure to humans⁹⁻¹¹. Therefore, mercury body burden from diverse environment samples is important to dentists as well, especially while evaluating occupational exposures in dentistry¹².

* Associate Professor Department of Zoology, Assumption Autonomous College, Changanacherry, Kottayam, Kerala. ** Periodontist, Valakuzhy Dental Clinic, Mallappally West PO, Pathanamthitta District, Kerala. ***Professor, School of Biosciences, M G University, Kottayam, Kerala. Corresponding Author: J G Ray Email: jgray@mgu.ac.in

Kerala is the South Western State of India where sea fish is a common delicacy of its non-vegetarian cuisine. In this context, the present study is undertaken to comparatively assess the degree of exposure in terms of blood mercury levels (BML) in people from three different exposure sources of mercury. The study population included dental professionals, and the general population including vegetarians, fish eaters and dental amalgam restored people.

► Materials and Methods

The study population consisted of 130 persons, both males and females from four districts in Kerala - Alappuzha, Pathanamthitta, Kottayam and Ernakulam; among them, 20 were the control group, 60-general population and 50-dental professionals. The twenty in the control group were pure vegetarians without amalgam fillings (C). Out of the 60 among the general population, twenty were fish-eaters without amalgam fillings (F), twenty were fish-eaters with amalgam fillings (AF), and twenty were pure vegetarians with amalgam fillings (A). All the 50 dental professionals were fish-eaters, and out of them, twenty were mercury practising and with own amalgam fillings (OAF), twenty were mercury practising but without own amalgam fillings (OF), ten were mercury-free dentists, of whom five were with own amalgam fillings (XAF), and five without own amalgam fillings (XF).

The study was conducted in accordance with the World Medical Association Declaration of Helsinki¹³ on the ethical principles for medical research involving human subjects. The participants volunteered as per a written informed consent, to provide 3 ml blood sample each. Blood samples were collected in 3 ml EDTA tubes, shook well and taken for

analysis at Thyrocare Technologies Limited, air transported to Mumbai in a frozen state, on the day of the collection itself where the blood samples were analysed by Inductively Coupled Plasma - Mass Spectrometry (ICP-MS). Statistical analysis was performed using SPSS (version 20 for Windows). Independent sample t-test was performed for comparison of two groups and ANOVA with Duncan's Multiple Range Test was done for multiple comparisons.

► Result

Mean Blood Mercury Level (BML) in the general population and the dentist categories are given in Table 1. Independent sample t-test for comparison of BML of two groups of different categories of the subjects is given in Table 2.

► Discussion

The three mercury exposure sources considered in the present study are discussed separately. Influence of fish consumption on BML was significant at 0.01 levels. The BML was significantly higher in 'F' ($1.811 \pm 1.217 \mu\text{g/L}$) compared to 'C' ($0.605 \pm 0.169 \mu\text{g/L}$) and significantly higher in 'AF' ($2.437 \pm 1.359 \mu\text{g/L}$) compared to 'A' ($0.709 \pm 0.436 \mu\text{g/L}$) as evident from Tables 1 and 2. It is noteworthy in this context that mercury level was low in the commonly consumed fish varieties of Kerala as reported by Jose and Ray¹⁴. Therefore, the positive impact of fish consumption seen in the present investigation reveals the cumulative impact of the mercury accumulation in humans through frequent consumption of fish. Joshi et al.¹⁵ report fish consumption as the primary factor for mercury exposure, in a study on dental and non-dental populations. Many authors are of the opinion that mercury exposures to humans come mainly from diet, especially, fish consumption¹⁶⁻¹⁷. Čejchanová et al.¹⁸ report lower mercury levels in non-fish eaters.

Table 1: Mean Blood Mercury Level(BML) ($\mu\text{g/L}$) in General population (I) and Dentists (II)

I	General population	C (n = 20)	F (n = 20)	A (n = 20)	AF (n = 20)	F – value
	Mean BML	0.61 ± 0.17	1.81 ± 1.22	0.71 ± 0.44	2.44 ± 1.36	17.697**
II	Dentists	OF (n = 20)	OAF (n = 20)	XF (n = 5)	XAF (n = 5)	F – value
	Mean BML	3.58 ± 2.23	4.05 ± 1.69	4.40 ± 3.65	3.29 ± 2.43	0.360

(C) - Pure vegetarians without amalgam fillings; (F) - Fish-eaters without amalgam fillings

(A) - Pure vegetarians with amalgam fillings; (AF) - Fish-eaters with amalgam fillings

(OF) - Mercury practising dentists without amalgam fillings; (XF) – Mercury-free dentists without amalgam fillings; (OAF) - Mercury practising dentists with amalgam fillings; (XAF) – Mercury-free dentists with amalgam fillings

Values are represented as mean \pm standard deviation.

** \rightarrow Difference is significant at 0.01 levels;

In General Population:

C vs. F $\rightarrow p < 0.01$; C vs. A $\rightarrow p > 0.05$; C vs. AF $\rightarrow p < 0.01$; F vs. A $\rightarrow p < 0.01$; F vs. AF $\rightarrow p > 0.05$; A vs. AF $\rightarrow p < 0.01$.

In Dentists: In all the comparisons, $p > 0.05$

The present data could not establish any statistically significant influence of mercury amalgam fillings on increase in BML in either dental amalgam filled general population or dentists (Table 1). Mean Blood Mercury Level (BML) of 'F' and 'AF' categories were not significantly different indicating that mercury amalgam restoration had no influence on BML as per the present study. It was also evident that 'A' and 'C' groups were not significantly different in BML, though both were vegetarians, differing only in the possession of mercury amalgam restorations (Table 1, 2). Likewise, it was also evident that all the dentist categories, both mercury practising ('OF' and 'OAF'), and mercury-free ('XF' and 'XAF') dentists, with

and without own amalgam restorations, were not significantly different regarding blood mercury levels (Table 1). Zimmer et al.¹⁹ and Lucchini et al.²⁰ finds a similar outcome, whereas Snapp et al.²¹ and Barregard²² find the contribution of dental amalgam to blood mercury levels significant. Jose and Ray¹⁴ have already reported in their study that mercury amalgam fillings did not show significant influence on BML in amalgam filled general population. It may also be noted that the extent of filling such as filling in '1 to 2' or 'more than 2 teeth' categories as well as duration of filling as 'one year' and 'above one year' categories were also considered. However, no significant difference could be established among these categories. Blood mercury levels were

Table 2. Independent sample t-test for comparison of mean Blood Mercury Level (BML) in µg/L of two groups of different categories of subjects

S. No.	Group	Mean	SD	t – value	p - value
1	C vs. F				
	C	0.605	0.169	4.392**	p < 0.01
	F	1.811	1.217		
2	A vs. AF				
	A	0.709	0.436	5.413**	p < 0.01
	AF	2.437	1.359		
3	C vs. A				
	C	0.605	0.169	1.000	p > 0.05
	A	0.709	0.436		
4	F vs. AF				
	F	1.811	1.217	1.534	p > 0.05
	AF	2.437	1.359		
5	OF vs. OAF				
	OF	3.583	2.230	0.752	p > 0.05
	OAF	4.054	1.695		
6	OF vs. XF				
	OF	3.583	2.230	0.644	p > 0.05
	XF	4.400	3.654		
7	OAF vs. XAF				
	OAF	4.054	1.695	0.829	p > 0.05
	XAF	3.290	2.425		
8	AF vs. OAF				
	AF	2.437	1.359	3.328**	p < 0.01
	OAF	4.054	1.695		
9	F vs. OF				
	F	1.811	1.217	3.120**	p < 0.01
	OF	3.583	2.230		

(C) - Pure vegetarians without amalgam fillings; **(F)** - Fish-eaters without amalgam fillings; **(A)** - Pure vegetarians with amalgam fillings; **(AF)** - Fish-eaters with amalgam fillings **(OF)** - Mercury practising dentists without amalgam fillings; **(XF)** - Mercury-free dentists without amalgam fillings; **(OAF)** - Mercury practising dentists with amalgam fillings; **(XAF)** - Mercury-free dentists with amalgam fillings;

** The difference is significant at 0.01 levels

not significantly different between mercury practising dentists and mercury-free dentists (Table 1); whereas in a comparison between general population and mercury practising dentists, BML was significantly higher in 'OAF' ($4.054 \pm 1.695 \mu\text{g/L}$) compared to 'AF' ($2.437 \pm 1.359 \mu\text{g/L}$) and significantly higher in 'OF' ($3.583 \pm 2.230 \mu\text{g/L}$) compared to 'F' ($1.811 \pm 1.217 \mu\text{g/L}$) as evident from Table 2. This indicates the occupational influence of mercury on BML in mercury practising dentists. Dentists had higher mean BML than that of general population (Table 2), but the exposure levels were below the reference levels of Iyengar and Woittiez²³ and Minoia et al.²⁴. This is similar to that reported from studies in a review on mercury exposure in dental personnel, by Nagpal et al.²⁵. Asians generally have higher BML than other races^{12, 17}. But in the present study, mean BML in all the categories were lower than the reference value of Iyengar and Woittiez²³ and Minoia et al.²⁴, which are 9.5 and 5.3 $\mu\text{g/L}$ respectively. The mean mercury levels in environmental and

food samples from the four districts¹⁴, as per Table 3, show that mercury in drinking water samples and rice samples alone were significantly different at 0.05 levels, whereas fish and paddy soil was not. Similar outcomes are reported in other studies^{26-27, 12}. This might be because dentists work with mercury amalgam on a regular and prolonged basis and might have high risk of elevated mercury levels⁸. With regard to occupational exposure to mercury in dentistry, mercury levels are low or not statistically significant in some other studies²⁸⁻²⁹. In conclusion it may be inferred that, fish consumption and occupational exposure were significant reasons to BML in humans.

► Conclusion

Though fish consumption and occupational exposure appeared to have the primary role in increasing blood mercury levels, the influence of dental amalgam restorations on the same was not found to be significant in the present study. Even though the mercury levels were below the reference values, low level of mercury in the blood of general population and dental professionals due to chronic exposure from fish consumption and due to chronic occupational exposure in dentists need further critical analysis as the impact of such a low level from chronic exposure is not yet fully understood.

► References

1. Zahir F, Rizwi SJ, Haq SK, Khan RH. Low dose mercury toxicity and human health. *Environmental toxicology and pharmacology*. 2005 Sep 1;20(2):351-60.
2. Rice KM, Walker Jr EM, Wu M, Gillette C, Blough ER. Environmental mercury and its toxic effects. *Journal of preventive medicine and public health*. 2014 Mar;47(2):74.
3. Tchounwou PB, Ayensu WK, Ninashvili N, Sutton D. Environmental exposure to mercury and its toxicopathologic implications for public health. *Environmental Toxicology: An International Journal*. 2003;18(3):149-75.
4. Bose-O'Reilly S, McCarty KM, Steckling N, Lettmeier B. Mercury exposure and children's health. *Current problems in pediatric and adolescent health care*. 2010 Sep 1;40(8):186-215.
5. Syversen T, Kaur P. The toxicology of mercury and its compounds. *Journal of Trace Elements in Medicine and Biology*. 2012 Oct 1;26(4):215-26.
6. Nersesyan A, Kundi M, Waldherr M, Setayesh T, Mišik M, Wultsch G, Filipic M, Barcelos GR, Knasmueller S. Results of micronucleus assays with individuals who are occupationally and environmentally exposed to mercury, lead and cadmium. *Mutation Research/ Reviews in Mutation Research*. 2016 Oct 1;770:119-39.
7. Park JD, Zheng W. Human exposure and health effects of inorganic and elemental mercury. *Journal of preventive medicine and public health*. 2012 Nov;45(6):344.
8. Kulkarni S, Tadakamadla SK, Jain K, Goyal D, Balasubramanyam G, Duraiswamy P. Mercury hygiene practice among practicing dentists and undergraduate dental students of India. *Archives of Oral Research*. 2008 Nov 29;4(1).
9. Webb J, Mainville N, Mergler D, Lucotte M, Betancourt O, Davidson R, Cueva E, Quizhpe E. Mercury in fish-eating communities of the Andean Amazon, Napo river valley, Ecuador. *EcoHealth*. 2004 Nov 1;1(2):SU59-71.

Table 3. Mean mercury levels in environmental and food samples (Jose and Ray 14)

Sl. No.	Samples	Mean \pm SD	F-value	p value
I	Drinking water – four districts ($\mu\text{g/L}$)			
	Alappuzha	0.167 \pm 0.047	5.022*	p < 0.05
	Pathanamthitta	0.113 \pm 0.006		
	Kottayam	0.110 \pm 0.017		
	Ernakulam	0.090 \pm 0.000		
II	Fishes ($\mu\text{g / kg}$)			
	King Fish	11.60 \pm 6.480	2.674	p > 0.05
	Mackerel	11.43 \pm 2.701		
	Seer Fish	11.23 \pm 3.625		
	Tuna	9.633 \pm 1.745		
	Pearl spot	5.380 \pm 0.954		
	Sardine	4.647 \pm 1.013		
III	Rice varieties ($\mu\text{g / kg}$)		10.14*	p < 0.05
	Surekha	6.977 \pm 0.318		
	Matta	3.817 \pm 1.577		
	Jaya	3.087 \pm 1.099		
IV	Paddy field soils ($\mu\text{g / kg}$)			
	Kayal	74.31 \pm 26.84		
	Kara	32.00 \pm 34.85		
	Kari	20.79 \pm 16.10	3.268	p > 0.05

* → Difference is significant at 0.05 levels

10. World Health Organization. Exposure to mercury: a major public health concern. WHO, Public Health Environment International. 2007.
11. Passos CJ, Mergler D. Human mercury exposure and adverse health effects in the Amazon: a review. *Cadernos de Saúde Pública*. 2008;24:s503-20.
12. Goodrich JM, Chou HN, Gruninger SE, Franzblau A, Basu N. Exposures of dental professionals to elemental mercury and methyl mercury. *Journal of exposure science & environmental epidemiology*. 2016 Jan; 26(1):78-85.
13. WMA. WMA, Declaration of Helsinki, Principles for Medical Research Involving Human Subjects 2008.
14. Jose A, Ray JG. Toxic heavy metals in human blood in relation to certain food and environmental samples in Kerala, South India. *Environmental Science and Pollution Research*. 2018 Mar 1;25(8):7946-53.
15. Joshi A, Douglass CW, Kim HD, Joshipura KJ, Park MC, Rimm EB, Carino MJ, Garcia RI, Morris JS, Willett WC. The relationship between amalgam restorations and mercury levels in male dentists and nondental health professionals. *Journal of public health dentistry*. 2003 Mar;63(1):52-60.
16. Keil DE, Berger-Ritchie J, McMillan GA. Testing for toxic elements: a focus on arsenic, cadmium, lead, and mercury. *Laboratory Medicine*. 2011 Dec 1;42(12):735-42.
17. Awata H, Linder S, Mitchell LE, Delclos GL. Biomarker levels of toxic metals among Asian populations in the United States: NHANES 2011–2012. *Environmental health perspectives*. 2017 Mar;125(3):306-13.
18. Cejchanová M, Wranová K, Spevácková V, Krsková A, Smid J, Cerná M. Human bio-monitoring study-toxic elements in blood of women. *Central European journal of public health*. 2012 Jun 1;20(2):139.
19. Zimmer H, Ludwig H, Bader M, Bailer J, Eickholz P, Staehle HJ, Triebig G. Determination of mercury in blood, urine and saliva for the biological monitoring of an exposure from amalgam fillings in a group with self-reported adverse health effects. *International journal of hygiene and environmental health*. 2002 Jan 1;205(3):205-11.
20. Lucchini R, Calza S, Camerino D, Carta P, Decarli A, Parrinello G, Soleo L, Zefferino R, Alessio L. Application of a latent variable model for a multicenter study on early effects due to mercury exposure. *Neurotoxicology*. 2003 Aug 1;24(4-5):605-16.
21. Snapp KR, Boyer DB, Peterson LC, Svare CW. The contribution of dental amalgam to mercury in blood. *Journal of dental research*. 1989 May;68(5):780-5.
22. Barregård L. Biological monitoring of exposure to mercury vapor. *Scandinavian journal of work, environment & health*. 1993 Jan 1:45-9.
23. Iyengar V, Woittiez J. Trace elements in human clinical specimens: evaluation of literature data to identify reference values. *Clinical chemistry*. 1988 Mar 1;34(3):474-81.
24. Minoia C, Sabbioni E, Apostoli PI, Pietra R, Pozzoli L, Gallorini M, Nicolaou G, Alessio L, Capodaglio E. Trace element reference values in tissues from inhabitants of the European community I. A study of 46 elements in urine, blood and serum of Italian subjects. *Science of the total environment*. 1990 Jun 1;95:89-105.
25. Nagpal N, Bettiol SS, Isham A, Hoang H, Crocombe LA. A review of mercury exposure and health of dental personnel. *Safety and health at work*. 2017 Mar 1;8(1):1-0.
26. Ritchie KA, Burke FJ, Gilmour WH, Macdonald EB, Dale IM, Hamilton RM, McGowan DA, Binnie V, Collington D, Hammersley R. Mercury vapour levels in dental practices and body mercury levels of dentists and controls. *British Dental Journal*. 2004 Nov;197(10):625-32.
27. Canto-Pereira LH, Lago M, Costa MF, Rodrigues AR, Saito CA, Silveira LC, Ventura DF. Visual impairment on dentists related to occupational mercury exposure. *Environmental toxicology and pharmacology*. 2005 May 1;19(3):517-22.
28. Atesagaoglu A, Omurlu H, Ozcagli E, Sardas S, Ertas N. Mercury exposure in dental practice. *Operative Dentistry*. 2006 Nov;31(6):666-9.
29. Sahani M, Sulaiman NS, Tan BS, Yahya NA, Anual ZF, Mahiyuddin WW, Khan MF, Muttalib KA. Mercury in dental amalgam: Are our health care workers at risk?. *Journal of the Air & Waste Management Association*. 2016 Nov 1;66(11):1077-83.

Bioceramics in Endodontics- A review

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Abstract

Bioceramics are ceramic compounds obtained both in situ and in vivo, by various chemical processes. Bioceramics exhibit excellent biocompatibility due to their similarity with biological materials, like hydroxyapatite and multi-substituted

hydroxyapatite or similar compounds have the ability to induce a regenerative response in the organism.

The aim of this article is to make a literature review on the main bioceramic materials

currently used in endodontics and on their specific characteristic

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► Introduction

Definition of biomaterials employed by the American National Institute of Health that describes biomaterial as any substance or combination of substances, other than drugs, synthetic or natural in origin, which can be used for any period of time, which augments or replaces partially or totally any tissue, organ or function of the body, in order to maintain or improve the quality of life of the individual¹.

Biomaterials are materials that possess some novel properties that makes them appropriate to come in immediate contact with the living tissue without eliciting any adverse immune rejection reactions. Biomaterials are used in dentistry, in restorative procedures such as dental restorations, dental implants and surgical procedures, endodontic materials, in devices such as orthodontic materials.²

Types of biomaterials

1. Bioinert material: The term bioinert refers to any material that once placed in the human body has minimal interaction with its surrounding tissue, examples of these are Metals (stainless steel and cobalt–chrome-based alloys, Ti and Ti alloy) Ceramics (Alumina Al_2O_3 and Zirconia) Polymers (silicone rubber, acrylic resins).

2. Bioactive material: A material that elicits a specific biological response at the interface of the material, which results in the formation of a bond between the tissue and that material, examples are bioactive glasses, hydroxyapatite, ceramic

3. Bioresorbable materials: On placement within the human body starts to dissolve (resorbed) and slowly replaced by advancing tissue (such as bone). Examples are tricalcium phosphate $[Ca_3(PO_4)_2]$ and polylactic polyglycolic acid copolymers. Calcium oxide, calcium carbonate and gypsum.

During the first decade of the twenty concepts of bioactive materials and resorbable materials have converged; bioactive materials are being made resorbable and resorbable polymers are being made bioactive.³

Bioceramics refers to biomaterials that are used in direct contact with living tissue. Various types of bioceramics that are available in medicine and dentistry include bioinert bioceramics like zirconia and alumina that do not react with the environment they are in contact with. Bioactive bioceramics that react with the tissue components may either be resorbable like calcium phosphate bone substitute materials or non-bioresorbable such as the calcium silicate or the hydraulic cements used in endodontics. Bioactivity of materials refers to its ability to create a hydroxyapatite layer when in contact with tissue fluid rich in calcium phosphate.

There is an intrinsic osteoinductive capacity of the bioceramics, because of their documented ability to absorb osteoinductive substances if there is a bone healing process nearby.⁴

Bioceramics have the quality to be biocompatible and

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also provide antibacterial properties. The latter occur as a result of precipitation in situ after the material's setting time, a phenomenon that leads to bacterial sequestration. Bioceramics form porous powders containing nanocrystals with diameters of 1-3 nm, which prevent bacterial adhesion⁵.

Bioceramic materials used in endodontics can be categorized by composition, setting mechanism, and consistency. There are sealers and pastes, developed for use with gutta-percha, and putties, designed for use as the sole material, comparable to MTA. Some are powder/liquid systems that require manual mixing.

Advantages of Bioceramics

Excellent biocompatibility properties due to their similarity with biological hydroxyapatite. Intrinsic osteoinductive capacity because of their ability to absorb osteoinductive substances if there is a bone healing process nearby. Function as a regenerative scaffold of resorbable lattices which provide a framework that is eventually dissolved as the body rebuilds tissue. Ability to achieve excellent hermetic seal, form a chemical bond with the tooth structure and have good radiopacity^{6,7}.

Antibacterial properties as a result of precipitation in situ after setting, a phenomenon that leads to bacterial sequestration. Bioceramics form porous powders containing nanocrystals with diameters of 1-3 nm, which prevent bacterial adhesion. Sometimes, fluoride ions are constituents of apatite crystals, and the resulted nanomaterial has antibacterial properties

Bioceramics used in endodontics

Calcium silicate based –Cements- Portland Cement, Mineral trioxide aggregate (MTA), Biodentine (Septodont, France) Sealers - Endo CPM Sealer (EGO SRL, Buenos Aires, Argentina), MTA Fillapex (Angelus, Brazil) BioRoot RCS (Septodont, France), TechBiosealer (Profident, Kielce, Poland).

Calcium phosphates/ tricalcium phosphate/ hydroxyapatite based: Mixture of calcium silicates and calcium phosphates - iRoot BP, iRoot BP Plus, iRoot FS (Innovative Bioceramix Inc., Vancouver, Canada), EndoSequence BC Sealer (Brasseler, Savannah, GA, USA)/ Total Fill, Bioaggregate (Innovative Bioceramix Inc., Vancouver, Canada), Ceramicrete (developed at Argonne National Lab, Illinois, USA)⁸.

► Calcium silicate based bioceramic materials

Port land cement

Introduced by Joseph Aspidin in 1824. PC is an inexpensive material and except for the absence of bismuth oxide and higher levels of calcium aluminate and calcium sulfate, PC and MTA have a similar main composition. PC like MTA is available as grey and white. PC has lesser discoloration and solubility comparing to MTA. Antibacterial property and sealing ability as root end filling material is similar to MTA. Maturation of MTA after hydration is more structured than PC hence the former displays better bioactivity

Limitations-Higher amount of lead and arsenic is released from PC which has raised questions regarding its safety with respect to the surrounding tissues⁹. Excessive setting expansion with PC may lead to crack formation within the tooth⁹. Biomineralization with PC is not as effective and as long term as with MTA which is critical for a bioactive material.

MTA Cement

The first bioceramic material successfully used in endodontics was the MTA cement (Mineral Trioxide Aggregate), developed based on Portland cement, in the Loma Linda University – California, in the early 90's. It was developed as a retrograde filling material and also for perforations closing.

MTA cement is calcium silicate cement, consisting of tricalcium silicate, dicalcium silicate and tricalcium aluminate. The radiopaque compound is bismuth oxide. The material comes in two forms, gray and white. In the first form gray color is given by iron ions, which were removed to obtain the white form¹⁰.

MTA's setting reaction is by hydration, obtaining hydrated calcium silicate and calcium hydroxide which is released over time. MTA's biological integration is due to the ions of Ca, which form hydroxyapatite in contact with phosphate ions present in body.

The antibacterial role of the MTA cement seems to be due to the release of calcium hydroxide, which explains the similar action with the calcium hydroxide pastes. In addition, it shows a strong alkaline pH, with antibacterial effect^{10,11}.

Limitations-Long setting time, Difficult handling, high cost and Potential tooth discoloration. Absence of a known solvent for this material, and Difficulty of its removal after placement.^{12,13}

Biodentine

This material was specifically designed as a "dentin replacement" material by Septodont (France) in 2009. Biodentine contains tricalcium silicate (Ca₃SiO₅), calcium carbonate, zirconium oxide and calcium chloride. Main indications include the treatment of resorptions, root perforations, pulp capping procedures, apexification, retrograde fillings, and dentin replacement.

Advantages of Biodentine over MTA

Consistency ensures improved handling which is better suited to the clinical use than MTA. Exhibits better mechanical properties than MTA. Does not require a two-step restoration procedure as in the case of MTA. As the setting is faster, there is a lower risk of bacterial contamination than with MTA¹⁴.

► Experimental Calcium Alumino Silicates

Endobinder

It preserve the properties and clinical applications of MTA and eliminate its negative characteristics. EndoBinder is produced with high levels of purity, eliminating traces of free magnesium oxide (MgO) and calcium oxide (CaO), which are responsible for the undesired expansion of the material, and ferric oxide (Fe₂O₃), which is responsible for tooth darkening. Among recent materials, EndoBinder presented satisfactory tissue reaction;¹⁵

Generex A

Generex A (Dentsply Tulsa Dental Specialties, Tulsa, OK, USA) is a calcium silicate based material that has some similarities to MTA but is mixed with unique gels instead of water¹⁵. Generex A material has very different handling properties in comparison to MTA. Generex A mixes to a dough-like consistency, making it easy to roll into a rope-like mass similar to intermediate restorative material.

Capasio

It is designed for retrograde fillings and perforation repair. It is considered to have superior resistance¹⁵. Capasio composed primarily of bismuth oxide, dental glass and calcium alumino-silicate with a silica and polyvinyl acetate-based gel. A recent study found that Capasio and MTA promote apatite deposition when exposed to synthetic tissue fluid thus had the mineralization capacity. The same researchers also concluded that when used as a root-end filling material, Capasio is more likely to penetrate dentinal tubules.

Quick-Set

Recently, Capasio powder has been refined and renamed as Quick-Set (Primus Consulting), and the cationic surfactant was removed from the liquid gel component, which was thought to interfere with cytocompatibility. In a contemporary research using odontoblast-like cells, Quick-Set and MTA exhibited similar cytotoxicity profiles. They possess negligible in vitro toxicological risks after time dependent elution of toxic components.¹⁵

Mixture of calcium silicates and calcium Phosphates

BioAggregate

BioAggregate (Innovative BioCeramix Inc, Canada) is a calcium silicate cement containing calcium silicate hydrate, calcium hydroxide, hydroxyapatite, silica and tantalum oxide. The product has qualities similar to cement MTA, in terms of marginal sealing, superior adhesion and pulp cells migration¹⁶.

Ceramicrete

Ceramicrete is a self-setting phosphate ceramic developed at the Argonne National Laboratory, Illinois, USA, that sets in

an ambient condition formed by acid base reaction between an acid phosphate (KH₂PO₄) and a negligible soluble basic metal oxide (calcined MgO). More recently, a biocompatible, radiopaque Ceramicrete based dental/ bone material has been created by incorporating hydroxyapatite powder and cerium oxide radiopaque filler into the phosphosilicate ceramic.

Physical and chemical analyses showed that the clinical handling and washout resistant of the Ceramicrete D were superior to those of MTA; however, it was weaker, less radiopaque, and initially more acidic than Generex A and Capasio.

Endosequence sealer and paste for retrograde filling and perforation repair

Endosequence BC sealer (Brasseler USA) is another calcium silicate material highly radiopaque, no shrinkage, hydrophilic, forming hydroxyapatite upon setting. The setting reaction is also a hydration reaction. It contains monocalcium phosphate which is responsible for hydroxyapatite formation in situ. Endosequence contains zirconium oxide and tantalum oxide as radiopaque fillers.¹⁷

Some characteristics of bioceramics used in endodontics

Microleakage

Endodontic cements and sealants ensure a tight seal to root dentin in order to prevent micro infiltration. Certain conditions, including perfectly dry canals, are required to achieve good adhesion. In some cases, these may be difficult to obtain clinically. Studies that compared MTA to other sealers widely used in endodontics led to good results for MTA even if canals were not perfectly dried. Comparing some classic sealers used in endodontics, like AH26, Excite DSC, MTA Fillapex and ZOE paste in dry and wet canals, Ehsan et al.¹⁶ demonstrated that AH26 shows the best seal in dry canals and ZOE paste the weakest seal in humidity conditions. MTA showed good sealing even in wet canals.

MTA adhesion to dentin may be influenced if the intracanal medication is not completely removed because of complex endodontic morphology, technical deficiencies or lack of equipment. When analyzing the strength of MTA displacement in canals with calcium hydroxide and antibiotic medication, Topçuoğlu et al. found an overall decrease of resistance for both situations.¹⁸

Microbiology

Comparing the antimicrobial activity of two endodontic cements (MTA Fillapex and AH 26), Madani et al. concluded that MTA has superior efficiency on *Enterococcus faecalis*, *Escherichia coli*, *Streptococcus mutans* and *Candida albicans*¹⁹. Moreover, similar studies shows that SealApex (Kerr Company,

Germany) shows antibacterial properties but meanwhile there are endodontic sealers with no antibacterial activity (eg. Endorez). MTA and Portland cement have demonstrated no antibacterial activity on *E. coli*²⁰.

Even though the antimicrobial activity is an important requirement of an endodontic sealer, most of them have no capacity to provide complete protection. MTA Dentsply, MTA Angelus and Portland cement inhibit the growth of *P. aeruginosa* while calcium hydroxide was effective against *P. aeruginosa* and *B. fragilis*. Under anaerobic conditions these materials have not been proven effective for *E. faecalis*, and *E. coli*²¹.

Cytotoxicity on periodontal ligament fibroblasts

Mineral Trioxide Aggregate (MTA), Endosequence Root Repair Material and Biodentine showed different results when fibroblast cell cultures were evaluated at 24 and 48 hours. Even if at the first 24 hours all the materials showed increased cell viability, at 48 hours, there is a slight decrease in cell viability. MTA showed statistically significant increase in the cell viability when compared to Endosequence Root Repair Material and Biodentine²². We can conclude that MTA shows better biocompatibility and may be indicated for sealing of communication between periodontal and endodontic space. Analyzing the effect on human endothelial cells ECV 304 line of two brands of MTA (Angelus® - MTA, Pro - Root™ -MTA) and Portland cement, in a comparative study, De Deus et al. showed that after initial high cytotoxic activity, these materials increase cell viability²³. Bismuth oxide has no negative cellular effects²⁴.

► Conclusion

The application of bioceramic technology has changed both surgical and non-surgical endodontic treatment, providing a promising direction for the preservation of patient's teeth. Most of the current bioceramic materials have rapidly gained acceptance in clinical application for their physico - chemical and biological properties. However, limitations still exist when compared to the criteria for an ideal material used for endodontic purposes. Indeed, it is expected that the presently available bioceramic materials will be further modified and developed to overcome the few remaining challenges.

► References

- Bergmann CP, Stumpf A. Dental ceramics: microstructure, properties and degradation. Springer Science & Business Media; 2013 Jun 22
- Bhat S, Kumar A. Biomaterials and bioengineering tomorrow's healthcare. Biomater. 2013 Jul 19;3(3):e24717
- Hench LL, Thompson I. Twenty-first century challenges for biomaterials. Journal of The Royal Society Interface. 2010 Aug 6;7(Suppl 4):S379-91
- Cheng L, Ye F, Yang R, Lu X, Shi Y, Li L, et al. Osteoinduction of hydroxyapatite/beta-tricalcium phosphate bioceramics in mice with a fractured fibula. Acta Biomater. 2010;6(4):1569-1574.
- Hermansson L. Nanostructural bioceramics: Advances in Chemically Bonded Bioceramics. CRC Press 2014.
- Prati C, Gandolfi MG. Calcium silicate bioactive cements: Biological perspectives and clinical applications. Dent Mater 2015;31(4):351-370.
- Utneja S, Nawal RR, Talwar S, Verma M. Current perspectives of bio-ceramic technology in endodontics: Calcium enriched mixture cement - review of its composition, properties and applications. Restor Dent Endod 2015;40(1):1-13
- Ghoddusi J. Material modifications and related materials. Berlin Heidelberg: Springer, 2014.
- Parirokh M, Torabinejad M. Mineral trioxide aggregate: A comprehensive literature review—part I: Chemical, physical, and antibacterial properties. J Endod 2010;36(1):16-27.
- Camilleri J. The chemical composition of mineral trioxide aggregate. J Conserv Dent. 2008;11(4):141-143.
- Camilleri J. Mineral Trioxide Aggregate in Dentistry. Springer 2014.
- Camilleri J. The chemical composition of mineral trioxide aggregate. J Conserv Dent 2008;11(4):141-143.
- Macwan C, Deshpande A. Mineral trioxide aggregate (mta) in dentistry: A review of literature. J Oral Res Rev 2014;6:71-74.
- Singh H, Kaur M, Markan S, Kapoor P. Biodentine: A promising dentin substitute. J Interdiscipl Med Dent Sci 2014;2:140.
- Saxena P, Gupta SK, Newaskar V. Biocompatibility of root-end filling materials: Recent update. Restor Dent Endod 2013;38(3):119-127
- Zhu L, Yang J, Zhang J, Peng B. A comparative study of BioAggregate and ProRoot MTA on adhesion, migration, and attachment of human dental pulp cells. J Endod. 2014;40(8):1118- 1123.
- Koch K, Brave D, Ali Nasseh A. A review of bioceramic technology in endodontics. Available from: http://www.dentaltribune.com/htdocs/uploads/printarchive/editions/60f01a2ff396414f6815530033a55bf8_6-12.pdf
- Topçuoğlu HS, Arslan H, Akçay M, Saygili G, Cakici F, Topçuoğlu G. The effect of medicaments used in endodontic regeneration technique on the dislocation resistance of mineral trioxide aggregate to root canal dentin. J Endod. 2014;40(12):2041- 2044.
- Madani ZS, Sefidgar SA, Rashed Mohasel A, Zabihi E, Mesgarani A, Bijani A, et al. Comparative evaluation of antimicrobial activity of two root canal sealers: MTA Fillapex and AH 26. Minerva Stomatol. 2014;63(7-8):267-272.
- Sipert CR, Hussne RP, Nishiyama CK, Torres SA. In vitro antimicrobial activity of Fill Canal, Sealapex, Mineral Trioxide Aggregate, Portland cement and EndoRez. Int Endod J. 2005;38(8):539-543.
- Ribeiro CS, Kuteken FA, Hirata Junior R, Scelza MF. Comparative evaluation of antimicrobial action of MTA, calcium hydroxide and Portland cement. J Appl Oral Sci. 2006;14:330- 333
- Samyuktha V, Ravikumar P, Nagesh B, Ranganathan K, Jayaprakash T, Sayesh V. Cytotoxicity evaluation of root repair materials in human-cultured periodontal ligament fibroblasts. J Conserv Dent. 2014;17(5):467-470.
- De Deus G, Ximenes R, Gurgel-Filho ED, Plotkowski MC, Coutinho-Filho T. Cytotoxicity of MTA and Portland cement on human ECV 304 endothelial cells. Int Endod J. 2005;38:604-609.
- Holland R, de Souza V, Murata SS, Nery MJ, Bernabé PF, Otoboni Filho JA, et al. Healing process of dog dental pulp after pulpotomy and pulp covering with mineral trioxide aggregate or Portland cement. Braz Dent J. 2001;12:109-113.

Routine Infection Prevention and Control; A Prosthodontic Perspective

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► Introduction

Infectious diseases have afflicted the world throughout our history. Being a surgical field, dentistry has high potential for disease transmission. The oral cavity carries plenty of potentially infective microorganisms, and saliva and blood are known vectors of infection. Most carriers of latent infection are unaware of their condition and, it is important, therefore, that the same infection control routine be adopted for all patients.¹

On January 30, 2020, the World Health Organization (WHO) declared the rampant spread of SARS-CoV-2. The outbreak of coronavirus disease 2019 (COVID-19) in the area of Wuhan, China, has evolved rapidly into a public health crisis² and has spread exponentially to other parts of the world³. The novel coronavirus belongs to a family of single-stranded RNA viruses known as Coronaviridae. This family of viruses are known to be zoonotic or transmitted from animals to humans⁴. Given the widespread transmission of SARS-CoV-2 and reports of its spread to health care providers, dental professionals are at high risk for nosocomial infection and can become potential carriers of the disease⁵. These risks can be attributed to the unique nature of dental interventions, which include aerosol generation, handling of sharps, and proximity of the provider to the patient's oropharyngeal region. In addition, if adequate precautions are not taken, the dental office can potentially expose patients to cross contamination.⁶ It is necessary to review our current practices of infection control to tighten them even further.

Dental professionals, especially prosthodontists, are exposed to a wide variety of microorganisms through blood and saliva of patients. Pathological microorganisms may cause infectious diseases like influenza, pneumonia, tuberculosis, herpes, hepatitis B and acquired immune deficiency syndrome. Most carriers of latent infection are unaware of their condition and, it is important, therefore, that the same infection control routine be adopted for all patients.

Infection control in health care continues to be the subject of intensive research and discussion.⁷ Infection control, also called, exposure control plan by the Occupational Safety and Health Administration (OSHA) is a required in - office programme that is designed to protect dentists and allied personnel against risks of exposure to infection.

It is essential that all dental laboratory technicians have a basic understanding of infection transmission and be properly evaluated for the exposure risk they face from blood-borne pathogens.⁷ Impressions, casts, impression trays, record bases, occlusal rims, articulators and dental prostheses can all transmit pathogenic microorganisms from the dental office to the dental laboratory.⁷ Implementation of universal infection control in dentistry, entails the prevention of infection transmission within the dental clinic environment. Such a policy protects both patients and staff, reduces staff concerns & prevents discrimination against patients. Implementing safe and realistic infection control procedures requires the full compliance of the whole dental team⁸

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There are a number of elements in a comprehensive infection control protocol:⁹

1. Patient evaluation
2. Personal protection
3. Instrument cleaning and Sterilization
4. Disinfection
5. Laboratory asepsis
6. Communication with dental laboratory staff
7. Regulated and general waste.

1. Patient evaluation

Any treatment is performed only after a comprehensive patient evaluation. This is achieved by a medical history specially designed to identify patients who are either particularly susceptible to infection or who are at risk of transmitting infection, known as carriers of disease or by being in a high-risk category¹⁰. The medical history should be updated at subsequent visits. Specific questions should be asked regarding medications, current and recurrent illnesses, unintentional weight loss, lymphadenopathy, oral soft tissue lesions, other infections, and history of hepatitis.¹¹ Medical consultation may be indicated when a history of active infection or systemic disease is elicited. Not all patients with infectious diseases can be identified by medical history, physical examination, or readily available laboratory tests. Each patient must be considered as potentially infectious and the same infection control procedures should be used for all patients.¹²

The most common route of transmission of infection :

- a) Direct contact (e.g. blood)
- b) Indirect contact (e.g. instruments)
- c) Contact of oral mucosa with droplets generated from an infected person (e.g. by coughing, sneezing, or talking);
- d) Inhalation Effective infection-control strategies prevent disease transmission by interrupting one or more links in the chain¹³

2. Personnel Health Elements of an Infection Control Program¹⁴

- Education and training
- Immunizations
- exposure prevention and post exposure management,
- Medical condition management and work-related illnesses and restrictions Health record maintenance
- Blood borne Pathogens
- Preventing Transmission of Blood borne Pathogens.

Treat all patients as potentially infectious. Use protective attire and barrier techniques when contact with body fluids or mucous membranes is anticipated.¹⁵ The personal hygiene of all staff members who are either directly or indirectly in contact

with patients should be scrupulous. Hand hygiene, the most cost effective and easy practice which can reduce potential pathogens is considered the single most critical measure for reducing the risk of transmitting infection to patients and health care professionals.¹⁶ The dental personnel should refrain from touching anything not required for the particular procedure. They should cover cuts and bruises on fingers with dressings because they serve as easy portals for infections. Fingers are the most common vehicles of infection transmission.¹⁷ A clean sink should be provided for hand washing, and the taps should be elbow, foot control, or sensor operated. Keep finger nails short and clean. Jewellery should be removed as they tend to entrap organisms and damage gloves. Liquid soap should be used for routine hand washing and antimicrobial liquids for hand washing prior to surgical procedures. Gloves should be worn as the last step before treatment commences. A freshly laundered uniform or overgarment should be worn by all clinical personnel.¹⁸

Use of dental instruments and air-water syringes creates droplets of water, saliva, blood, microorganisms, and other debris. Aerosols remain suspended in air for long time and can be inhaled.¹⁹ Appropriate work practices, including use of dental dams²⁰ and high-velocity air evacuation, should minimize dissemination of droplets, spatter, and aerosols.²¹ Barrier protection include use of gloves, eye shields, face masks and rubber dam isolation. OSHA regulations specify that all clinical personnel must wear treatment gloves during all treatment procedures. Gloves must meet new Food and Drug Administration (FDA) regulation, less than 4 per 100 can have a leak detectable by a water test. Hand cleansers containing a mild antiseptic like 3% PCMX (p-chloro, meta-nylenole), povidone iodine or chlorhexidine are preferred.²² Protective eyewear may consist of goggles, or glasses with solid side shields which protect the eyes from droplets or aerosols.²³ Face masks prevent splatter from patient's mouth or splashes of contaminated solutions of chemicals.²⁴ Hepatitis B Virus (HBV) is a well-recognized occupational risk for dental professionals.²⁵ Dentist can best manage patients infected with HBV and protect themselves, and in turn other patients, by being vaccinated. Clare Connor's¹¹ has shown that the vaccine is safe and highly efficacious, affording protection with a success rate of more than 95%. In June 1982, the council on dental therapeutics adopted a resolution recommending that all dental personnel having patient contact including dentists, dental students and dental auxiliary personnel, and all dental laboratory personnel receive the Hepatitis B vaccine.²⁶ The vaccination programme must certainly be considered the most effective cross infection control measure to protect dental personnel and in turn their patients, from a potentially fatal disease.²⁷ The schedule for immunization is three doses of 0, 1 and 6 month and a booster dose after every 5 years.²⁸

Avoid hand injuries. Avoid injury with sharp instruments and needles. Handle sharp items carefully. Do not bend or break disposable needles. Infection may be due to a needle stick injury or cut with a sharp object or contact of mucous membrane or non intact skin with blood or other body fluids that are potentially infectious.⁹ The risk status post sharps injury, blood or body fluid exposure from a source will depend on 1) the status of the source 2) type of injury and 3) the status of the victim. Sharps containers of approved type should be used-should not be overfilled and must be properly closed. When recapping needles a single handed bayonet technique or a resheathing device should be used. Remove burs from handpieces when finished, or if left in handpiece, point the bur away from hands and body.¹⁵

Water testing from the dental chair should be an integral part for microbiological surveillance. Studies have demonstrated that dental unit waterlines²⁹ (i.e. narrow-bore plastic tubing that carries water) can become colonized with microorganisms, including bacteria, fungi, and protozoa.³⁰ Literature states that dental waterlines should be flushed at the beginning of the day to reduce the microbial load, but it is not sufficient for removal of biofilms.²¹ To improve the water quality self-contained water systems with chemical treatment, in line micro-filters and combination of these treatments can be applied²⁸.

► Instrument cleaning and sterilization

Instruments cleaning can be categorised into these stages.

1. Presterilization

soaking (Holding)

2. Pre-cleaning

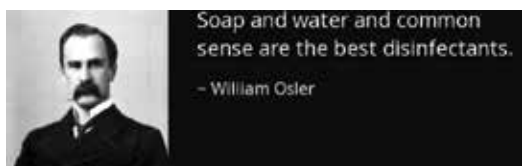
Corrosion control,drying, lubrication

Packaging

Sterilization or high level disinfection

Sterilization monitoring.

Disinfectants



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Disinfection is a less effective process than sterilization because it does not kill bacterial endospores. They are antimicrobial agents that are applied to non-living objects to destroy microorganisms, the process of which is known as disinfection. American Dental Association (ADA) guidelines state that impressions should be rinsed to remove saliva, blood and debris and then disinfected before being sent to the laboratory. When considering methods of disinfection for impressions, two factors are important: 1) the effect of the treatment on the dimensional stability and surface detail of the impression and 2) the deactivating effect of the impression material on the disinfecting solution, which could reduce the efficacy of the process.³¹

Spraying disinfectants onto the surface of the impression reduces the chance of distortion, especially in the case of alginate, hydrocolloid and polyether materials, but may not adequately cover areas of undercuts.³² Thorough rinsing of the impression is necessary before and after disinfection. Rinsing before removes the bioburden present, which may prevent exposure of the surface to the disinfectant. Rinsing after disinfection removes any residual disinfectant, which may affect the stone surface after the cast has been poured

Laboratory asepsis

Infection control is fundamental in a dental laboratory so that dental technicians/ technologists can be prevented from getting infected. Before 1970s, infection control was not performed in dental laboratories though there was a major concern on handling of items from “high-risk patients”¹⁵. It was later realised that microorganisms could survive on saliva and blood and that any patient could be a source of infection. As a result, infection control became apparent and has now resulted in impressive protocols to prevention of disease spread in the dental office and laboratories.¹² Dental laboratories should isolate prostheses of high-risk patients from other laboratory work. When handling these materials, one should wear surgical gloves and mask. All instruments and devices that come into contact with a high- risk patient's prosthesis must be sterilized.³³ Technicians/ Technologists working in this area should wear clean laboratory dust coats, face masks, protective eyewear and disposable gloves. Work surfaces and equipment should be kept clean and disinfected daily. All instruments, attachments, and materials to be used on new prostheses should be separated from those used on prostheses that have already been inserted in the mouth.³² Rag wheels should be washed and autoclaved after every use. Colonization from airborne and other organisms in warm, wet pumice can be prevented by suspending the pumice in a tincture of green soap or other surfactant and possibly adding an effective disinfectant solution to the mix and then using it with the polishing lathe.¹⁵ The pumice should be changed daily. Irrespective of the machine's location, if chemicals are used,

appropriate Personal Protective Equipment must be employed [gloves, mask and protective eyewear] All dental technicians/technologists must be immunized against hepatitis B virus.¹²

For irreversible hydrocolloids (Alginate), the recommended disinfectant is chlorine compounds or iodophors using immersion method for less than 10 minutes. Polysulphide silicone: Immerse in glutaraldehyde, chlorine compound, iodophors or phenolics for not more than 30 minutes. Polyether: Immerse with caution in chlorine compounds or iodophors for less than 10 minutes. Zinc oxide eugenol impression paste: Immerse in glutaraldehyde or iodophors. Impression compound: Iodophors or chlorine compounds or phenolic spray. Pumice must be changed after the completion of every case. At minimum the pumice and rag wheels should be disinfected daily.³⁴ Bench tops and work areas should be cleaned daily or. Surface disinfection protocols are the same in a Dental laboratory as that in a dental clinic¹².

Communication with dental laboratory staff

Responsibility for disinfection of items sent to the dental laboratory lies with the dental office.³⁹ All items disinfected in the dental office should be labelled indicating that such items have been decontaminated using an accepted disinfection routine. If the dental laboratory staff have not been notified that incoming work is decontaminated, all incoming items must be disinfected.⁴⁰

Regulated and general waste

Category of medical and biomedical waste and disposal³⁶

Government of India rules on BMW disposal are in place, but the practices currently are not up to the mark. Spreading awareness of the rules and their strict implementation is necessary and it is the need of the hour.

India's pollution watchdog, the Central Pollution Control Board (CPCB), has released guidelines for handling, treatment and safe disposal of biomedical waste generated during treatment, diagnosis and quarantine of patients confirmed or suspected to have the novel coronavirus disease (COVID-19)³⁷. According to the guidelines the bags/containers used for collecting biomedical waste from COVID-19 patients should be labelled as COVID-19 waste to enable CBWTFs (Common Biomedical Waste Treatment Facility) to identify the waste easily for priority treatment and immediate disposal after getting it. In addition, the guidelines sent to all states, direct use of dedicated trolleys and collection bins in COVID-19 isolation wards and recommended that the surface of containers, bins, trolleys used for storage of COVID-19 are disinfected regularly.³⁸

Dental Aerosols and COVID-19

Dental aerosols have been studied for well over 50 years. The tissues and fluids of the oral cavity are replete with bacteria

and viruses⁴². When the oral cavity is exposed to instruments that rotate, vibrate or expel compressed air, an aerosol of these microbes is inevitably created⁴³. All the evidence to date points to droplet transmission as the primary vector of infection by SARS-CoV-2⁴⁷. Contact transmission plays a minor role⁴⁸. It is also well established in the literature that the attentive use of high volume evacuation (HVE) will reduce dental aerosols by at least 90%⁴⁴. The majority of dental aerosol droplets that escape HVE land innocuously on the patient's face or body⁴⁵. A smaller percentage of these droplets constitute the "dental aerosol" that remain suspended in the air for 10-30 minutes, depending on the airflow characteristics of the operatory⁴⁶.

There are many studies examining the relative infectivity of dental aerosols as well as the risk of cross-contamination in dental settings. Most of these studies were written in response to a new or resurgent disease such as TB, HIV/AIDS, Hep B, SARS-CoV-1 etc.⁴⁹ There is no evidence that the viral load of the 2020 dental aerosols is more infectious than that of those previously encountered.

The use of high volume evacuation and routine PPE has protected dentists, staff and patients from cluster infections. If this were not the case, there would already be ample evidence to the contrary.

Two primary concerns in the current regulatory environment (the real dangers):⁵⁰

1. Unfounded emphasis on dental aerosol mitigation is a "red herring," which might distract us from the real transmission risk in a dental office – the non-clinical areas. Non-clinical areas are where higher viral doses from sustained speaking (and perhaps even coughing and sneezing) may occur, possibly without masks, and certainly without the benefit of high volume evacuation. We believe it is imperative to enforce protocols designed to protect staff and patients in the non-clinical spaces of dental offices.

2. Unfounded emphasis on dental aerosol mitigation has created a false impression that visits to the dentist are dangerous. Patients are unquestionably safer in dental offices than in most other social settings. Yet if the public perceives visits to the dentist as a health risk, their dental health will inevitably suffer.

Regarding Precautionary and preventive measures to prevent spreading of Novel Coronavirus (COVID-19)⁴¹

- a) All dentists and support staff should wash their hand thoroughly with soap and water and follow up with alcohol based hand sanitizers before and after every patient. Surgical scrubbing of hands is recommended. Disposal gloves to be used routinely as usual.

b) Staff and doctors should avoid touching their face specially the ear, nose and mouth.

c) Every patient who enters and exits the clinic should be provided hand sanitizers.

d) The waiting room/clinic including the handles and doors as well as dental chairs and other surfaces should be wiped several times in a day with alcohol based disinfectant.

e) Thorough Medical & Travel history of each Patient should be recorded before any clinical procedures.

f) Patients should be scrubbed with Iso Propyl alcohol extra orally.

g) Pre-procedural rinse with Povidone Iodine is recommended.

h) Wearing of N95 or atleast 3 ply masks and suitable head caps, product e eye wear and face shield is recommended.

i) Fumigation of clinics periodically is advised.

► Conclusion

From an infectious point of view, dentistry has never been safe for both patients and dental team. Although the principles and ideology of potential infection control remain unchanged, new technologies, equipment and data require incessant assessment of current infection control practices. The result of the precautions taken now would be that, at the end of the COVID-19 saga, dental patients would be able to continue to return for their services with confidence.

► References

- Kohn WG, Harte JA, Malvitz DM, Collins AS, Cleveland JL, Eklund KJ. Guidelines for infection control in dental health care settings—2003; Centers for Disease Control and Prevention. J Am Dent Assoc 2004;135:33-47.
- Centers for Disease Control and Prevention. Transmission of coronavirus disease 2019 (COVID-19). Available at: <https://www.cdc.gov/coronavirus/2019-ncov/about/transmission.html>.
- Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. Lancet Infect Dis 2020.
- Gorbalenya AE, Baker SC, Baric RS, et al. The species Severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. Nat Microbiol 2020.
- Wax RS, Christian MD. Practical recommendations for critical care and anesthesiology teams caring for novel coronavirus (2019-nCoV) patients. Can J Anaesth 2020.
- Lan L, Xu D, Ye G, et al. Positive RT-PCR test results in patients recovered from COVID-19. JAMA 2020.
- Bhat VS, Shetty MS, Shenoy KK. Infection control in the Prosthodontic laboratory. J Indian Prosthodont Soc 2007;7:62-5.
- Prince Kumar, Ashish Kumar1, Ashish Khattar2, Roshni Goel; Infection control in prosthodontic perspective: An overview on the present scenario; European Journal of General Dentistry | Vol 1 | Issue 3 | September-December 2012.
- Alapatt JG, Varghese NM, Joy PT, Saheer MK, Correya BA. Infection Control In Dental Office: A Review. Journal of Dental and Medical Sciences. 2016 Feb;15(2):10-15.
- Naveen BH, Kashinath KR, Jagdeesh KN, Mandokar RB. Infection Control In Prosthodontics. Journal of Dental Sciences and Research. 2011 Feb;2(1):93-107.
- Clare Connor. —Cross - contamination control in prosthodontic practice. J. Prosthodont, 1991; 4:337-344.
- Infection control recommendations for the dental office and the dental laboratory. ADA Council on Scientific Affairs and ADA Council on Dental Practice. J Am Dent Assoc. 1996 May;127(5):672-680.
- Greene VW. Microbiological contamination control in hospitals.1.Perspectives. Hospitals 1969;43:78-88.
- Kohn WG, Collins AS, Cleveland JL, Harte JA, Eklund KJ, Malvitz DM. Guidelines for infection control in dental health-care settings—2003. MMWR. 2003;52(RR17):1-61
- Dr. Sumanth K. S. Dr. Shwetha Poovani. Dr. Gautam Shetty. Dr. Nithin Kumar S. B. Dr. Sindhu Sudhakar K. INFECTION CONTROL PROTOCOL IN PROSTHODONTICS – A REVIEW; International Journal of Scientific Research; Volume-8 | Issue-3 | March-2019.
- Steere AC, Mallison GF. Handwashing practices for the prevention of nosocomial infections. Ann Intern Med 1975;83:683-90.121.
- Maki DG, Alvarado CJ, Hassemer CA, Zilz MA. Relation of the inanimate hospital environment to endemic nosocomial infection. N Engl J Med 1982;307:1562--6.
- Danforth D, Nicolle LE, Hume K, Alfieri N, Sims H. Nosocomial infections on nursing units with floors cleaned with a disinfectant compared with detergent. J Hosp Infect 1987;10:229--35
- Harrel SK, Molinari J. Aerosols and splatter in dentistry: a brief review of the literature and infection control implications. J Am Dent Assoc. 2004; (135)4:429-437
- Cochran MA, Miller CH, Sheldrake MS. The efficacy of the rubber dam as a barrier to the spread of microorganisms during dental treatment. J Am Dent Assoc 1989;119:141--4. (172)
- CDC. Recommended infection-control practices for dentistry, 1993. MMWR 1993;42(No. RR-8).
- Council on dental materials, instruments, and equipment, council on dental practice, council on dental therapeutics. —Infection control recommendations for the dental office and the laboratory. J. Am. Dent. Assoc., 1998; 116:241 -248.
- Sherry. A. Harfst. —Personal barrier protection. D. C. N. A., 1991;35(2): 357 – 366.
- Mast EE, Alter MJ. Prevention of hepatitis B virus infection among health-care workers. In: Ellis RW, ed. Hepatitis B vaccines in clinical practice. New York, NY: Marcel Dekker, 1993:295-307.
- Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management of blood-borne infections in health care workers. Clin Microbiol Rev 2000;13:385-407.
- Council on dental materials, instruments, and equipment, council on dental practice, council on dental therapeutics. —Infection control recommendations for the dental office and the laboratory. J. Am. Dent. Assoc., 1998; 116:241 -248.
- Mills SE. The dental unit waterline controversy: defusing the myths, defining the solution.
- Mayo JA, Oertling KM, Andrieu SC. Bacterial biofilm: a source of contamination in dental air-water syringes. Clin Prev Dent 1990;12:13--20
- Walker JT, Bradshaw DJ, Bennett AM, Fulford MR, Martin MV, Marsh PD. Microbial biofilm formation and contamination of dental unit water systems in general dental practice. Appl Environ Microbiol

- 2000;66:3363--7.
30. William Osler: The Treatment of Disease. Canada Lancet 1909;42:899-912
31. McNeill MR, Coulter WA, Hussey DL. Disinfection of irreversible Hydrocolloid impressions: A comparative study. *Int J Prosthodont* 1992;5:563-7.
32. Matyas J, Dao N, Caputo AA, Lucatorto FM. Effects of disinfectants on dimensional accuracy of impression materials. *J Prosthet Dent* 1990;64:25-31.
33. Cottone JA, Terezhalmay GT, Molinari JA. Practical Infection Control in Dentistry. 2nd edition. USA. 1996; Williams & Wilkins.
34. Sammy KC, Benjamin SN. Infection Control Mechanisms Employed by Dental Laboratories to Prevent Infection of their Dental Technicians/Technologists. *J Oral Health Craniofac Sci*. 2016;1:1-11.
35. Pasupathi P, Sindhu S, Ponnusha BS, Ambika A. Biomedical waste management for health care industry. *Int J Biol Med Res* 2011; 2: 472-486.
36. Biomedical Waste Management Rules, 1998; notified by the Government of India
37. Published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i)] GOVERNMENT OF INDIA MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE NOTIFICATION New Delhi, the 28th March, 2016.
38. <https://india.mongabay.com/2020/03/pollution-watchdog-releases-guidelines-to-handle-covid-19-biomedical-waste/>
39. Kugel G, Perry RD, Ferrari M, Lalicata P. Disinfection and communication practices: A survey of U.S. dental laboratories. *J Am Dent Assoc* 2000;131:786-92.
40. Wood PR. Crossinfection control in dentistry a practical illustrated guide.
41. DENTAL COUNCIL OF INDIA (A STATUTORY BODY CONSTITUTED UNDER THE DENTISTS ACT, 1948) Regarding Precautionary and preventive measures to prevent spreading of Novel Coronavirus (COVID- 19) –Dated March 17, 2020.
42. Gao, L., et al., Oral microbiomes: more and more importance in oral cavity and whole body. *Protein & Cell*, 2018. 9(5): p. 488-500.
43. Harrel, S.K. and J. Molinari, Aerosols and splatter in dentistry: A brief review of the literature and infection control implications. *The Journal of the American Dental Association*, 2004. 135(4): p. 429-437.
44. Jacks, M.E., A laboratory comparison of evacuation devices on aerosol reduction. *Journal of Dental Hygiene*, 2002. 76(3): p. 202-6.
45. Bentley, C.D., N.W. Burkhart, and J.J. Crawford, Evaluating spatter and aerosol contamination during dental procedures. *The Journal of the American Dental Association*, 1994. 125(5): p. 579-84.
46. Bennett, A.M., et al., Microbial aerosols in general dental practice. *British Dental Journal*, 2000. 189(12): p. 664-667.
47. Wu, D., et al., The SARS-CoV-2 outbreak: What we know. *Int J Infect Dis*, 2020. 94: p. 44-48.
48. Ferretti, L., et al., Quantifying SARS-CoV-2 transmission suggests epidemic control with digital contact tracing. *Science*, 2020. 368(6491): p. eabb6936.
49. Volgenant, C.M.C. and J.J. de Soet, Cross-transmission in the Dental Office: Does This Make You Ill? *Current Oral Health Reports*, 2018. 5(4): p. 221-228.
50. Anthony D. Mair DDS, M. Cl.D. Paul H. Korne DDS, M. Cl.D.; Decoding Dental Aerosols; May 21, 2020
51. EN 1822 (2009), High efficiency particulate air filters (EPA, HEPA and ULPA): Part 1: 'Classification, performance testing and marking', Part 2: 'Aerosol production, measuring equipment, particle counting statistics', Part 3: 'Testing flat sheet filter media', Part 4: 'Determining leakage of filter elements (scan method)', Part 5: 'Determining the efficiency of filter elements', Idem, *ibid.*, November.
52. Whyte, W. (2001), *Cleanroom Technology: Fundamentals of Design, Testing and Operation*, Chichester, UK : John Wiley & Sons.
53. *Sterility, Sterilisation and Sterility Assurance for Pharmaceuticals ...* by Tim Sandle; Published by Woodhead Publishing Limited, 2013

Periodontal therapy is central to Interdisciplinary Dentistry - A critical evaluation

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Abstract

Dentistry is a specialty which deals with various issues affecting the teeth and its adjoining structures. Today's dentist does not just repair teeth to make them better for chewing. With the increase in patients demands for more attractive teeth, dentists must now become more

familiar with the previously independent discipline of orthodontics, periodontics, restorative dentistry and maxillofacial surgery. In today's interdisciplinary treatment approach, treatment planning must begin with well-defined aesthetic objectives. By beginning with aesthetics, and taking

into consideration the impact on function, structure, and biology of the stomatognathic system the clinician will be able to use various disciplines to deliver highest level of dental care to each patient

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► Introduction:

A healthy Periodontium is essential for the proper functioning of the teeth and thereby the entire stomatognathic system. True requirement of periodontics in maintaining healthy dentition cannot be ignored by any other specialty because they play a pivotal role in the interdisciplinary approach. As said by Nadine Artemis, "Teeth with its supporting structures are live units, and given the proper environment, they can regenerate; this is why internal factors that nourish the teeth are so important". Periodontics is not practiced in isolation; as we come across frequently many patients have multiple dental needs or medical health issues that require management. An interdisciplinary approach to problem solving involves drawing appropriately from multiple disciplines to redefine problem outside of normal boundaries and reach a solution based on a new understanding of complex situations.²

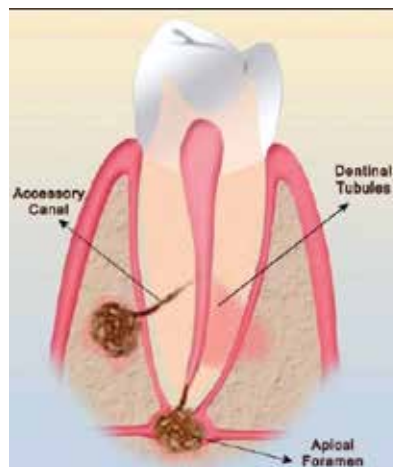
The Endo-Perio Continuum:

The relationship between the periodontium and the pulp was first discovered by Simring and Goldberg in 1964. The periodontium and pulp have embryonic, anatomic and functional interrelationship. Ecto-mesenchymal cells proliferate to form the dental papilla and follicle, which are the precursors of the periodontium and the pulp respectively¹⁰. This embryonic development gives rise to anatomical connections, which remain throughout life.

Three main pathways have been implicated in the development of periodontal-endodontic lesions, namely:

1. Dentinal tubules
2. Lateral and accessory canals
3. Apical foramen

Pulpal and periodontal problems are responsible for more than 50% of tooth mortality.



The possible anatomic pathways of communication between the pulp and the periodontium; apical foramen, lateral canals and dentinal tubules

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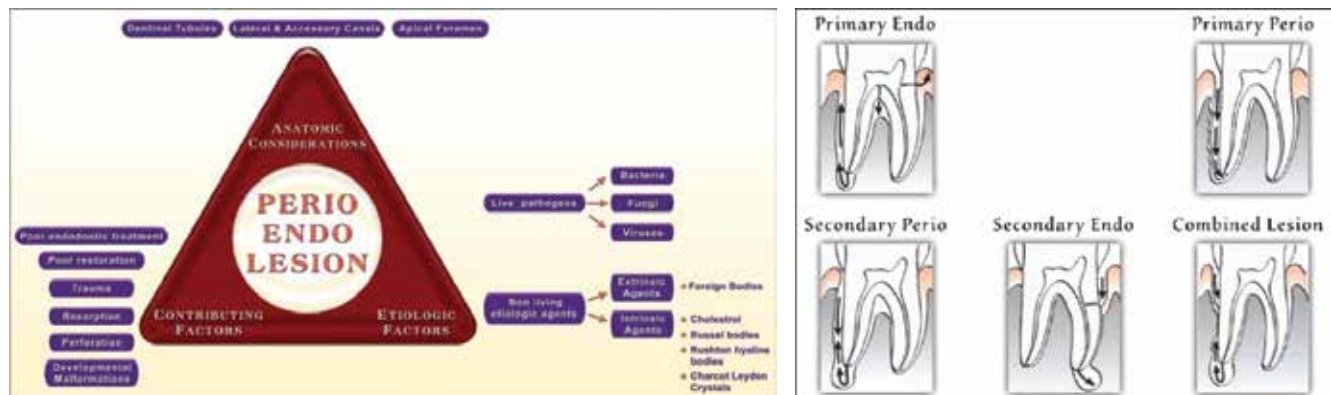
ETIOPATHOGENESIS:**CLASSIFICATION:**

The most commonly used classification was given by Simon, Glick and Frank in 1972. According to this, perio-endo lesions can be classified into:

Various diagnostic procedures that can be used to identify perio-endo lesions:

(Modified from Rotstein I, Simon JHS. Diagnosis, prognosis and decision making in the treatment of combined periodontal-endodontic lesions.⁶

Endodontic therapy is more predictable and completion

**ETIOPATHOGENESIS:****Visual examination****Soft Tissues**

- Inflammation
- Ulcerations
- Sinus tracts

Teeth

- Caries
- Defective restorations
- Abrasions
- Cracks
- Fractures
- Discolorations

Palpation

- Periradicular abnormalities
- Cannot differentiate between endodontic and periodontal lesion
- Compare with control teeth

Percussion

- Periradicular inflammation
- Compare with control teeth

Mobility

- Loss of periodontal support
- Fractured roots
- Recent trauma
- Periradicular abscess

Radiographs

- Periradicular bone resorption of endodontic origin - not effective
- Bone loss due to periodontal disease - effective

Pulp vitality testing

(Cold test, Electric test, Blood flow tests, Cavity test)

- Abnormal response – Degenerative changes
- No response – Pulp necrosis
- Moderate transient response – Normal vital pulp
- Quick painful response – Reversible pulpitis
- Lingering painful response – Irreversible pulpitis

Pocket probing

- Probing depth
- Clinical attachment level
- Sinus tracking

Fistula tracking

- Semi rigid radioopaque material (gutta percha)

of this therapy before periodontal procedures has a positive effect on periodontal healing. The prognosis of combined diseases rests with the severity and extent of the periodontal lesion and the efficacy of periodontal therapy. However the success of endodontic therapy is dependent on the completion of periodontal therapy.¹⁰

The Prosthodontic – Perio Interface:

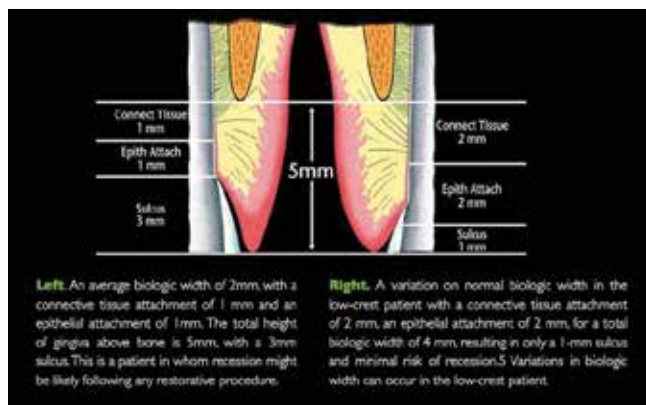
When planning prosthodontic treatment, consideration should be given to factors such as the design of the prosthesis, the preparation of the pontic, the number and quality of the abutment teeth and choice of material, and also the patient's concerns and expectations. Abutment selection, tooth position, residual ridge form and occlusion should also be evaluated before treatment. The location of the margin and the contour and emergence profile of the prosthesis will influence the response of the gingival tissues to the prosthesis. Although periodontal factors do not usually have a direct effect on the survival of a fixed prosthesis, harmony between the prosthesis and the periodontium is critical for the longevity of the prosthesis.³

Pontic design also contribute to the response of the gingival tissues as well as to the clinical and esthetic outcomes. Even an optimal pontic design will not prevent inflammation of the mucosa adjacent to the pontic if pontic hygiene is not maintained by periodic check up and oral prophylaxis.¹

Implant and Periodontium:

The evidence relating to a history of periodontitis as a risk factor for implant success and survival, and the role of supportive periodontal therapy in maintaining implants for individuals with a history of periodontitis, must be considered before initiating an implant therapy.

Case selection is therefore essential, with patient compliance and motivation to maintain a disease-free mouth being particularly important. Regular recalls will also provide the opportunity for review and early detection and treatment of failures.



Variations of biologic width.

Biocompatibility of the materials used in fabricating prosthesis should also be documented.

Effect of orthodontic treatment on the periodontal tissues:

Orthodontic management can be described as a 'double edged sword', as it can correct periodontal problem to a certain extent and at the same time also holds potential for the harm of the periodontal tissues. A different orthodontic treatment approach is required in periodontally compromised patients in terms of stabilizing anchorage system, application of orthodontic forces, retention, as well as plaque control during treatment. More recently, great emphasis has been placed on the use of bicortical screw [cortical implants] for establishing orthodontic anchorage.^{1,2,4}

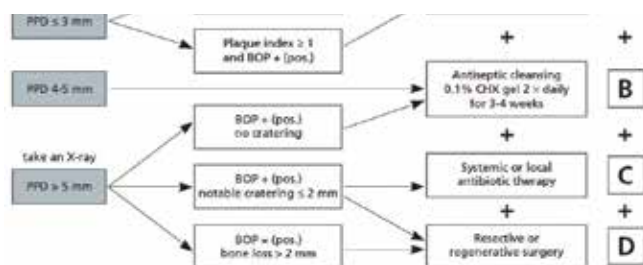
Wilckodontics, also known as Periodontally Accelerated Osteogenic Orthodontics is a clinical procedure that combines selective alveolar corticotomy, particulate bone grafting and application of orthodontic forces. It is based on the theoretical phenomenon of regional acceleratory phenomenon of healing pattern of bone.¹²

Table 1. Gingival morphologic standards

Variable	Description and Ideal criteria
Attached gingiva	Continuous and with an even width of at least 2 mm
Gingival display	Varies between individuals Dependent on the lip line during function: <ul style="list-style-type: none"> High lip line: most challenging to manage clinically Average lip line: considered to be the most esthetic Low lip line: the least demanding
Color and surface texture	Pink and firmly bound down to the necks of the teeth The surface texture of the gingival tissues is stippled, with an orange-peel appearance
Interdental papilla	Firm and knife-edged Occupies the interdental space made by a contact point and the interdental embrasure
Contour	Symmetrical Follows the contour of the upper lip The gingival height should match on the central incisors and canines The gingival height on the lateral incisor should be slightly more incisal (about 1.5 mm) than on the central incisors The peak of gingival margin convexity should be positioned distal to the long axis of the tooth on the labial surface of the maxillary anterior teeth

The correction of some orthodontic problems, such as excessively tipped molars, traumatic deep-bites and flared and spaced incisors, may be particularly beneficial in periodontally compromised patients who are undergoing periodontal therapy. Specific tooth movements can also help regaining adequate interdental and inter occlusal space for placing dental implants. However, several factors may contribute to a harmful periodontal response also. Inadvertent use of heavy orthodontic forces, and poor oral hygiene maintenance by the patient can prove detrimental to the periodontal health. Excessive and unrealistic tooth movements are also likely to result in reduced alveolar bone thickness, especially in patients with thin cortical plates and aesthetic problems at the end. However studies shows that application of lighter orthodontic force on periodontally compromised teeth with pathologic migration helps bone regeneration and better prognosis,

It has to be emphasized that the key element in the orthodontic management of adult patients with periodontal disease is to eliminate plaque accumulation and gingival inflammation. On the other hand, the response of the soft tissues is less predictable and likely to be influenced by multiple factors.



Classification of cumulative interceptive therapy (CIST). CIST-A and CIST-B show peri-implant mucositis; CIST-C and CIST-D show peri-implantitis



The Emerging Role of Maxillofacial Radiology in the diagnosis and management of Complex Periodontal Cases.⁶

In contrary to the conventional intra oral and panoramic radiography, Cone-beam computed tomography (CBCT) imaging offers specific advantages for periodontal diagnosis in that three-dimensional images of dental and marginal alveolar bone structures can be rendered with geometric accuracy in one procedure. Defects which can be identified greater accuracy include furcation involvement and intrabony, buccal and lingual defects. It is proposed that in these situations, limited-field-of-view, high-resolution protocols are followed.

Surgical Management of Periodontal Disease;

The final goal of periodontal therapy is regeneration of the entire periodontal tissues including alveolar bone, periodontal ligament (PDL) and cementum. [1]Several procedures have been developed for regeneration, such as guided tissue regeneration (GTR) or use of enamel matrix derivatives. As a novel method of periodontal regeneration, transplantation of the necessary stem cells is also proposed as a new paradigm (Bartold et al 2000)[8]. With the advent of piezoelectric devices and laser therapy, the periodontal therapy aims to bring down the invasive treatment modalities which were conventionally followed throughout ages.

Management of Periodontal Health in Children:

Oral health of children and adolescents mirrors their general health. Because oral health care is often delivered in isolation from general health care, oral signs and symptoms do not always alert practitioners to their significance beyond the mouth. An example of this is the association of a higher risk of dental caries and periodontal disease with prediabetic conditions in children and adolescents who are overweight or obese. Dentists and periodontists therefore need to consider the health conditions of their patients to aid in diagnosis, and alert the practitioner to oral conditions that may not resolve without general health-care intervention.



Periodontal disease in Geriatrics and the Special Needs Patient:⁷

Diagnostic criteria used for the assessment and diagnosis of periodontitis in younger adults may not be fully applicable in older individuals, and the progression of periodontitis may be slower in older individuals. Older individuals with periodontitis may therefore benefit from more conservative treatment approaches. In older individuals, declining health, perception of treatment needs, dietary changes, comorbidity with other diseases and reduced immune function are challenging factors in terms of therapies and understanding the etiology of periodontitis.⁸

Individuals with special needs are at higher risk of dental disease, including periodontal diseases, and special needs patients have a greater prevalence and incidence of periodontal diseases compared with the rest of the population.

Clinical Relevance to Interdisciplinary Dentistry (IDD)

- Interdisciplinary dentistry is based on proper and adequate communication within the interdisciplinary team, but frequently mentioned problems of communication and difficulties when assemble an interdisciplinary team with a high conflict potential.

- A clear model of IDD is required and training concepts should be incorporated in undergraduate and postgraduate trainings.

- Cooperation between specialties including medical specialties is mandatory for a better result in complex dental situations.

► Conclusion

One must not forget that no matter what types of periodontal therapy are currently available, it does not alter the inherent susceptibility of the host to the periodontal disease even after the treatment because of the genetic factors. Even then success in periodontal therapy lies in long term maintenance of good oral hygiene by both the patient and the clinician and it is heavily influenced by the patients oral hygiene practices. Without compliance to a periodontal maintenance program, attachment gained by any means can be easily lost in the due course.. Interestingly conveying this message to patients can sometimes be more difficult than achieving periodontal regeneration.

Advancing technological developments in inter disciplinary dentistry will probably enforce a certain degree of specialization. Therefore, in the future it will become necessary not to lose contact with other specialties, keep open communication lines

by means of a common language and common concepts, and also maintain communication with other medical specialties. There may well be a greater need to impart these competences in the course of training and post-graduate training.

In India, dental services, unlike other health-care services, are not covered by the principle of universal access. It has only been in the last twenty years that there has been a greater interaction between medicine and dentistry. Various health-care systems around the world may provide public dental services to the young and the disadvantaged, but relatively few provide access to public dental services for the entire population. New policies must be deployed to bring in awareness regarding general issues of poor oral hygiene and its systemic influences.. The insurance schemes and policies should be made accessible to general population especially in the rural sector. Recognizing and acting on the interrelatedness between oral health and overall health helps to protect patients from pathological diseases, such as infective endocarditis, suboptimal glycemic control and deterioration in renal function. As William Osler said “Mouth is the mirror of body”, achieving healthy teeth and its supporting structures should be one among the primary goal of public health care delivery system.

► Reference:

1. Michael G. Newman et al., Margin Placement Guidelines, Carranza's Clinical Periodontology 11th Edition.
2. Lyons, K. M., & Darby, I. (2017). Interdisciplinary periodontics, Periodontology 2000, 74(1), 7–10.
3. Interdisciplinary interface between fixed prosthodontics and periodontics. Periodontology 2000, 74(1), 40–62
4. Antoun, J. S. et al (2017). Effect of orthodontic treatment on the periodontal tissues. Periodontology 2000, 74(1), 140–157.
5. Bennani et al, The periodontal restorative interface: esthetic considerations. Periodontology 2000, 74(1), 74–101.
6. Scarfe WC et al, The emerging role of maxillofacial radiology in the diagnosis and management of patients with complex periodontitis. Periodontol 2000 2017: 74: 116–139.
7. Persson RG. Dental geriatrics and periodontitis. Periodontol 2000 2017: 74: 102–115.
8. Brown L et al, Periodontal disease and the special needs patient. Periodontol 2000 2017: 74: 182–193.
9. Drummond BK et al. Management of periodontal health in children: pediatric dentistry and periodontology interface. Periodontol 2000 2017: 74: 158–167.
10. J Conserv Dent. 2008 Apr;11(2):54-62. The periodontal - endodontic continuum: A review.
11. Slavicek G et al. Concepts, aims, and drawbacks in interdisciplinary dentistry: Results of an international questionnaire. J Interdiscip Dentistry 2013;3:91-102
12. SirishaK,SrinivasMandPratapGoud –Wilkodontics-ANovel Synergy in time to save time. Journal of Clinical and diagnostic research: 2014 Jan;8(1):322-325

Association between periodontal diseases and gestational diabetes mellitus – A review

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Abstract

Chronic inflammatory process underlying periodontal diseases can affect glycemic status. The prevalence of gestational diabetes mellitus is alarmingly high in Kerala. Also, the prevalence of periodontal diseases among pregnant women is more than 55%. Emerging evidence indicates a

probable association between periodontal diseases and gestational diabetes mellitus (GDM). It is plausible that periodontal diseases can exacerbate maternal insulin resistance during gestation. This review briefly addresses the pathophysiology of gestational diabetes mellitus, provides

mechanistic explanation to the probable association between periodontal diseases and gestational diabetes mellitus and scans the current available evidence in this regard.

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► Introduction:

Periodontal disease results from immunoinflammatory responses to microbes present in the subgingival biofilm and are mediated by a complex interplay of cytokines, prostaglandins, chemokines and enzymes. In addition to its localized effect on periodontal tissues resulting in connective tissue, alveolar bone and tooth loss, this chronic inflammatory process can contribute to a systemic inflammatory burden. This effect of periodontal diseases on systemic inflammation underlies the impact of periodontal diseases on other organ systems of the body such as the endocrine, cardiovascular, reproductive and respiratory systems. There is abundant evidence substantiating the bidirectional relationship between periodontitis and diabetes mellitus. Periodontitis is the sixth complication of diabetes mellitus and conversely periodontal diseases can impair insulin sensitivity and thereby affect glucose homeostasis. Recent emerging evidence points out that periodontal diseases may be associated with gestational diabetes mellitus (GDM). Gestational diabetes mellitus is diabetes that is first diagnosed in the second or third trimester of pregnancy that is not clearly either pre-existing type 1 or type 2 diabetes.¹ Advanced maternal age, obesity, micronutrient deficiencies and a family history of

diabetes mellitus are important risk factors for GDM. GDM resolves after delivery. However, women who have had GDM are at increased risk for preeclampsia, development of type 2 diabetes mellitus and cardiovascular diseases. The infant could suffer from macrosomia, shoulder dystocia and birth complications. Over long term, the child is at risk for cardiovascular diseases, type 2 diabetes and obesity.² The prevalence of gestational diabetes mellitus in India varies from 3.8% - 21% in different geographical locations³ and prevalence of GDM in Thiruvananthapuram was 15%.⁴ In India, the prevalence of periodontal diseases among pregnant women was reported to be 56.8%.⁵

Diagnosis of gestational diabetes mellitus

The International Association of Diabetes and Pregnancy Study Group (IADPSG) criteria is now used in the diagnosis of GDM.¹ In this one step approach, a 75-g Oral Glucose tolerance Test (OGTT) is done and plasma glucose is measured when patient is fasting, at 1 and 2 h, at 24–28 weeks of gestation in women not previously diagnosed with overt diabetes. The OGTT should be performed in the morning after an overnight fast of at least 8 h.

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The diagnosis of GDM is made when any of the following plasma glucose values are met or exceeded:

Fasting: 92 mg/dL (5.1 mmol/L)

1 h: 180 mg/dL (10.0 mmol/L)

2 h: 153 mg/dL (8.5 mmol/L)

Gestational diabetes mellitus -Pathophysiology

Healthy pregnancy is associated with some degree of reversible insulin resistance which is especially significant in the second and third trimesters.⁶ Placental hormones such as oestrogen, progesterone, leptin, cortisol, placental lactogen, and placental growth hormone have diabetogenic actions and are released as pregnancy progresses, contributing to the state of insulin resistance and increased blood sugar levels.⁶ Tumour necrosis factor α and other interleukins can also interrupt the insulin signalling pathway and can lead to insulin resistance during normal pregnancy.⁷ The alteration in insulin sensitivity during pregnancy is a physiologic adaptation of the mother to meet the energy requirements of the foetus. Women during gestation have increased energy requirements⁸ and the average glucose utilization by a growing foetus at the 3rd trimester is approximately $33\mu\text{mol/kg/min}$.⁹ Maternal insulin resistance leads to increased utilization of fats than carbohydrates to meet the energy requirements of the mother and spares carbohydrates for the growing foetus. The development of this reversible insulin resistance ensures adequate carbohydrate supply for the rapidly growing foetus.⁹ Glucose is then transported across the placenta to be utilized by the foetus. In pregnant women beta cells of the pancreas undergo hypertrophy, hyperplasia and glucose stimulated insulin secretion to achieve glucose homeostasis. Within a few days after delivery insulin resistance

is reversed. Gestational diabetes mellitus sets in when these normal metabolic adaptations are disrupted or impaired. β -cell dysfunction and chronic insulin resistance underlie more than 80% cases of GDM. Women with GDM have a greater level of insulin resistance than healthy pregnant.¹⁰

Mechanistic explanations to the probable association between periodontal diseases and gestational diabetes mellitus.

Evidence points out that women with gestational diabetes mellitus have higher levels of systemic inflammation as evidenced by increased C-reactive protein levels¹¹ and also elevated serum levels of pro inflammatory cytokines such as tumour necrosis factor- α (TNF- α) and Interleukin-6 (IL-6)¹². These findings suggest the role of both infection and inflammation in the pathogenesis of GDM. In periodontal diseases, bacteria and bacterial products such as lipopolysaccharide from the sub gingival biofilm stimulate the release of pro-inflammatory cytokines such as tumour necrosis factor- α , interleukin-1 β , interleukin-6 and interleukin-8 from the inflamed periodontal tissues.¹³ These inflammatory mediators can enter into systemic circulation and can interfere with insulin signalling, cause insulin antagonism and pancreatic β -cell destruction.^{14,15} The sustained elevation of these cytokines could impair carbohydrate metabolism and glucose tolerance.¹⁴ Together, they may exacerbate insulin resistance in pregnancy.(Figure 1)

Evidence of association between periodontal diseases and gestational diabetes mellitus

Cross sectional studies that have investigated the association between periodontal diseases and gestational diabetes mellitus have yielded mixed results. While one study reported increased prevalence of periodontal diseases among women with GDM,¹⁶ two other studies concluded that there was no statistically significant difference in the prevalence of periodontal diseases among cases with GDM when compared to pregnant women without GDM.^{17,18}

When evidence drawn from case control studies are considered, few studies have reported an increased prevalence of periodontal diseases among cases with GDM than among controls without GDM,^{14,19,20 and 21} however other case control studies in this regard do not support this association.^{22,23}

Dasanayake et al from their prospective cohort study did not report a statistically significant association between periodontal diseases and GDM²⁴ but the results of a recent prospective cohort study by Kumar et al in a North Indian population reported that periodontal disease was significantly associated with GDM.⁵ (adjusted hazard ratio (aHR) of 2.85, 95% CI = 1.47-5.53)

While Esteves et al in their systematic review could not conclusively attribute a positive association between periodontal

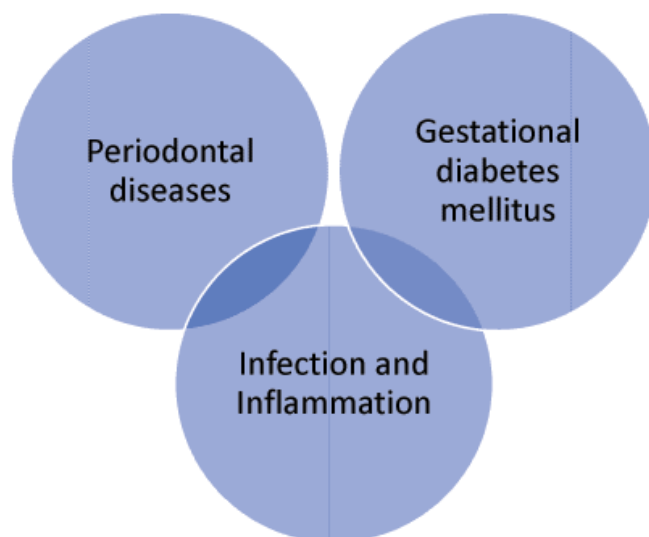


Fig 1: Periodontal diseases and gestational diabetes mellitus-A probable association

diseases and GDM,²⁵ the most recent systematic review and meta-analysis by Abariga et al reported that among pregnant women, periodontitis was associated with an increased risk of GDM when compared to women without periodontitis.²⁶

► Conclusion:

Periodontal diseases and gestational diabetes mellitus may be linked by underlying infectious and inflammatory mechanisms. Evidence regarding their association is mixed and inconclusive. Considering the higher prevalence of gestational diabetes mellitus in our state, future prospective and interventional studies with robust designs exploring the associational and causal relationship between periodontal diseases and gestational diabetes mellitus could have important public health implications.

► References:

1. American Diabetes Association Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes—2018. *Diabetes Care*. 2018;41: S13–S27.
2. Plows JF, Stanley JL, Baker PN, Reynolds CM, Vickers MH. The Pathophysiology of Gestational Diabetes Mellitus. *Int J Mol Sci*. 2018;19(11):3342.
3. Seshiah V, Banerjee S, Balaji V, Muruganathan A, Das AK; Diabetes Consensus Group. Consensus evidence-based guidelines for management of gestational diabetes mellitus in India. *J Assoc Physicians India*. 2014;62(7 Suppl):55-62
4. Seshiah, V., Balaji, V., Madhuri, S.B., Sanjeevi, C.B., Green, A. Gestational Diabetes Mellitus in India. *J Assoc Physicians India*. 2004; 52, 707–711.
5. Kumar A, Sharma DS, Verma M, Lamba AK, Gupta MM, Sharma S, Perumal V. Association between periodontal disease and gestational diabetes mellitus-A prospective cohort study. *J Clin Periodontol*. 2018;45(8):920-931.
6. Sonagra AD, Biradar SM, K D, Murthy D S J. Normal pregnancy- a state of insulin resistance. *J Clin Diagn Res*. 2014;8(11):CC01–CC3.
7. Kirwan J, De Mouzon S, Lepercq J, Challier J, Presley L, Friedman J, et al. TNF- α Is a Predictor of IR in Human Pregnancy. *Diabetes*. 2002; 51:2207–13.
8. Catalano P.M., Huston L., Amini S.B., Kalhan S.C. Longitudinal changes in glucose metabolism during pregnancy in obese women with normal glucose tolerance and gestational diabetes mellitus. *Am. J. Obstet. Gynecol*. 1999; 180:903–916.
9. Sivan E, Homko C, Chen X, Reece E, Boden G. Effect of insulin on fat metabolism during and after normal pregnancy. *Diabetes*. 1999; 48:834–38.
10. Buchanan T.A., Xiang A.H. Gestational diabetes mellitus. *J. Clin. Investig*. 2005; 115:485–491
11. Leipold H, Worda C, Gruber CJ, Prikozovich T, Wagner O, Kautzky-Willer A. Gestational diabetes mellitus is associated with increased C-reactive protein concentrations in the third but not second trimester. *Eur J Clin Invest* 2005; 35:752–757.
12. Atègbo JM, Grissa O, Yessoufou A, et al. Modulation of adipokines and cytokines in gestational diabetes and macrosomia. *J Clin Endocrinol Metab* 2006; 91:4137-4143.
13. Kinane DF. Causation and pathogenesis of periodontal disease. *Periodontol* 2000 2001; 25:8-20.
14. Chokwiriyaichit A, Dasanayake AP, Suwannarong W, et al. Periodontitis and gestational diabetes mellitus in non-smoking females. *J Periodontol* 2013; 84:857-862.
15. Moller DE. Potential role of TNF-alpha in the pathogenesis of insulin resistance and type 2 diabetes. *Trends Endocrinol Metab*. 2000;11(6):212–217.
16. Habib FA. Evaluation of periodontal status among Saudi females with gestational diabetes and its relation to glucose and lipid homeostasis in ohud hospital, Al madina Al-munwarrah. *Int J Health Sci* 2009; 3:143-154.
17. Bullon P, Jaramillo R, Santos-Garcia R, et al. Relation of periodontitis and metabolic syndrome with gestational glucose metabolism disorder. *J Periodontol* 2014;85: e1-e8.
18. Novak KF, Taylor GW, Dawson DR, Ferguson JE, Novak J. Periodontitis and gestational diabetes mellitus: exploring the link in NHANES III. *J Public Health Dent* 2006; 66:163-168.
19. Xiong X, Elkind-Hirsch KE, Vastardis S, Delarosa RL, Pridjian G, Buekens P. Periodontal disease is associated with gestational diabetes mellitus: a case-control study. *J Periodontol*. 2009;80(11):1742–1749.
20. Ruiz DR, Romito GA, Dib SA. Periodontal disease in gestational and type I diabetes mellitus pregnant women. *Oral Dis* 2011; 17:515-521.
21. Bagis N, Bostanci HS. The relationship between gestational diabetes mellitus and periodontal health: a case-control study. *Int J Exp Dent Sci*. 2013;2(2):71.
22. Esteves Lima RP, Miranda Cota LO, Costa FO. Association between periodontitis and gestational diabetes mellitus: a case-control study. *J Periodontol* 2013; 84:1257-1265.
23. Mishra P, Gita B, Chandrasekaran S. Assessment of periodontal status in association with gestational diabetes mellitus: a case-control study. *J Diab Metab*. 2014;5(467):2.
24. Dasanayake AP, Chhun N, Tanner ACR, Craig RG, Lee MJ, Moore AF, Norman RG. Periodontal pathogens and gestational diabetes mellitus. *J Dent Res*. 2008;87(4):328–333.
25. Esteves Lima RP, Cyrino RM, de Carvalho DB, Oliveira da Silveira J, Martins CC, Miranda Cota LO, Costa FO. Association between periodontitis and gestational diabetes mellitus: systematic review and meta-analysis. *J Periodontol*. 2016;87(1):48–57.
26. Abariga SA, Whitcomb BW. Periodontitis and gestational diabetes mellitus: a systematic review and meta-analysis of observational studies. *BMC Pregnancy Childbirth*. 2016;16(1):344.

The Art of Remineralization: An out look

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Abstract

Dental caries is a highly prevalent chronic public health disease. The goal of modern dentistry is to manage non-cavitated carious lesions non-invasively through remineralization in an attempt to prevent disease progression, and to improve strength, esthetics, and function of teeth. There is a recent outburst of alternate

non-fluoride remineralizing agents which may serve as alternative and also adjunct for preventing, arresting or even reversing dental caries. This paper reviews the various non-fluoride remineralizing agents that may hold promising results in prevention of dental caries in future.

Key words: Enamel caries, Remineralization, Non-fluoride remineralization, Fluoride booster

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► Introduction

Owing to its globally high prevalence, dental caries is now considered as a 'pandemic' disease characterized by a high percentage of untreated carious teeth having a significant impact in terms of pain, discomfort, functional limitations and on quality of life of the individual.¹ The non-invasive treatment of early lesions by remineralisation has the potential to be a major advance in the clinical management of the disease.

Demineralization –Remineralization Cycle

Demineralization occurs at a low pH when the oral environment is under saturated with mineral ions, relative to a tooth's mineral content. The enamel crystal, which consists of carbonated apatite, is dissolved by organic acids (lactic and acetic) that are produced by the cellular action of plaque bacteria in the presence of dietary carbohydrates.² Remineralisation is the natural repair process for non cavitated lesions, and relies on calcium and phosphate ions assisted by fluoride to rebuild a new surface on existing crystal remnants in subsurface lesions remaining after demineralization. These remineralized crystals are less acid soluble than the original mineral.² Demineralization and remineralisation occur many times during the day and it is the balance between these two processes over time that influences whether a caries lesion will progress, reverse or stay the same.³ Strategies to prevent caries should aim to limit

exposure to demineralizing factors, where possible, and also to promote remineralisation.⁴

Reasons to seek alternatives to fluorides

Fluoride is highly effective on smooth surface caries, but its effect is limited on pit and fissure caries.^{5,6} For every two fluoride ions, 10 calcium ions and six phosphate ions are required to form one unit cell of fluorapatite. Hence on topical application of fluoride ions, the availability of calcium and phosphate ions can be the limiting factor for net enamel remineralization to occur and this is highly exacerbated under xerostomic conditions.⁷ A high-fluoride strategy cannot be followed to avoid the potential for adverse effects (e.g., fluorosis, Neurotoxicity, Fluoride syndrome) due to overexposure to fluoride.⁵ The anti-fluoride lobby which is mounting pressure poses certain legal limitations to the use of fluorides, so non-fluoride remineralising agents are mostly preferred.⁶

Properties of remineralising agents

According to Walsh et al., the requirements for an ideal remineralizing agent are:

- Should deliver calcium and phosphate into the subsurface.
- Should not deliver any excess of calcium.
- Should not favor calculus formation.

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- Should work at an acidic pH so as to stop demineralization during a carious attack.
- Should work in xerostomic patients also, as saliva cannot effectively stop the carious process.
- Should be able to boost the remineralizing properties of saliva.
- The novel materials should be able to show some benefits over fluoride.^{8,9}

Non-Fluoride Enamel Remineralizing Systems Classification¹⁰

1. Biomimetic Regenerative Systems.

- a) Dentin phosphoprotein 8DSS peptides
- b) P11-4 peptides
- c) Leucine-rich amelogenin
- d) Poly (amido amine) dendrimers
- e) Electrically accelerated and enhanced remineralization
- f) Nanohydroxyapatite

2. Approaches That Synergize Fluoride Efficacy

- a) Calcium-phosphate systems
 - Stabilized calcium phosphates – Casein phosphopeptide-amorphous calciumphosphate
 - Crystalline calcium phosphates – Functionalized β -tricalcium phosphate, Calcium sodium phosphosilicate
 - Unstabilized calcium phosphates – Amorphous calcium phosphate
- b) Polyphosphate systems– Sodium trimetaphosphate, Calcium glycerophosphate, Sodium hexametaphosphate
- c) Natural products- Gallachinensis, Hesperidin, Gumarabic

Biomimetic Remineralization

Dentine Phosphoprotein-Derived 8DSS Peptides

Dentine phosphoprotein (DPP) is the most abundant non-collagenous extracellular matrix component in dentine and is known to play a critical role in tooth mineralization.¹¹ Among the DPP-derived peptides, the octuplet repeats of aspartateserine-serine (8DSS) are the most active in promoting biomineralization.¹² 8DSS peptides have essentially two mineral-binding surfaces and can strongly bind not only to free Ca^{2+} and PO_4^{3-} ions, but also to the HA surface. 8DSS peptides thus appear to have a dual mechanism in the mediation of biologically directed mineral deposition. First, they limit the dissolution of Ca^{2+} and PO_4^{3-} ions from demineralized dentine, and second, they promote the capture of these ions to form new mineral deposits on demineralized enamel.¹³ The newly grown mineral had uniform deposition of small apatite crystals with significantly improved properties such as reduced surface roughness, and higher hardness and elastic modulus.¹⁴

Self-Assembling P11-4 Peptides

It is a monomeric peptide consisting of 11 amino acids called P11-4. This rationally designed peptide self-assembles into hierarchical 3-dimensional fibrillar scaffolds in response to local conditions such as high ionic strength and acidic pH found in the lesion body.¹⁵ Analysis of in vitro data showed that the presence of P11-4 fibres in the lesion body resulted in faster HA formation, yielding tangentially arranged needle-shaped crystals, with increased microhardness of the remineralized subsurface.¹⁶ The low viscosity isotropic P11-4 when applied on the initial carious lesion rapidly diffuses into the lesion body, where it transforms to an elastomeric nematic gel in the presence of cations and $\text{pH} < 7.4$, leading to the 3-dimensional fibre matrix assembly and subsequent biomineralization of the lesion.¹⁷

Amelogenin

The amelogenin-rich enamel organic matrix plays a critical role in regulating the growth, shape, and arrangement of HA crystals during enamel mineralization.¹⁸ Recombinant porcine amelogenin (rP172) was found to stabilize calcium phosphate clusters and promote the growth of hierarchically arranged enamel crystals on acid-etched lesions, significantly improving its hardness and elastic modulus.¹⁹ This biomimetic regrowth of HA crystals also generated a robust interface between the newly formed layer and native enamel ensuring efficacy and durability of restorations. A disadvantage of amelogenin-mediated enamel regeneration is that not only is the protein difficult to extract and store, but the growth of the repaired enamel layer also takes an extended amount of time, making it potentially unsuitable for clinical use.²⁰

Poly (Amido Amine) Dendrimers (PAMAM)

PAMAM are highly branched polymers characterized by the presence of internal cavities, a number of reactive end groups, and a well-defined size and shape.²¹ These amelogenin-inspired dendrimers have been referred to as “artificial proteins” as they can mimic the functions of organic matrices in modulating the biomineralization of tooth enamel. Several in vitro studies have demonstrated that amphiphilic, carboxyl-terminated, and phosphateterminated PAMAM dendrimers exhibited a strong tendency to self-assemble into hierarchical enamel crystal structures.²¹

Electrically Accelerated and Enhanced Remineralization(EAER)

EAER is a recently developed remineralization technology targeted at initial and moderate enamel lesions with the treatment objectives of preserving all healthy tissue, restoring the full depth of the caries lesion, and improving mechanical properties of the treated enamel. It utilizes iontophoresis to accelerate the flow of remineralizing ions into the deepest part

of the subsurface caries lesion. This creates an environment that favours remineralization of the lesion that then matures to give the repaired lesion optimal hardness and mineral density.²²

Nano-hydroxyapatite

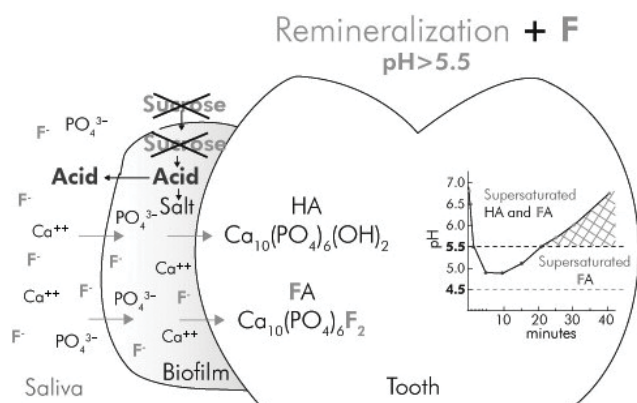
The nano-sized particles can strongly bind to enamel surfaces and with fragments of plaque and bacteria. The mechanism of nHA biomimetic function is not clear with some researchers suggesting that it promotes remineralization through the creation of a new layer of synthetic enamel around the tooth or by depositing apatite nanoparticles in the enamel defects.²³ However, others have proposed that nHA acts as calcium phosphate reservoir maintaining a state of super saturation with respect to enamel minerals, thereby inhibiting demineralization and enhancing remineralization.

FLUORIDE BOOSTERS

A. CALCIUM PHOSPHATE SYSTEMS

Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP)

By selectively inhibiting streptococcal adhesion to teeth, it can modulate the microbial composition of dental plaque and favor establishment of less cariogenic species such as oral actinomyces. This could also control acid formation (buffering) in dental plaque, in turn reducing hydroxyapatite dissolution from tooth enamel. It can be incorporated into the pellicle in exchange for albumin, and thus inhibits the adherence of *Streptococcus mutans* and *Streptococcus sobrinus*, causing both neutralization and enhancement of remineralization.²⁴⁻²⁶ The Recaldent technology was developed by Prof. Eric Reynolds of the University of Melbourne. CPP-ACP has been trademarked Recaldent and has been launched in sugarless chewing gum and confectionery. More recently, a sugar-free, water-based cream containing RECALDENT™ (CPP-ACP) (GC Tooth Mousse/Prospec MI Paste) has been made available to dental professionals.²⁷



Functionalized Tricalcium Phosphate (fTCP)

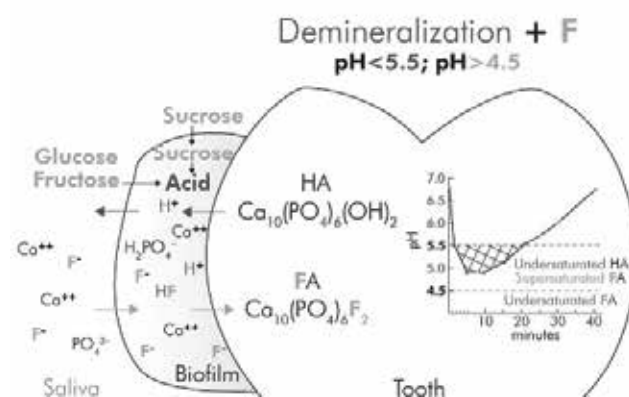
fTCP is produced by milling TCP with sodium lauryl sulfate. It stabilizes fluoride in solution and maintains high concentration of calcium, phosphate and fluoride in white spot lesions. Inclusion of the functionalized TCP ingredient in NaF formulations has been shown to produce stronger, more acid-resistant mineral relative to fluoride alone in laboratory and clinical evaluations. fTCP has been shown to have remineralizing effects in both in vitro and in situ studies.^{28,29} A novel 5,000 ppm fluoride dentifrice Clinpro® 5000, was recently introduced by 3M ESPE. This 1.1% NaF silica containing paste containing an innovative functionalized tricalcium phosphate (fTCP) ingredient that, when evaluated in development formulations, has been shown to boost remineralization performance relative to fluoride-only systems.³⁰

Calcium Sodium Phosphosilicate.

It is a bioactive glass material originally developed as a biocompatible bone regenerative agent. When introduced into the aqueous oral environment, it releases Na^+ , Ca^{2+} , and PO_4^{3-} ions, which then interact with saliva and deposit a crystalline hydroxyl carbonate apatite layer that is structurally and chemically similar to tooth mineral.³¹ It was initially used for the treatment of dentine hypersensitivity but there have been suggestions it could be useful for enamel remineralization too. However, evidence from in vitro and in situ data is weak and contradictory, while there are no clinical data from RCTs to prove its remineralizing efficacy.³²

Amorphous calcium phosphate (ACP)

The ACP technology was developed by Dr. Ming S. Tung. In 1999, ACP was incorporated into toothpaste called Enamelon and later reintroduced in 2004 in Enamel Care toothpaste by Church and Dwight.⁵ ACP is the initial solid phase that precipitates from a highly supersaturated calcium phosphate solution, and when applied topically, it hydrolyses under physiological



temperatures at a pH of 7.4 to form octacalcium phosphate and an intermediate, and then surface apatite. This is purely a surface phenomenon, and fundamentally different from remineralisation of enamel subsurface lesions, which requires penetration of ions into the enamel surface. It is available as Discus Dental's Nite White Bleaching Gel and Premier Dental's Enamel Pro Polishing Paste.

B. POLYPHOSPHATE SYSTEM

Sodium Trimetaphosphate (STMP)

STMP is a condensed inorganic phosphate that is able to strongly bind to phosphate sites on enamel surface and remain adsorbed for a longer time compared to other phosphates.³³ This leads to the formation of a protective layer on the enamel surface which does not seem to hinder the diffusion of Ca^{2+} and F^{-} ions into the enamel. In situ models have shown that supplementation of a low-fluoride product with STMP produced similar remineralization effects to a 1,100-ppm fluoride formulation.

C. NATURAL PRODUCTS

Gallachinensis, a leaf gall produced by parasitic aphids, which has been found to be effective in inhibiting demineralization, enhancing remineralization, and increasing the efficacy of fluoride. G.chinensis remineralization is believed to be mediated through different polyphenol compounds that act as Ca^{2+} ion carriers into the lesion body. Hesperidin, a citrus flavonoid, and gum arabic, an Acacia exudate, are other natural products that have been found to suppress acid dependent demineralization and boost remineralization even under fluoride-free conditions.³⁴

OTHER NON-FLUORIDE REMINERALISING AGENTS

Resin Infiltration

The concept of caries infiltration was first developed at the Charité Berlin and the University of Kiel as a micro-invasive approach for the management of smooth surface and proximal non-cavitated caries lesions.³⁵ The principal of resin infiltration is to perfuse the porous enamel with resin by capillary action. This aims to arrest lesion progression by occluding the micro porosities that provide diffusion pathways for the acids and dissolved materials.³⁶ It is an effective method to arrest the progression of non-cavitated proximal caries lesions extended radiographically at maximum to the outer third of dentin in combination with non-operative measures compared to non-operative measures applied alone. It is marketed under the name Icon® (DMG America Company, Englewood, NJ).

Xylitol carrier

Xylitol is one of the non-sugar alcohol sweetener that has been shown to have non - cariogenic as well as cariostatic effects. The use of chewing gum carrying xylitol increases salivary

flow rate and enhances the protective properties of saliva. A novel method of delivering remineralizing ions (calcium and phosphate) in combination with xylitol has been developed using a NaF varnish (Embrace Varnish, Pulpdent). This varnish contains calcium and phosphate salts that have been nano-coated with xylitol. The xylitol coating prevents early reaction and produces a sustained release of the remineralizing ions. Saliva exposure dissolves the xylitol and frees the calcium and phosphate ions. They then react with the fluoride in the varnish to form protective fluorapatite on the teeth.

Grape Seed Extract

Proanthocyanidin (PA), which is a bioflavonoid-containing benzene-pyran-phenolic acid molecular nucleus, accelerates the conversion of soluble collagen to insoluble collagen during development and increases collagen synthesis. Grape seed extract has a high PA content. PA-treated collagen matrices are non-toxic and inhibit the enzymatic activity of glucosyltransferase, F-ATPase and amylase. glucosyltransferases, which are produced by S. mutans that polymerize the glucosyl moiety from sucrose and starch carbohydrates into glucans and in turn inhibits caries.

► Conclusion

In the last few decades, advances in technologies, changes in lifestyle, modifications in the diet, and longer life expectancy are some of the many factors which have affected the health and esthetics of tooth enamel and dentin. With a clearer understanding of the implementation of these remineralizing agents and new technologies accessible to dentists, we can create a more favorable relationship in which remineralization occurs more often than demineralization.

► References

1. Edelstein BL. The dental caries pandemic and disparities problem. BMC Oral Health 2006; 6(Suppl 1):S2.
2. Featherstone JD. Dental caries: a dynamic disease process. Aust Dent J. 2008; 53(3):286-91.
3. Selwitz RH, Ismail AI, Pitts NB. Dental caries. Lancet 2007; 369(9555):51-9.
4. Reynolds EC. Calcium phosphate-based remineralization systems: scientific evidence? Aust Dent J 2008;53(3):268- 73.
5. Goswami M, Saha S, Chaitra TR. Latest developments in non-fluoridated remineralizing technologies. J Indian SocPedodPrev Dent 2012; 30:2-6.
6. Chhabra KG, Shetty PJ, Prasad KVV, Mendon CS, Kalyanpur R. The beyond measures: Non fluoride preventive measures for dental caries. J Int Oral Health 2011; 3:1-8.
7. Reynolds EC. Calcium phosphate-based remineralization systems: scientific evidence?.Aust Dent J 2008; 53(3):26
8. Walsh J. Contemporary technologies for remineralisation therapies: A review. International Dentistry SA, 2009, 11(6) 6-16.
9. Zero DT. Dentifrices, mouthwashes, and remineralization/caries arrestment strategies.BMC Oral Health. 2006;6Suppl 1(Suppl 1):S9
10. NebuPhilip, State of the Art Enamel Remineralization Systems: The Next Frontier in Caries Management, Caries Research, 2019

11. Alkilzy M, Tarabaih A, Splieth CH: Efficacy, clinical applicability and safety of Curodont™ Repair in children with early occlusal caries. *Caries Res* 2015; 49: 311.
12. Yarbrough DK, Hagerman E, Eckert R, He J, Choi H, Cao N, Le K, Hedger J, Qi F, Anderson M, Rutherford B, Wu B, Tetradis S, Shi W: Specific binding and mineralization of calcified surfaces by small peptides. *Calcif Tissue Int* 2010; 86: 58–66.
13. Yang Y, Lv XP, Shi W, Li JY, Li DX, Zhou XD, Zhang LL: 8DSS-promoted remineralization of initial enamel caries in vitro. *J Dent Res* 2014; 93: 520–524.
14. Yang Y, Lv X, Shi W, Zhou X, Li J, Zhang L: Synergistic inhibition of enamel demineralization by peptide 8DSS and fluoride. *Caries Res* 2016; 50: 32–39.
15. Kirkham J, Firth A, Vernals D, Boden N, Robinson C, Shore RC, Brookes SJ, Aggeli A: Selfassembling peptide scaffolds promote enamel remineralization. *J Dent Res* 2007; 86: 426–430.
16. Schmidlin P, Zobrist K, Attin T, Wegehaupt F: In vitro re-hardening of artificial enamel caries lesions using enamel matrix proteins or selfassembling peptides. *J Appl Oral Sci* 2016; 24: 31–36.
17. Brunton PA, Davies RP, Burke JL, Smith A, Aggeli A, Brookes SJ, Kirkham J: Treatment of early caries lesions using biomimetic self-assembling peptides – a clinical safety trial. *Br Dent J* 2013; 215:E6.
18. Moradian-Oldak J: Protein-mediated enamel mineralization. *Front Biosci (Landmark Ed)* 2012; 17: 1996–2023.
19. Ruan Q, Moradian-Oldak J: Amelogenin and enamel biomimetics. *J Mater Chem B* 2015; 3: 3112–3129.
20. Kwak SY, Litman A, Margolis HC, Yamakoshi Y, Simmer JP: Biomimetic enamel regeneration mediated by leucine-rich amelogenin peptide. *J Dent Res* 2017; 96: 524–530.
21. Chen L, Liang K, Li J, Wu D, Zhou X, Li J: Regeneration of biomimetic hydroxyapatite on etched human enamel by anionic PAMAM template in vitro. *Arch Oral Biol* 2013; 58: 975–980.
22. Pitts NB, Wright JP: Reminova and EAER: keeping enamel whole through caries remineralization. *Adv Dent Res* 2018; 29: 48–54.
23. Pepla E, Besharat LK, Palaia G, Tenore G, Migliau G: Nano-hydroxyapatite and its applications in preventive, restorative and regenerative dentistry: a review of literature. *Ann Stomatol (Roma)* 2014; 5: 108–114.
24. Rose RK: Effects of an anticariogenic casein phosphopeptide on Ca diffusion in streptococcal model dental plaques. *Arch Oral Biol* 2000; 45: 569–75.
25. Reynolds EC: Calcium phosphate-based remineralization systems: Scientific evidence? *Aust Dent J* 2008; 53: 268–73.
26. Ranjitkar S, Rodriguez JM, Kaidonis JA, Richards LC, Townsend GC, Bartlett DW: The effect of caseinphosphopeptide- amorphous calcium phosphate on erosive enamel and dentin wear by toothbrush abrasion. *J Dent* 2009; 37: 250–4.
27. Manton DJ, Cai F, Yuan Y, Walker GD, Cochrane NJ, Reynolds C, et al. Effect of casein phosphopeptide –amorphous calcium phosphate added to acidic beverages on enamel erosion in vitro. *Aust Dent J* 2010; 55: 275–9.
28. Karlinsey RL, Mackey AC, Stookey GK, et al. In vitro assessments of experimental NaF dentifrices containing a prospective calcium phosphate technology. *Am J Dent.* 2009; 22 3: 180–184.
29. Mensinkai PK, Ccahuana-Vasquez RA, Chedjieu I, et al. In situ remineralization of white-spot enamel lesions by 500 and 1,100 ppm F dentifrices. *Clin Oral Investig.* 2012; 16 (4): 1007–1014.
30. Rakesh M., Nikhil R. Tanya T. Remineralizing Agents: A Comprehensive Review. *Int J ClinPrev Dent* 2017; 13(1): 1–4.
31. Burwell AK, Litkowski LJ, Greenspan DC: Calcium sodium phosphosilicate (NovaMin®): remineralization potential. *Adv Dent Res* 2009; 21: 35–39.
32. Parkinson CR, Siddiqi M, Mason S, Lippert F, Hara AT, Zero DT: Anticaries potential of a sodium monofluorophosphate dentifrice containing calcium sodium phosphosilicate: exploratory in situ randomized trial. *Caries Res* 2017; 51: 170–178.
33. McGaughey C, Stowell EC: Effects of polyphosphates on the solubility and mineralization of HA: relevance to a rationale for anticaries activity. *J Dent Res* 1977; 56: 579–587.
34. Islam SM, Hiraishi N, Nassar M, Sono R, Otsuki M, Takatsura T, Yiu C, Tagami J: In vitro effect of hesperidin on root dentin collagen and de/remineralization. *Dent Mater J* 2012; 31: 362–367.
35. Kugel G, Arsenault P, Papas A. Treatment modalities for caries management, including a new resin infiltration system. *CompendContinEduc Dent.* 2009; 30(3): 1– 10 49.
36. Meyer-Lueckel H, Paris S. Progression of artificial enamel caries lesions after infiltration with experimental light curing resins. *Caries res.* 2008; 42(2): 117–124.

Obstructive Sleep Apnea - An Overview

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Abstract

Obstructive Sleep Apnea (OSA) found more common in children than previously. OSA consists of a constellation of symptoms which can vary with age. Adenotonsillar hypertrophy remains the most common cause of the condition in children. There has been a surge in our understanding

of the condition due to advance in diagnostic methods such as nocturnal polysomnography and pulse oximetry. This paper provides an insight into the underlying mechanisms of Obstructive Sleep Apnea in children, current diagnostic methods and the treatment options with a

brief on the dentist's role in its identification and management.

Keywords: Obstructive Sleep Apnea, Polysomnography, Adenotonsillar Hypertrophy Oral appliance therapy.

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► Introduction

Sleep apnea, and particularly obstructive sleep apnea, is a common disorder that is characterized by repetitive partial or complete cessation of air flow, associated with oxyhemoglobin desaturation and increased effort to breathe. It takes its name from the Greek word apnea, which means "without breath." Sleep apnea means "cessation of breath".¹ Because individuals with narrow airways and/or craniofacial anomalies may have increased risk for obstructive sleep apnea/hypopnea syndrome (OSAS), dentistry can play a pivotal role in the identification and possible treatment of patients with this syndrome. (Fig 1)

The syndrome is now recognized as being very prevalent, and current epidemiologic data indicates that sleep apnea syndrome is second only to asthma in the prevalence league table of chronic respiratory disorders.¹⁰ Furthermore, there is an increasing evidence that sleep apnea syndrome is associated with

a considerable number of adverse sequelae, both behavioral and physical. Behavioral consequences include daytime sleepiness, impaired concentration, and neuropsychological dysfunction, whereas physical consequences include cardiovascular disorders, particularly hypertension.²⁻⁵ The combination of acute and chronic hemodynamic effects in OSAS have been associated with increased risk of myocardial infarction, cerebrovascular accidents, hypertension, congestive heart failure, and motor vehicle crashes.^{6,10-18}

Prevalence

OSA can occur in any age group, but prevalence increases between middle and older age. OSA with resulting daytime sleepiness occurs in at least 4% of men and 2% of women. About 80% to 90% of adults with OSA remain undiagnosed. OSA occurs in about 2% of children and is most common at preschool ages.¹¹⁻¹⁴

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► Pathophysiology of Obstructive Sleep Apnea

Normal sleep architecture

Normal sleep architecture is characterized by two forms. These forms are referred to as non-rapid eye movement (NREM) and rapid eye movement (REM). REM sleep is also known as dream sleep. These sleep states alternate throughout the sleep cycle.

Physiology of the Upper airway

In healthy patients, as the chest muscles expand a negative pressure is created which draws air into the lungs. This negative pressure extends from within the lungs to the upper airways, Hence the airway is under negative pressure during inspiration. When unimpeded, air passes reasonably freely through the upper airway, although there is some minor resistance to the airflow by friction against the walls of the pharynx. Along the way, the airflow and negative pressure may influence multiple anatomic structures including the dorsal surface and base of the tongue, uvula, nasal structures, lateral and posterior walls of the pharynx, adenoids, and tonsils.¹⁹

Pathogenesis of OSA

In normal conditions, the muscles of the upper part of the throat keep the airway open to allow air to flow into the lungs. These muscles usually relax during sleep, but the passage remains open enough to permit the flow of air.

OSA is caused by repetitive upper airway obstruction during sleep as a result of narrowing of the respiratory passages. Patients with the disorder are most often overweight, with associated peripharyngeal fat infiltration and or increased size of the soft palate and tongue.

Some patients have a diminutive jaw that results in insufficient room for the tongue. These anatomic abnormalities

decrease the cross-sectional area of the upper airway. Decreased airway muscle tone during sleep and the pull of gravity in the supine position further decrease airway size, thereby impeding air flow during respiration.

Initially, partial obstruction may occur and lead to snoring. As tissues collapse further, the airway may become completely obstructed. Whether the obstruction is incomplete (hypopnoea) or total (apnoea), the patient struggles to breathe and is aroused from sleep. Often, arousals are only partial and are unrecognized by the patient, even if they occur hundreds of times a night. The obstructive episodes are often associated with a reduction in oxyhaemoglobin saturation. With each arousal event, the muscle tone of the tongue and airway tissues increases. This increase in tone alleviates the obstruction and terminates the apnoeic episode. Soon after the patient falls back to sleep, the tongue and soft tissues again relax, with consequent complete or partial obstruction and loud snoring. (Fig-2)

Predisposing factors²⁰ (Fig 3)

Symptoms of obstructive sleep apnea (fig 4)

Effects of obstructive sleep apnea²¹⁻²³ (fig 5)

Diagnosis of obstructive sleep apnea²⁴⁻²⁸

The frequency of pauses in breathing on an hourly basis is used for assessment of the severity of the obstructive sleep apnea/hypopnea syndrome and it is called the apnea/hypopnea index (AHI) or the respiratory disturbance index (RDI). (Fig 6)

Subjective assessment of sleepiness

Individuals with this disorder may present with non-specific symptoms such as poor concentration, irritability, personality changes and family problems.

The Epworth Sleepiness Scale (ESS) is a validated method used to assess the probability of falling asleep. The score

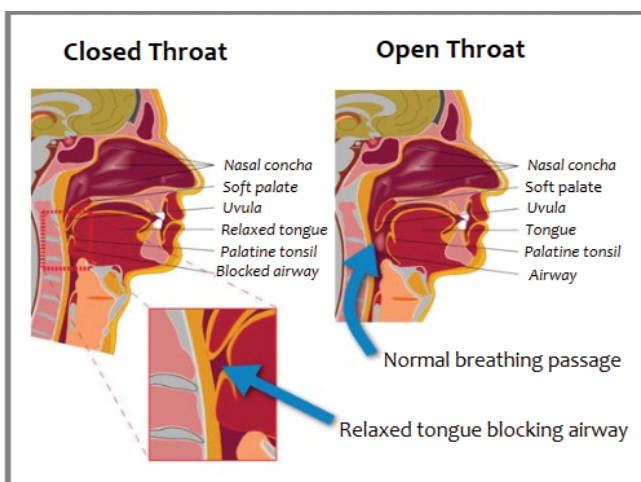


Fig. 1

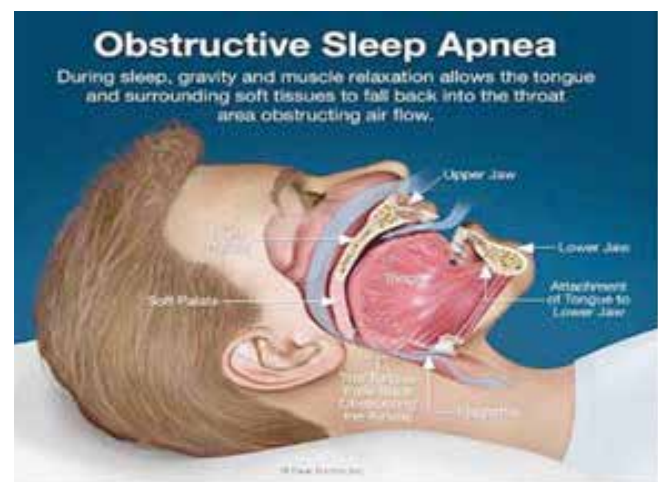


Fig. 2

subdivide the patients clinically into 4 categories. (Fig 7)

Objective assessment of sleepiness

The Multiple Sleep Latency Test (MSLT) is used to measure the time to fall asleep (using EEG criteria). This is performed in a darkroom on at least four separate occasions across the day. This period of time is called as sleep latency.

The Maintenance of Wakefulness Test (MWT) where the subject is instructed to stay awake, rather than to fall asleep. This test is terminated at 40 minutes and a result of <20 minutes is regarded as abnormal.

The OSLER Test, a variant of the MWT, uses a behavioural assessment of sleep onset rather than one based on EEG, gives similar results but requires less technical input.²⁹⁻³¹

Physical examination

Weight and height are noted at the first clinic visit. Changes in height and weight are observed at all subsequent visits as approx 50% of patients with OSAHS are obese (BMI >30 kg/m²).

- Circumference of neck are measured as patients with OSAHS often have increased neck circumference >17 (43 cm).
- Visually inspect for retrognathic mandible.
- Assess patency of nasal airway.
- Upper airway obstruction is assessed using indirect laryngoscopy if possible. Inspect the tongue for macroglossia.
- Assess dentition for the presence or absence of teeth.
- Assess pharynx for size of tonsil, appearance of uvula and size of lumen.
- Measure blood pressure.
- Perform respiratory, cardiovascular and neurological examination for detection of any disease such as cor pulmonale, deformity in chest wall and myopathies.

Tools used in diagnosis of obstructive sleep apnea^{32,33}

Polysomnography

Polysomnography records patterns of sleeping and breathing together. PSG is performed overnight at a sleep centre with the help of a technician and a standard PSG typically consists of EEG, electromyogram, electro-oculogram, respiratory airflow, thoraco-abdominal movement and oxygen saturation tracings

S. No.	Predisposing factors of OSAHS
1	Obesity
2	Presence of structural abnormalities that causes upper airway obstruction
3	Increasing age
4	Male gender
5	Smoking and alcohol consumption
6	Sedatives
7	Retrognathic mandible
8	Adenoids
9	Micrognathia
10	Enlarged tonsils
11	Enlarged tongue

Fig. 3

S. No.	Symptoms of OSAHS
1	Sleeping
2	Apneic pauses (i.e., choking, gasping, snoring during the night)
3	Restless sleep and increased body movements
4	Bruxism (nocturnal tooth grinding)
5	Nocturnal and daytime enuresis
6	Neck hyper extension
7	Growth failure restriction
8	Mouth breathing due to dryness in mouth
9	Chronic nasal congestion
10	Walking during sleep
11	Obesity
12	Mouth breathing due to dryness in mouth
13	Fatigue
14	Mood changes: irritability, frustration, impatience, depression, anxiety
15	Aggression and hyperactivity
16	Poor school performance
17	Poor concentration, and distraction
18	Infraorbital venous congestion

Fig. 4

S. No.	Effects of OSAHS
1	Fluctuations in oxygen levels
2	Increased heart rate
3	Chronic elevation in daytime blood pressure
4	Increased chances of stroke
5	Heart disease
6	Impairment in glucose tolerance and insulin resistance
7	Impaired concentration
8	Mood changes
9	Increased motor vehicle accidents
10	Disturbed sleep of the bed partner

Fig. 5

S. No.	Forms of OSAHS	AHI Score
1	Mild	AHI 5-14/hr
2	Moderate	AHI 15-30/hr
3	Severe	AHI >30/hr
4	Very severe	AHI >40/hr

Fig. 6

S. No.	Types of Sleepiness	ESS Score
1	Normal range	ESS <11
2	mild subjective daytime sleepiness	ESS =11
3	moderate subjective daytime sleepiness	ESS =16
4	Severe subjective daytime sleepiness	ESS >18

Fig. 7



Fig 8: Tongue repositioning device



Fig 9 : Mandibular advancement appliances

(oximetry). Polysomnography requires about 30-60 min set up time before sleep and about 30 minutes detachment time in the morning. Staff should be present for at least ten hours overnight to perform and monitor this test.

Oximetry

Cheap recording pulse oximeters are readily available; therefore oximetry is used as the first screening tool for OSAHS. These are spectrophometric devices that are used for the detection and calculation of the differential absorption of light by presence of oxygenated and deoxygenated haemoglobin in blood. This is a method for detection of the blood oxygen saturation.

Treatment of obstructive sleep apnea³³⁻³⁷

Treatment options can be broadly divided into

1. Behavioral interventions
2. Non-surgical options
3. Surgical options

Behavioral interventions:

Since patients with obstructive sleep apnea are obese, therefore patients should be advised to undergo weight reduction therapy as it improves symptoms of OSAHS and other related disorders.

Drugs and sleeping tablets should be avoided as this may decrease airway dilator function and worsen OSAHS. Positional therapy is for patients who suffer from mild OSA. Patients should be advised from sleeping on their backs and head of the bed is raised to reduce symptoms.

Non-surgical interventions

Continuous positive airway pressure (CPAP): CPAP is the treatment option for moderate to severe cases of OSA. A continuous positive airway pressure machine is a new device with a mask that fits snugly over the nose of patient. It transmits a continuous flow of air and keeps the throat open throughout the night.

Continuous positive airway pressure (CPAP) functions like a pneumatic splint and keeps the airway patent during sleep breathing. It works by means of a flow generator that delivers positive pressure through air tube to a nasal mask worn by the patient. Major side effects of CPAP are significant epistaxis, paranasal sinusitis but they are rare.

Oral appliance therapy: Orthodontic appliances should be fabricated in a way that it can be worn by the patient either in a permanent or removable manner depending upon the condition of the patient. These appliances bring the mandible and tongue forward, opens up the lower pharynx and allows

continuous breathing during sleep. Examples are Tongue repositioning devices (TRD) and mandibular advancement appliances (MAA). (Fig 8 and Fig 9)

Mechanism of action of Oral appliances: Oral appliances are used only during sleep which repositions the lower jaw, tongue, soft palate or uvula and maintains an open and unobstructed airway. It protrudes the mandible and tongue forwards and prevents upper airway collapse during sleep.

Disadvantages of oral appliances: Reciprocal forces are generated on the teeth and jaw by mandibular advancement splints which results in dry mouth, gum soreness, salivation, tooth pain, headaches, and TMJ problems.

Surgical interventions

Surgery is considered when noninvasive therapy such as CPAP and oral appliances has been not successful. It is done in a situation when there is any deformity in anatomic structure that can be later on corrected to eliminate the breathing problems.

Many different surgical approaches have been used in the treatment of OSAHS.

Uvulopalatopharyngoplasty (UPPP): It is the reconstruction of the throat by resection of posterior margins of the soft palate and unwanted mucosa present on the pharyngeal walls.

Adenotonsillectomy: It is the surgical removal of the tonsils and adenoids and it is the most common treatment option for children with OSA.

Tracheostomy: Tracheostomy was the first surgical treatment for OSAHS and bypasses the obstruction completely.

Other surgical techniques

a) Bariatric (weight reducing) surgery: Weight influences theseverity of OSAHS and weight loss is an effective treatment for OSAHS in some patients.

b) Nasal surgery: Nasal surgery reduces nasal airflow resistance and reduces pressure and improves compliance with nasal CPAP.

► Conclusion

OSAS is a common condition associated with significant morbidity and mortality. It is therefore important that dental professionals be aware of the signs and symptoms of OSAS, so that the diagnosis can be confirmed and treatment initiated as soon as possible. As knowledge about the pathophysiology of OSAS improves, treatments may be designed to address the

specific causes of the condition.

While many patients experience a complete or partial resolution of their symptoms, some do not improve or may even become worse. It is therefore imperative that physicians conduct progress evaluations while the respective dental care provider continues to make adjustments to optimize the effectiveness of the chosen appliance. Future research will help to identify the types of patients who are suitable for a specific kind of OSA treatment.

► References

1. Bliwise DL, Pascual RA (1984) Sleep-related respiratory disturbance in elderly persons. *Compr Ther* 10: 8-14.
2. Guilleminault C (1985) Obstructive sleep apnea. The clinical syndrome and historical perspective. *Med Clin North Am* 69: 1187-1203.
3. Gottlieb DJ, Whitney CW, Bonekat WH, Iber C, James GD, et al. (1999) Relation of sleepiness to respiratory disturbance index, the Sleep Heart Health Study. *Am J Respir Crit Care Med* 159: 502-507.
4. American Academy of Sleep Medicine Task Force (1999) Sleep related breathing disorders in adults: recommendations for syndrome definition and measurement techniques in clinical research. *Sleep* 22: 667-689.
5. Kushida CA, Littner MR, Morgenthaler T, Alessi CA, Bailey D, et al. (2005) Practice parameters for the indications for polysomnography and related procedures, an update for 2005. *Sleep* 28: 499-521.
6. Young T, Peppard P, Palta M, Hla KM, Finn L, et al. (1997) Population based study of sleep-disordered breathing as a risk factor for hypertension. *Arch Intern Med* 157: 1746-1752.
7. Shahar E, Whitney CW, Redline S, Lee ET, Newman AB, et al. (2001) Sleep-disordered breathing and cardiovascular disease, cross-sectional results of the Sleep Heart Health Study. *Am J Respir Crit Care Med* 163: 19-25.
8. Meisinger C, Heier M, Lowel H, Schneider A, Doring A (2007) Sleep duration and sleep complaints and risk of myocardial infarction in middle-aged men and women from the general population, the MONICA/KORA Augsburg cohort study. *Sleep* 30: 1121-1127.
9. Lindberg E, Carter N, Gislason T, Janson C (2001) Role of snoring and daytime sleepiness in occupational accidents. *Am J Respir Crit Care Med* 164: 2031-2035.
10. Teran-Santos J, Jimenez-Gomez A, Cordero-Guevara J (1999) The association between sleep apnea and the risk of traffic accidents, Cooperative Group Burgos-Santander. *N Engl J Med* 340: 847-851.
11. Young T, Palta M, Dempsey J, Skatrud J, Weber S, et al. (1993) The occurrence of sleep-disordered breathing among middle-aged adults. *N Engl J Med* 328: 1230-1235.
12. Bixler EO, Vgontzas AN, Lin HM, Ten Have T, Rein J, et al. (2001) Prevalence of sleep-disordered breathing in women: effects of gender. *Am J Respir Crit Care Med* 163: 608-613.
13. Bixler EO, Vgontzas AN, Ten Have T, Tyson K, Kales A (1998) Effects of age on sleep apnea in men: I. Prevalence and severity. *Am J Respir Crit Care Med* 157: 144-148.
14. Bearpark H, Elliott L, Grunstein R, Cullen S, Schneider H, et al. (1995) Snoring and sleep apnea. A population study in Australian men. *Am J Respir Crit Care Med* 151: 1459-1465.
15. Cistulli PA, Sullivan CE (1994) Pathophysiology of sleep apnea. In: Saunders NA, Sullivan C (eds.), *Sleep and breathing*, New York, NY: Marcel Dekker pp: 405-448.
16. Mathur R, Mortimore IL, Jan MA, Douglas NJ (1995) Effect of breathing, pressure and posture on palatoglossal and genioglossal tone. *Clin Sci (Lond)* 89: 441-445.
17. Isono S, Remmers JE, Tanaka A, Sho Y, Sato J, et al. (1997) Anatomy of pharynx in patients with obstructive sleep apnea and in normal subjects. *J Appl Physiol* (1985) 82: 1319-1326.
18. Schwartz AR, Gold AR, Schubert N, Stryzak A, Wise RA, et al. (1991) Effect of weight loss on upper airway collapsibility in obstructive sleep apnea. *Am Rev Respir Dis* 144: 494-498.
19. Schwartz AR, Smith PL, Wise RA, Gold AR, Permutt S (1988) Induction of upper airway occlusion in sleeping individuals with subatmospheric nasal pressure. *J Appl Physiol* 64: 535-542.
20. Schwab RJ (2003) Pro: sleep apnea is an anatomic disorder. *Am J Respir Crit Care Med* 168: 270-271.
21. Katz I, Stradling J, Slutsky AS, Zamel N, Hoffstein V (1990) Do patients with obstructive sleep apnea have thick necks? *Am Rev Respir Dis* 141: 1228-1231.
22. Ulfberg J, Carter N, Talbäck M, Edling C (1996) Headache, snoring and sleep apnoea. *J Neurol* 243: 621-625.
23. Martin SE, Mathur R, Marshall I, Douglas NJ (1997) The effect of age, sex, obesity and posture on upper airway size. *Eur Respir J* 10: 2087-2090.
24. Rowley JA, Aboussouan LS, Badr MS (2000) The use of clinical prediction formulas in the evaluation of obstructive sleep apnea. *Sleep* 23: 929-938.
25. Young T, Shahar E, Nieto FJ, Redline S, Newman AB, et al. (2002) Predictors of sleep-disordered breathing in community-dwelling adults: the Sleep Heart Health Study. *Arch Intern Med* 162: 893-900.
26. Bailey DR (2001) Oral evaluation and upper airway anatomy associated with snoring and obstructive sleep apnea. *Dent Clin North Am* 45: 715-32.
27. Puvanendran K, Goh KL (1999) From snoring to sleep apnea in a Singapore population. *Sleep Res Online* 2: 11-14.
28. Tami TA, Duncan HJ, Pfeleger M (1998) Identification of obstructive sleep apnea in patients who snore. *Laryngoscope* 108: 508-513.
29. Beutler LE, Ware JC, Karacan I, Thornby JI (1981) Differentiating psychological characteristics of patients with sleep apnea and narcolepsy. *Sleep* 4: 39-47.
30. Issa FG, Sullivan CE (1982) Alcohol, snoring and sleep apnea. *J Neurol Neurosurg Psychiatry* 45: 353-359.
31. Shneerson J, Wright J (2002) Lifestyle modification for obstructive sleep apnoea (Cochrane Review). In: *The Cochrane Library*, Oxford: Update Software.
32. Moran WB, Orr WC (1985) Diagnosis and management of obstructive sleep apnea. Part II *Arch Otolaryngol* 111: 650-658.
33. Dillon JE, Blunden S, Ruzicka DL, Guire KE, Champine D, et al. (2007) DSM-IV diagnoses and obstructive sleep apnea in children before and 1 year after adenotonsillectomy. *J Am Acad Child Adolesc Psychiatry* 46: 1425-1436.
34. Johns MW (1993) Daytime sleepiness, snoring, and obstructive sleep apnea. The Epworth Sleepiness Scale. *Chest* 103: 30-36.
35. Viner S, Szalai JP, Hoffstein V (1991) Are history and physical examination a good screening test for sleep apnea? *Ann Intern Med* 115: 356-359.
36. Maislin G, Pack AI, Kribbs NB, Smith PL, Schwartz AR, et al. (1995) A survey screen for prediction of apnea. *Sleep* 18: 158-166.
37. Netzer NC, Stoohs RA, Netzer CM, Clark K, Strohl KP (1993) Using the Berlin Questionnaire to identify patients at risk for the sleep apnea

Conventional trans-oral approach for the removal of submandibular sialolith

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Abstract

Sialolithiasis is one of the most common pathologies associated with the salivary glands. Smaller sialoliths can be managed conservatively while larger ones need to

be removed which may be a cumbersome procedure.

The case report is on the presentation of a submandibular sialolith located on the right

floor of the mouth that was removed via a trans-oral approach.

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► Introduction:

Sialolithiasis is an inflammatory condition caused by sialolith formation resulting in obstruction of the duct or the gland itself. About 80% sialoliths involve the submandibular gland.

Salivary calculi are calcified masses composed of hydroxyapatite, magnesium carbonate and ammonium. They commonly occur in the 3rd and 4th decades of life with a slight male predilection.¹ Only 3% of sialoliths have been reported among the paediatric population.²

They can range from a few millimetres up to centimetres in size.⁵ The main presenting symptom is history of acute pain before and after having meals.

Diagnostic methods include clinical examination followed by occlusal radiographs, ultrasonography, sialography, Sialendoscopy, CT, CBCT and MRI.

Treatment modality adopted is dependent on the site and size of the sialolith.

► Case Report:

A 38-year-old female patient presented to our unit with the complaint of pain and swelling over the right floor of the mouth since 2 and half months. She did not have any fever or chills.

Pain was acute in onset, moderate in intensity, dull aching type, intermittent in nature that aggravated while having food and relieved on taking medications. It was also associated with fluid discharge that had characteristics similar to viscous saliva.

Intra-oral examination by bimanual palpation revealed a hard, tender mass of approximately 2x1cm at the right side of the floor of the mouth. The posterior extent of the mass was non-palpable.

Extra-oral examination revealed no facial asymmetry or any enlarged lymph nodes. Based on the clinical findings, a provisional diagnosis of sialolith was made.

Occlusal radiograph (Image 1) displayed a radiopaque mass of 2x1cm on the medial aspect of the right body of the mandible suggestive of Sialolith in the right submandibular duct.

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Surgical Excision of the sialolith was planned under local Anaesthesia through an intra-oral approach.

Surgical Technique:

The floor of the mouth around the mass was infiltrated using 2% lignocaine with 1:80,000 adrenaline. A traction suture (Image 2) was used to retract the tongue to the opposite side for better visualisation of the operating field. An upward extra-oral digital compression was given to bring the calculus to the surface of oral cavity. Prior to the incision, a deep suture was placed posterior to the stone to prevent its proximal slippage. A 1 cm linear incision was placed over the palpated mass. Blunt dissection was done to expose the stone. The stone was grasped but it shredded off into fragments probably due to the low mineralisation content of the stone. Complete removal of the fragments were done and an occlusal radiograph was taken to confirm the presence of any residual calcification. The operating field was thoroughly irrigated with saline. A single mucosal layer closure was done using 3-0 silk (Image 3).

Post-operatively after 1 month, Patient was asymptomatic with no signs of ductal stenosis, tingling at tip of tongue or ranulas and had a satisfactory wound healing.

► Discussion:

Sialolithiasis is a common condition involving the salivary gland resulting in a calculi formation that obstructs the salivary flow. About 80% of the sialoliths involve the submandibular gland while only 5-20% involve the parotid gland.³

The long torturous course of the Wharton's duct, thick mucin content rich in calcium and phosphate & high pH makes the submandibular gland more vulnerable to sialolith formation.⁶

Sialoliths are oval, round or elongated yellow masses containing both organic and inorganic substances. The central core consists mainly of the organic substances (82%) and the peripheral of the inorganic matter (18%). The exact ratio of the inorganic content depends upon the chemical environment in which the sialolith forms.⁷ Organic substances include neutral and acid glycoproteins, collagen, lipids, proteins and carbohydrates like mannose and glucose. Calcium phosphate, whitlockite, brushite, silicon, brimstone, iron, potassium and chloride are some of the inorganic substances.⁶

There are several theories describing the etiopathogenesis of sialolith formation. Retrograde theory explains that the sialoliths are thought to be formed by the mucin content that acts as a scaffold for the deposition of the calcium salts along with debris, bacteria or foreign bodies which undergoes further dystrophic type of calcification.³ Metabolic theory suggests that an imbalance in the calcium solubility results in the calcium

precipitation thereby favouring the sialolith formation.⁴

They can present as a small calculus ranging from a few millimetres to several centimetres. Largest sialolith reported in literature was about 72mm in the submandibular duct by Rai and Burman in 2009.¹

Some of the predisposing factors responsible for sialolithiasis are tobacco smoking, reduced fluid intake and some medications that reduce the salivary flow.⁹

The medications (Table I) reduce the intravascular and extravascular fluid volume that reduces the salivary flow.⁹

Tobacco smoking is known to affect the cytotoxic activity, reduce the polymorphonuclear phagocytic efficacy and salivary amylase content. This results in the accumulation of microbes within the ductal system that acts as a substrate for the salivary stone.⁹

The presenting symptom is pain and swelling of the affected gland particularly during meal time due to the stasis of saliva as a result of the obstruction caused by the calculi. The intensity of the symptoms mainly depends upon the extent of obstruction and the presence of any secondary infection. The chronic stasis of saliva can result in fistula or a sinus tract formation, fibrosis and gland atrophy.¹⁰

Diagnosis is made through a detailed history, thorough clinical examination by bimanual palpation coupled with the various imaging modalities.

Table I

SOME OF THE MEDICATIONS THAT INDUCES XEROSTOMIA ARE:
Anti-Neoplastics
Anti-Parkinson drugs
Benzodiazepines
Beta Blockers
Opioids
Tricyclic Anti-Depressants
Diuretics

Some of the imaging modalities for the detection of sialolith are panoramic radiography, occlusal radiography, sialography, ultrasound, computed tomography, especially cone beam computed tomography and magnetic resonance imaging.¹

Occlusal radiographs are considered as the most reliable diagnostic method but visualisation of stones posterior to the wharton's duct (posterior to 2nd molars) is limited. Panoramic radiographs are helpful in such cases. Yet another drawback of conventional radiograph is that the identification of the less calcified stones is difficult.¹

However, calcifications can be easily visualised on computed tomography even in the initial stages.¹

Cone Beam Computed Tomography has good sensitivity and specificity for the detection of calcified stones and helps in evaluating the glandular parenchyma along with the adjacent structures.¹

99% accuracy by ultrasound is possible if the stones are larger than 1.5mm and have high mineral content. They also help in detecting the salivary flow after the sialolith removal.³

Sialography is considered as the gold standard for detecting sialoliths.¹⁰ MR Sialography is used for the visualisation of the salivary ducts without the need for contrast and no radiation exposure.



Fig 1 Occlusal Radiograph revealing a radiopaque mass on the medial aspect of the right side of mandible.



Fig 2 Pre-Operative Image with traction suture for better visualisation of the sialolith.



Fig 3: Mucosal layer closure



Fig 4 Extracted Salivary Calculi

Sialendoscopy is yet another non-invasive diagnostic tool. It even helps in detecting the stones less than 1.5mm and soft stones with scanty mineralisation. It is considered both as a diagnostic as well as a therapeutic tool. Therapeutically endoscopy can be combined for the extraction of sialoliths via basket, forceps, bur or Shock wave Lithotripsy.¹¹ Sialendoscopy can also be used to evaluate the presence of any residual stones. However, it is technique sensitive and can lead to complications like ductal perforation and stenosis and lingual nerve paresis.

There are various treatment modalities. The type of treatment modality adopted mainly depends on the size, location, the number of the salivary calculi and the surgical equipment available.

The treatment objective is maintaining the normal functioning of the gland and prevent any damage to the adjacent vital structures.

Small sialoliths located near the ductal periphery can be conservatively managed by the use of sialogogues, hydration and massaging the gland or milking of the duct by digital palpation so that the stone gets flushed out through the duct orifice.¹² Unimpacted stones can undergo Dilatation or catheterization of the duct for its extraction.¹

Some of the non-invasive techniques include extracorporeal lithotripsy, endoscopically assisted basket retrieval, intracorporeal lithotripsy and lasers.

If the stones are intra-parenchymal and less than 7mm, endoscopically assisted basket retrieval can be done. If larger than 7mm, the stones can be fragmented into multiple pieces by extracorporeal shock wave lithotripsy where shock waves are directed to the surface of the stone without damaging the adjacent structures.⁶ Other techniques for sialolith fragmentation are by use of hydraulic devices and pneumoblastic devices.¹⁰ The drawback of stone fragmentation is the high chances for the presence of residual stones thereby increasing the recurrence rate.

Trans oral removal of the submandibular stones is the conventional method for sialolithotomy. It is indicated for the stones that are larger than 8mm, located in the distal third of the duct and for those stones that can be palpated.¹⁰ The only contraindication is a limited mouth opening.

Even though there are complications such as tingling at tip of the tongue, lingual nerve injury, ranulas, ductal strictures

associated with the trans-oral technique, they are known to have a high success rate of 82-98%.

► Conclusion:

Sialolithiasis constitute about 80% of the salivary gland diseases. Even though the treatment modality chosen depends upon site and size of the calculus, intra-oral approach is still considered as the mainstay of treatment for sialolithotomy of the submandibular stones due its high success rate despite the risks and complications associated with it, which can be avoided if the surgery is performed meticulously and accurately. Moreover, non-invasive techniques are less preferred as they are technique sensitive and due to the lack of availability of the equipment and its cost.

► References:

1. Santos, J., da Silva Firmino, B., Carvalho, M., de Pinho Mendes, J., Teixeira, L., de Castro Lopes, S., Costa, A. and Pinto, A., 2018. 3D Reconstruction and Prediction of Sialolith Surgery. *Case Reports in Dentistry*, 2018, pp.1-5.
2. Pachisia, S., Mandal, G., Sahu, S. and Ghosh, S., 2019. Submandibular sialolithiasis: A series of three case reports with review of literature. *Clinics and Practice*, 9(1).
3. Shetty, L., Khandelwal, N., Domah, T., Seshagiri, D., Talele, P. and Londhe, U., 2019. Submandibular sialolith – a case report. *Journal of Oral Disease Marker*, 3(1), pp.1-3.
4. Dr. Syed Wakeel, Dr. Mohammad Shafi Dar and Dr.Shajah Hussain Sheikh. Sialolithiasis and its management: A clinical study. *International Journal of Applied Dental Sciences*. 2017; 3(4): 469-471.
5. Cho, S., Han, J., Kim, J., Lee, S., Jo, J., Kim, C. and Kim, B., 2017. Removal of submandibular calculi by surgical method and hydraulic power with curved needle: a case report. *Journal of the Korean Association of Oral and Maxillofacial Surgeons*, 43(3), p.182.
6. Duong, L., Kakiche, T., Ferré, F., Nawrocki, L. and Bouattour, A., 2019. Management of anterior submandibular sialolithiasis. *Journal of Oral Medicine and Oral Surgery*, 25(2), p.16.
7. e Santana Santos, T., da Costa Araújo, F., Frota, R., Caubi, A. and de Oliveira e Silva, E., 2012. Intraoral Approach for Removal of Large Sialolith in Submandibular Gland. *Journal of Craniofacial Surgery*, 23(6), pp.1845-1847
8. Rai, M. and Burman, R., 2009. Giant Submandibular Sialolith of Remarkable Size in the Comma Area of Wharton's Duct: A Case Report. *Journal of Oral and Maxillofacial Surgery*, 67(6), pp.1329-1332.
9. Huoh, K. and Eisele, D., 2011. Etiologic Factors in Sialolithiasis. *Otolaryngology–Head and Neck Surgery*, 145(6), pp.935-939.
10. Marchal, F. and Dulguerov, P., 2003. Sialolithiasis Management. *Archives of Otolaryngology–Head & Neck Surgery*, 129(9), p.951.
11. Ardekian, L., Klein, H., Araydy, S. and Marchal, F., 2020. The Use Of Sialendoscopy For The Treatment Of Multiple Salivary Gland Stones.
12. Bhovi, T., Jaju, P., Ojha, S. and Bhadouria, P., 2016. Giant submandibular sialolith in an old female patient: A case report and review of literature. *Journal of Indian Academy of Oral Medicine and Radiology*, 28(4), p.437.

Inferior alveolar nerve repositioning for implant supported fixed prosthesis in ectodermal dysplasia patient - A case report

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Abstract

Background: Ectodermal dysplasia is a genetic disorder affecting the ectodermally derived structures. The oral manifestations include oligodontia or anodontia, malformed teeth and underdeveloped alveolar ridges. Implant supported prosthesis is the ideal treatment option for the rehabilitation of atrophic jaws. Since the proximity of the inferior alveolar nerve to the alveolar crest makes it difficult or impossible to place implants in the mandibular posterior region, the nerve lateralization or nerve transposition can

be used to place an implant with optimum height.

Case report: In this case report inferior alveolar nerve repositioning simultaneous with implant placement has been done in a patient with ectodermal dysplasia. Anterior and posterior osteotomy were made with piezoelectric device in the right mandibular buccal cortical bone and inferior alveolar nerve bundle was moved laterally with an elastic tape. Dental implants were inserted medial to the nerve bundle, and bone grafts

were placed in the defect. A fixed prosthesis was placed after 4 months. Anesthesia persisted for 4 1/2 months after which the sensory function was completely restored.

Conclusion: Inferior alveolar nerve repositioning with this anterior and posterior osteotomy technique, minimizes the extensive stretching of inferior alveolar nerve thereby reducing the postoperative neurosensory disturbances.

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► Introduction

Ectodermal dysplasia is a genetic disorder characterized by abnormalities within the ectodermally derived structures. The oral manifestations include congenitally missing teeth (oligodontia or anodontia), malformed teeth and underdeveloped alveolar ridges.¹

Though implant supported prosthesis have become a widely accepted treatment modality for the rehabilitation of patients with atrophic jaws, the proximity of the inferior alveolar nerve to the alveolar crest makes it difficult or impossible to place implants in the mandibular posterior region.^{2,3} In such situations the treatment plan will have to be compromised to a removable prosthesis or fixed prosthesis with limited number of replacing teeth. One of the solutions for this clinical dilemma is nerve lateralization or nerve transposition to place an implant with optimum height.

Inferior alveolar nerve lateralization involves making rectangular osteotomy over the cortical plate of bone lateral to the mandibular canal and the nerve is retracted buccally

with an elastic tape until the implant placement is completed. This technique has the advantage of reduced healing time and increased primary stability in posterior implants along with lower degree of nerve injury as compared to inferior alveolar nerve transposition.^{4,5} This technique was introduced during the late 1970s. But the procedures usually failed due to lack of adequate equipments. In those days drills and rotary devices were used for performing osteotomy which had several disadvantages like bone overheating and damage to the adjacent soft tissues⁵.

Recently with the introduction of piezoelectric devices, the procedure has become easier, and it has certain advantages like rapid bone healing and precise cutting of the hard tissues without damaging adjacent soft tissues. However the piezoelectric equipments have less power resulting in longer time elapsed for osteotomy.⁶ This case report describes rehabilitation of a patient with ectodermal dysplasia, where the decreased posterior mandibular bone height was managed with nerve lateralization using piezoelectric surgery followed by implant placement and fabrication of implant supported fixed prosthesis.

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► Case report

A 20 year old male patient with a complaint of multiple missing teeth reported to the Department of Prosthodontics, Government Dental College, Kozhikode for the rehabilitation of missing teeth. On examination severe oligodontia was present with only 35 & 36 remaining in the mandibular arch (Fig 1). In the maxillary arch there was a midline diastema and bilateral congenitally missing lateral incisors. But the patient was not concerned about rehabilitation of the upper anteriors. Patient

had been using various kinds of removable dentures from the childhood, but the comfort and function was compromised. Hence an implant supported prosthesis was planned.

The radiographic evaluation with Orthopantomogram (OPG) (Figure 2) and Cone beam computed tomography (CBCT) (Figure 3) revealed a severely resorbed mandibular alveolar ridge with a bone height of 5-6 mm superior to the mandibular canal and the superior part of the ridge was knife edged with a bone thickness of 1-2 mm. Since the available bone was inadequate for



Fig 1 Preoperative view



Fig 2 Preoperative radiograph



Fig 3 Preoperative CBCT image



Fig 4 Incision followed by flap elevation and exposing neurovascular bundle



Fig 5 Osteotomy



Fig 6 Implant placement

the fabrication of a routine implant supported fixed prosthesis, lateral repositioning of the inferior alveolar nerve followed by placement of implant was planned. The risks and benefits of the treatment plan were explained and the consent was obtained.

The surgery was done under standard surgical protocol. Local anesthesia was performed with 2% lignocaine with 1:80,000 epinephrine (Lignospan Special; Septodont; France). A crestal incision was made in the right premolar region which was extended distally till the second molar area, followed by a vertical releasing incision mesial to the right mental foramen. The flap was reflected laterally and the residual ridge and buccal cortex were exposed upto the second molar region. The mental neurovascular bundle was located and identified (Fig 4). Osteotomy was done with a piezoelectric device (Surgic Touch LED, Guilin Woodpecker Medical Instrument Co. Ltd, China) under copious irrigation. A square osteotomy was created around the mental foramen and rectangular osteotomy was performed parallel to the mandibular canal about 1-2 cm posterior to the mental foramen (Fig 5). The rectangular block was separated carefully with the help of a bone chisel. Then the neurovascular bundle and the circumferential rim of bone around the mental foramen were secured and retracted laterally with a low thickness latex tape. Drilling for implant placement was done at the 45,

46 region and two implants of dimension 4.2 x 10 mm (Triple™ Implant System, Adin Dental Implant Systems Ltd, Israel) were placed (Fig 6) while the nerve was being retracted. The rectangular piece of cortical bone couldn't be repositioned due to lack of space following implant placement, which was then crushed by bone crusher grinder and placed in the bone defect. The grafted site was secured with a GTR membrane (Bio-Gide® Perio, Geistlich, USA) (Fig 7) and was stabilized under the sutured mucoperiosteal flap. A second surgical procedure was performed after 3 weeks, for implant placement in the lower anterior region and 4 implants were placed.

Patient was recalled after 3 months for prosthodontic intervention. Open tray-splinted impression was made with polyvinyl siloxane material (Express™, 3M ESPE, USA) using a custom tray. A screw retained fixed prosthesis design was adopted and a metal ceramic restoration was fabricated. The final prosthesis was secured on the abutments (Fig 8, Fig 9) and occlusal adjustments were made.

Patient was reviewed after 1 week (Fig 10), 1 month and every 6 months for 2 years. Patient initially reported of having loss of sensation in the lower lip. But anesthesia persisted only for 41/2 months after which the lip sensitivity was completely restored.



Fig 7 Grafting followed by placement of GTR membrane



Fig 8 Placement of abutments



Fig 9 Postoperative view

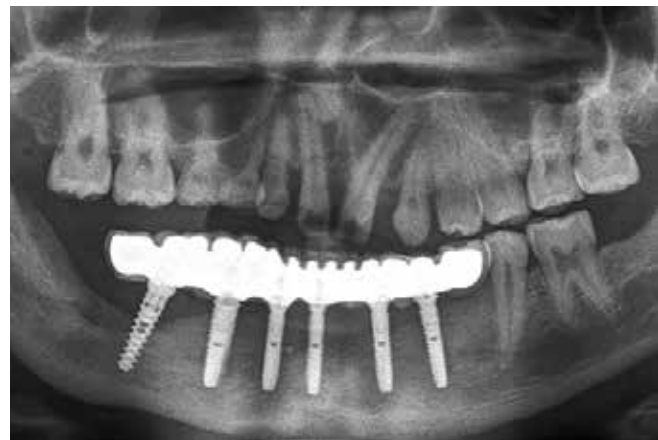


Fig 10 Postoperative radiograph

► Discussion

In ectodermal dysplasia patients, the posterior edentulous mandible is atrophied to the point that the comfort and function of the removable prosthesis is severely compromised. The remaining bone height is often limited to 5 millimeter or less in which the implant placement is also difficult without damaging the inferior alveolar nerve. Since the implant supported fixed prosthesis exhibit better stability, support and increased masticatory efficiency several surgical techniques were introduced for the rehabilitation of atrophic jaws like guided bone regeneration, reconstruction with bone grafts, installation of short implants and inferior alveolar nerve repositioning or transpositioning.⁵

Traditionally the nerve is repositioned through a bone window created posterior to the mental foramen excluding it. With only a single posterior window an extensive stretching of nerve is required for the lateralization. For transposition the osteotomy is created including mental foramen and the nerve is released from the foramen and displaced distally.⁵ This creates a large bone segment that is difficult to manipulate and its axis of rotation is within the mental nerve area. As a result permanent nerve damage may occur with this approach.²

In this technique two osteotomies were created, one around the mental foramen and one posterior to it, which minimizes the chances of postoperative neurosensory disturbances.

Lateral repositioning of inferior alveolar nerve provides several advantages like placement of implants with optimum length, greater initial implant stability, and increased protection of the mandibular nerve. Also the donor site morbidity is avoided due to lack of bone graft harvesting procedures.⁴ But it has several disadvantages like removal of large portion of the buccal cortex thereby reducing the structural integrity of mandible, associated mandibular fractures and chances of neurosensory disturbances (anesthesia, paresthesia, hypoesthesia and hyperesthesia)⁷

Hirsch et al⁸ evaluated the neurosensory disturbance after nerve transposition and lateralization. They found that the mean time taken for the restoration of sensation was 4.7 weeks. The duration of neurosensory disturbance after transposition was 5.7 weeks and after lateralization was 3.8 weeks. Lorean et al⁹ found that the duration of neural disturbances after the surgery ranged from 1 to 6 months but no permanent neural damage was reported. If manipulation of the inferior alveolar nerve is minimal and the traction of the nerve is less than 5%, normal nerve function should return within 4 to 6 weeks.¹⁰

Kan et al¹¹ found that during inferior alveolar nerve transposition the incidence of neurosensory disturbance was 77.8%, and with nerve lateralization (only posterior osteotomy) the incidence of neurosensory disturbance was 33.3%. In the present scenario, technique involving two osteotomies, the incidence of neurosensory disturbance was less than 8%. Hence the occurrence of neurosensory disturbances can be reduced by adopting this technique.

In the beginning of the procedure patient was concerned only about the lower edentulous arch. After placement of the final prosthesis, patient demanded the closure of midline diastema and replacement of congenitally missing lateral incisors. He was then referred for the orthodontic alignment of maxillary teeth prior to the prosthetic rehabilitation in the maxillary arch.

► Conclusion

An implant based prosthetic rehabilitation was done in an ectodermal dysplasia patient with severe atrophy in the edentulous mandibular posterior region. Implants were placed after the lateral repositioning of the inferior alveolar nerve. Anesthesia persisted for 41/2 months after which the sensory function was completely restored. A fixed prosthesis was placed after 4 months. Inferior alveolar nerve repositioning with this anterior and posterior osteotomy technique, minimizes the extensive stretching of inferior alveolar nerve thereby reducing the postoperative neurosensory disturbances.

► References

1. Knobloch LA, Larsen PE, Saponaro PC, L'Homme-Langlois E. Early implant placement for a patient with ectodermal dysplasia: Thirteen years of clinical care. *J Prosthet Dent* 2018;119:702-9.
2. Peleg M, Mazor Z, Chaushu G, Garg AK. Lateralization of the inferior alveolar nerve with simultaneous implant placement: a modified technique. *Int J Oral Maxillofac Implants* 2002;17:101-6.
3. Jensen O, Nock D. Inferior alveolar nerve repositioning in conjunction with placement of osseointegrated implants: a case report. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1987;63:263-8.
4. de Vera Del JC, Chamorro MP, Cebrian JC. Repositioning of the inferior alveolar nerve in cases of severe mandibular atrophy. a clinical case. *Med Oral Patol Oral CirBucal* 2008;13:E778-82.
5. Pimentel AC, Sanches MA, Ramalho GC, Roman-Torres CV, Manzi MR, Sendyk WR. Lateralization technique and inferior alveolar nerve transposition. *Case reports in dentistry* 2016;2016:1-10
6. de Vicente JC, Pena I, Brana P, Hernandez-Vallejo G. The use of piezoelectric surgery to lateralize the inferior alveolar nerve with simultaneous implant placement and immediate buccal cortical bone repositioning: a prospective clinical study. *Int J Oral Maxillofac Surg* 2016;45:851-7.
7. Vetromilla BM, Moura LB, Sonego CL, Torriani MA, Chagas Jr OL. Complications associated with inferior alveolar nerve repositioning for dental implant placement: a systematic review. *Int J Oral and Maxillofac Surg* 2014;43:1360-6.
8. Hirsch JM, Branemark PI (1995) Fixture stability and nerve function after transposition and lateralization of the inferior alveolar nerve and fixture installation. *Br J Oral Maxillofac Surg* 33:276-281
9. Lorean A, Kablan F, Mazor Z, Mijiritsky E, Russe P, Barbu H, Levin L (2013) Inferior alveolar nerve transposition and reposition for dental implant placement in edentulous or partially edentulous mandibles a multicenter retrospective study. *Int J Oral Maxillofac Surg* 42:656-659
10. Bailey PH, Bays RA. Evaluation of long-term sensory changes following mandibular augmentation procedures. *J OralMaxillofac Surg* 1984;42:722-7.
11. Kan JY, Lozada JL, Goodacre CJ, Davis WH, Hanisch O. Endosseous implant placement in conjunction with inferior alveolar nerve transposition: an evaluation of neurosensory disturbance. *Int J OralMaxillofac Implants* 1997;12:722-7

A Novel Technique in the Prosthetic Rehabilitation of an Ocular Defect - A case report

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Abstract

Ocular prosthesis is an artificial replacement of the eye, in patients who have lost the same as a result of trauma or malignancies. Replacement with an ocular prosthesis is to be done symmetrically and also

should simulate a natural one. The present article describes a simple and time saving novel technique for fabricating an ocular prosthesis using resin material with accurate fit and good esthetic treatment outcome.

Keywords: Ocular defect, Rehabilitation, graph grid, custom ocular prosthesis, enucleation.

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► Introduction

Eyes are generally the first features of the face to be noticed, playing a significant role in our daily lives^{1,6}. The Loss or absence of eyes as a result of congenital defects, irreparable trauma or tumors will have a physical, social and psychological stigma for those who are affected.

Surgical procedures in the removal of an eye can be broadly classified as evisceration where the contents of the globe are removed leaving the sclera intact and then enucleation in which where the entire eyeball is removed after severing the muscles and the optic nerve, finally exenteration in which surgical removal of the orbit including the eyelids and the surrounding tissues are done^{2,7}. In such cases fabrication of an ocular prosthesis is inevitable to restore a more normal facial appearance.

Ocular prosthesis can be custom made or a stock shell. Stock ocular prosthesis available in standard sizes, shapes, and colors. Custom eyes have several advantages compared to stock ocular prosthesis like better movement of eye lids, distribution of pressure, enhanced fit, comfort, adaptation, improved facial

contours, and enhanced esthetics achieved from the proper control over the size and color of the iris, pupil and sclera².

There are different methods available to fabricate a custom ocular prosthesis, This article describes a novel technique of fabricating an ocular prosthesis by the combination of custom and stock ocular prosthesis procedures with precise fit and better treatment outcome. Hence we have used graph grid technique here for the accurate positioning of the iris as well.

► Case Report

A 35-year-old male patient reported to department of Prosthodontics for the restoration of missing the right eye. His past medical history revealed that he has been undergone for enucleation of the right eye to treat septicemia resulting from a shrapnel injury. Patient was wearing a prefabricated eye shell since fifteen years which was oversized and restricts complete closure of the eye. Our treatment plan was to restore the defect with a custom made acrylic ocular prosthesis fabricated by using the graph grid method.

On examination, the ocular defect was healed properly.

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Mobility of the posterior wall of the ocular defect was assessed. The palpebral fissure was examined in both open and closed position to rule out any anatomical as well as physiological abnormality. Conjunctiva, depth of fornices, and presence of cul de sac was also examined⁴ [fig 2]. It was planned to rehabilitate the patient with a prosthesis fabricated by combination of custom and stock ocular prosthesis.

► Materials and techniques

Procedures

The area of the defect was examined and treatment planning was formulated along with informed consent from the patient. The procedure was initiated by selecting and modifying a pre-fabricated (stock) eye shell, whose iris and pupil closely matched with that of the natural eye, to comfortably and snugly fit into the socket. This was duplicated with clear heat cured Polymethyl methacrylate (PMMA) and perforated for use as a tray in the impression procedure⁴ [Fig 3].

Perforation of the tray was done to avoid any compression of the ocular tissues. The tray was placed in the socket and the patient was asked to gaze at a distant point to accurately mark the pupil as per the contralateral side, on the tray.

First, petroleum jelly was applied to the eyebrows for the easy removal of the impression once it sets. A thin tube of 1 mm diameter and 2 cm length was fabricated to serve as a handle for the impression tray and attached at the pupillary point for

proper tray orientation during impression making Polyvinyl siloxane light viscosity impression material was then injected into the socket and loaded on the tray which was placed in position. The patient was asked to move normal eye in all directions to allow the impression material to flow into all areas of the enucleated socket as well as onto the tray's outer surface to record the eyelid movements. Impression was then examined for accuracy and then invested in dental gypsum in order to obtain a positive cast of the eye socket [Fig 4, 5].

Try-in of scleral wax pattern

The wax pattern was fabricated by pouring the molten wax into the impression. Then it was properly contoured and carved to give it a simulation of the lost eye. The pattern was then tried in patient's socket and checked for size, fullness, support, retention, and comfort by performing the functional ocular muscle movements.

Corneal portion of the acrylic stock eye was separated from the entire stock eye by using a straight fissure carbide bur, leaving the sclera and was incorporated into the wax conformer. Then transparent graph grid was used to attach iris disc. Try- in of the wax pattern along with cornea was done in the patient to check the fit, extension and position of the pupil and cornea [Fig 6].

Transparent graph grid

Markings were made on grid template on X-axis from A to H starting from midline and on left side from A' to H'. Similarly



Fig 1. Pretreatment



Fig 2. Ocular defect

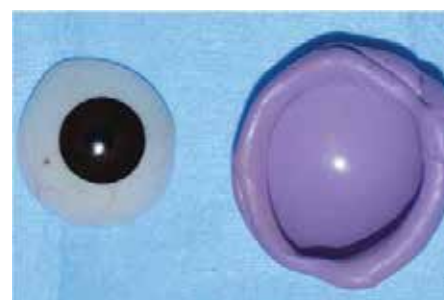


Fig 3. putty impression of the stock eye



Fig 4. Impression of the ocular defect



Fig 5. Die stone model

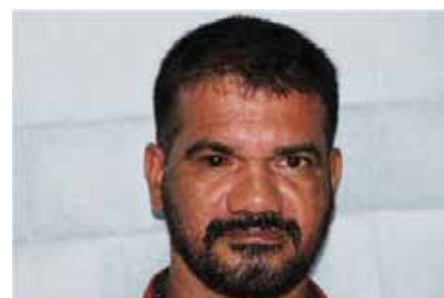


Fig 6. Wax trial and iris position

from 1 to 7 on Y-axis and 1' to 7' on left side. The distance between each marking was 1 cm on both X and Y axes [Fig 7].

Guidelines on patients face

A vertical midline was marked passing through the forehead crease, glabella, tip of the nose and the chin. The distance from the medial canthus to the midline marking for both right and left eye were standardized and was used to reposition the grid template each time during the try-in visit.

Evaluation with grid

The patient was asked to gaze straight at an object kept four feet away. The operator then marked the vertical lines coinciding with the medial and distal extremities of the iris of the natural eye. Similarly the horizontal lines referring to the centre, inferior and superior limits of the iris were marked. The facial markings were transferred to the grid template by placing it on the patients face. These markings were transported to the side of the defect and transferred to the sculptured wax pattern and the iris button attached to it^{4,8} [Fig7].

Investing, Dewaxing, Packing

The wax pattern with iris button was flaked, dewaxed, and packed with tooth colored heat cure acrylic resin (Dental products of India, Mumbai), the shade of which was matched with the scleral portion of the contralateral eye [Fig 8,9]. Fine red embroidery resin threads are placed on the sclera during

packing to mimic the blood vessels of the natural eye. The entire scleral portion is then coated with monomer polymer syrup to keep the blood-vessel fibers in place and allowed to set. Then a thin layer of wax was placed over the surface of scleral shell to create a space for clear acrylic, and to provide a lifelike appearance. The curing of scleral shell with corneal button was carried. After curing, rough edges of the prosthesis were trimmed off, and using polishing burs, pumice and a buff the prosthesis was polished to get a natural glossy finish.

Instructions for maintaining the ocular prosthesis.

1. Never ever try to clean or soak the artificial eye in alcohol as it will crack and spoil the finer details of the ocular prosthesis.
2. Remove the ocular prosthesis only if necessary. Multiple insertion and removal of the prosthesis on the day can cause socket irritation and excessive secretions. Hence removal should be done judiciously without harm.
3. If you remove your ocular prosthesis, be sure to store it in normal water or soft contact lens saline solution. This will prevent deposits from drying on the surface and helps in maintaining it hygienic.
4. A liquid soap can be used to clean the prosthesis on a regular basis. While cleaning, the prosthesis has to be held firmly between your fingers to avoid falling down.
5. Similarly socket also cleaned using a sterile saline rinse.
6. If indicated any eye drops maybe used with prosthesis in position.



Fig 7. Grid with iris positioning



Fig 8. invested eye shell



Fig 9. Dewaxing



Fig 10. Ocular prosthesis



Fig 11. Intaglio surface



Fig 12. Prosthesis insitu

7. Visit at initial six months, later once a year review is mandatory for checkup, cleaning and polishing of the prosthesis.

► Discussion

The ocular prosthesis is an artificial replacement for the bulb of the eye. After the surgeon eviscerates or enucleates the eye, Prosthodontist is the specialist who comes into an act of providing the patient with an artificial eye to overcome the agony and social stigma of the lost eye. A well and properly made ocular prosthesis maintains its orientation when patient performs various movements^{2,6}.

A custom made ocular prosthesis has an improved adaptation to underlying tissues, better functional movements, and enhanced esthetics due to control over the appropriate size of the iris, pupil and improved the facial contours.

Advantages of a custom ocular prosthesis is that it retains the shape of the socket, prevents collapse of the eye lids, provides proper muscular activity of the eye lids, avoid accumulation of fluid in the socket, maintains palpebral opening similar to the natural eye, a gaze similar to the other natural eye, and also mimics the natural eye in color and proportions⁵.

The technique adopted here for the fabrication is a rather novel as far as the accuracy of the gaze using graph grid unlike the conventional one. It is also a very simple, precise technique with minimum equipments and good utilization of artistic skills.

► Conclusion

The use of custom made ocular prosthesis has been a boon to the any patient who cannot afford the expensive treatment options available. The esthetic outcome of the custom-made ocular prosthesis was much superior than the stock ocular prosthesis. The technique described in this report represents a combination of both custom and stock ocular prosthesis procedures which is simple and cost-effective with a good esthetic appeal and accurate prosthetic outcome². Although the patient sans the vision with the ocular prosthesis but it will help to enhance self-confidence and also eliminate the existing social stigma.

► References

1. Choubisa D. A simplified approach to rehabilitate an ocular defect: Ocularprosthesis. The Journal of the Indian Prosthodontic Society. 2017Jan;17(1):89
2. MeenakshiA, Pradeepa TS, Agarwal S. Prosthetic rehabilitation of an ocular defect: A case report.
3. Tripuraneni SC, Vadapalli SB, Ravikiran P, Nirupama N. An innovative impression technique for fabrication of a custom made ocular prosthesis. Indian journal of ophthalmology. 2015Jun;63(6):545.
4. Kaira LS, Mandal NB, Bharathi SS. Prosthodontic rehabilitation of patient with ocular defect using an alternative technique. Journal of Orofacial Sciences. 2012 Jan1;4(1):60.
5. Sinha ND, Bhandari AJ, Gangadhar SA. Fabrication of custom ocular prosthesis using a graph grid. Pravara Med Rev. 2009 Mar;4(1):21-4.
6. Doshi PJ, Aruna B. Prosthetic management of patient with ocular defect. The Journal of Indian Prosthodontic Society. 2005 Jan1;5(1):37.
7. ElDakkak M. Problem solving technique in ocular prosthetic reconstruction. Saudi Dental Journal. 1990;2(1):7-10.
8. Manvi S, Ghadiali B. Prosthetic rehabilitation of a patient with an orbital defect using a simplified approach. The Journal of Indian Prosthodontic Society. 2008 Apr1;8(2):116

Rehabilitation of congenital maxillary defect with modified fixed removable Prosthesis: A Case Report

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Abstract

Prosthetic rehabilitation of congenital anterior ridge defect is a challenge for the prosthodontist as it should satisfy both aesthetic and functional demands of the patient. Congenital intraoral defects, not treated surgically, presents with compromised clinical situation where, treatment plan should be aimed at providing a prosthesis that is aesthetic, functional and hygienic. Often patients prefer fixed restorations as it is superior to

removable restoration in terms of function and comfort. But, oro-nasal fistula treated with fixed restorations have raised concerns on oral hygiene. Therefore, an appropriate prosthetic design, other than conventional removable or fixed partial denture, should be formulated that satisfies all the objectives of a prosthesis. Andrews Bridge is a partial denture design where pontic portion of the prosthesis is removable permitting access for oral hygiene. This article describes a

case of missing maxillary anterior teeth with cleft in the pre-maxillary region which was rehabilitated using modified Andrews's bridge design.

Key words- Fixed removable prosthesis, Andrews Bridge, cleft palate, Oro-nasal fistula.

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► Introduction

Tooth loss associated with a cleft palate and a deficient alveolar ridge presents with the dilemma of restoring both the missing teeth and the lost ridge. This problem may be aggravated by an oral-nasal fistula. Prosthetic restoration in these situation should be designed to achieve aesthetics, phonetics and mastication.

McCracken¹ stated that when anterior teeth are replaced with a removable partial denture, support for the anterior segment is difficult to obtain unless multiple rests on several adjacent teeth are utilized.

Ramstad² has stated that a fixed partial denture must be extended sufficiently to retain the maxillary segments and teeth in their optimal positions and stabilization of these segments prevent arch collapse. Therefore, sufficient teeth must be included in the fixed partial denture design. Special care should

be exercised in evaluating the remaining dentition for support in fixed partial denture. Number of missing teeth, abutment tooth and its bony support is critical in success of restoration. Usually, teeth adjacent to the cleft have limited bony support on the side toward the defect. The lack of support weakens the tooth as an abutment. It usually becomes necessary to include one extra tooth on each side of the cleft to prevent failure of the fixed partial denture.

Conventional fixed partial denture options limit the access to underlying tissues for cleansing purpose. A combination of fixed prosthesis with removable pontics should be designed, that provide access to underlying tissue for oral hygiene, without compromising on the stability, support and retention.

A fixed partial denture-removable partial denture system was introduced by Dr James Andrews of Amite, Louisiana,

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USA in 1965³. Primary indications for this restoration are cases where the abutments are capable of supporting a fixed partial denture but the residual ridge has been partially lost due to trauma, congenital defects or other pathologic processes so that a conventional fixed partial denture would not adequately restore the patient's missing teeth and supporting structures.

This system incorporates a fixed component on the abutment teeth with removable pontics. The fixed component is made of porcelain fused to metal crowns that are joined together by casted bar cemented on to the prepared abutments. The removable component consists of acrylic denture with metal housing for attachment of retentive components. This technique has the advantage of flexibility in arranging the removable partial denture teeth with minimum extension along with better retention and stability⁴.

Indications⁵.

- Several missing teeth along with defect in the edentulous ridge;
- Failure of removable partial denture because of discomfort related to its palatal extension;
- Long edentulous space where fixed partial denture has failed;

- Cleft palate patients.

► Case Presentation

A 38-year-old female patient reported to the Department of Prosthodontics and crown and bridge, Azeezia College of dental sciences and research, complaining of poor aesthetics and difficulty in maintaining hygiene. History reveals a congenital maxillary defect involving premaxilla and alveolus which was not surgically obturated. She had three missing anterior teeth in the cleft regions which was treated using fixed partial denture five years back. A Vitalium fixed prosthesis extending from right maxillary central incisor to the left maxillary second premolar was used to replace the missing teeth (i.e., maxillary left lateral incisor, canine and first premolar) (fig 1). She complained of nasal regurgitation of fluids due to the oro-nasal communication (fig 2) and difficulty in maintaining oral hygiene.

It was decided to remove the existing FPD for proper accessibility to the defect area. Soft tissue covering the ridge was found inflamed which was attributed to the limited accessibility for hygiene. On clinical examination, anterior abutments were found to have grossly decayed coronal structure and radiographic evaluation revealed poor bone support.

Various treatment options addressing patients concern for aesthesia, comfort and oral hygiene were formulated. Due to



Fig. 1 Vitalium fixed prosthesis with poor aesthetics and hygiene



Fig. 2 Oro-nasal communication



Fig. 3 master cast



Fig. 4 Putty index



Fig. 5 Castable bar (Rhein83)

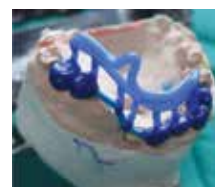


Fig. 6 Bar castable bar contoured to ridge and sprue attached



Fig. 7 Casted metal frame work and trial



Fig. 9 Denture trial

compromised clinic conditions, a fixed removable Andrew's bridge was planned for the patient. Additional anterior and posterior abutments were included in the treatment plan. Patient was explained about treatment plan and consent was obtained.

All the proposed abutment teeth were endodontically treated followed by preparation for full veneer metal ceramic restorations. Impressions were made using the putty wash impression technique and master casts were fabricated (fig 3). Mock wax up was done to obtain a putty index for the prosthesis (fig 4). Wax patterns were fabricated on the prepared abutment teeth and were connected using a preformed plastic bar attachment (fig 5). Plastic bar attachment was contoured to follow the ridge (fig 6). Contouring the plastic bar to ridge required sectioning the attachment bar into three planes. Position of the bar attachment was assessed three dimensionally using the putty index. This entire assembly was then cast in chrome cobalt alloy (fig 7). The finished and polished metal framework was tried in the patient's mouth for proper fit and clearance between the bar attachment and underlying soft tissues (fig 7). Box housings were casted separately in chrome cobalt alloy (fig 8). Wax trial denture was tried for aesthetic approval by the patient (fig 9). The removable part of Andrew's bridge was fabricated using heat cured polymethylmethacrylate (PMMA) resin (DPI).

The fixed component of the Andrew's system was cemented over the prepared teeth using glass ionomer cement (GC Fugii II). After 1 hour the removable component was inserted and occlusal adjustments were carried out. Relief was given on the tissue surface of removable prosthesis for metal housing. Positioning clip was placed along with the metal housing and positioned over the metal bar (fig 10). Then the metal sleeve with clip was picked up with autopolymerising resin. Care was taken not to engage any soft tissue or undercut beneath the bar attachment. Positioning clip was replaced with retentive pink clip using inserting tool (fig 11). Removable prosthesis was inserted and post insertion instruction regarding maintenance and care of the prosthesis was given (fig 12).

► Discussion

Congenital or acquired defects present with inadequate alveolar ridge in terms of height and width. Removable prosthesis can be utilized in reconstruction of defects, but removable prosthesis have inferior retention, stability and comfort compared to fixed prosthesis. Most patients prefer fixed prosthesis. But, the treatment with fixed prosthesis have questionable long-term prognosis especially in case of compromised ridge and abutment condition. Fixed-removable prosthetic design is a viable option that can be used successfully in rehabilitation of ridge defects.



Fig. 8 Box housing

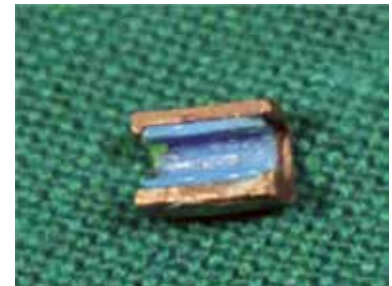


Fig. 10 Metal housing with positioning clip

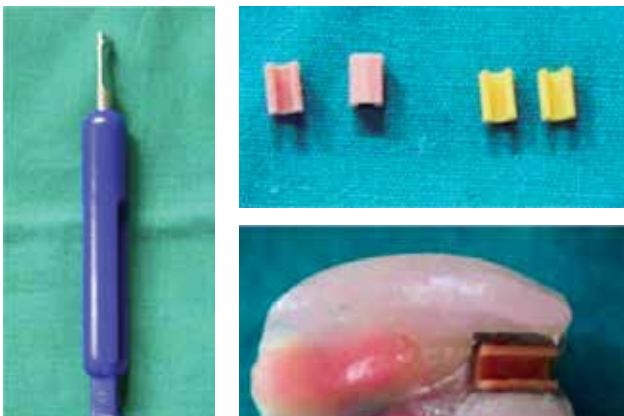


Fig. 11 Retentive clips inserted using inserting tool



Fig. 12 Post insertion

Immeleus JE and Aramany M⁶ in 1975 described the use of fixed-removable partial denture for cleft palate patients. The Andrew's bridge permits rehabilitation with a FPD-RPD used in treating cleft-palate patients with congenital or acquired defects when conventional methods are contraindicated. It permits the replacement of the lost teeth and supportive structures at the same time allows easy maintenance.

Andrews's bridge system has many advantages in patients with severe ridge defect which includes better aesthetics, hygiene along with better adaptability and increased retention. Andrews design seems comfortable for the patient as there is no palatal extension. Soft tissue response will be good due to less tissue impingement. The system also avoids transfer of unwanted leverage forces to the abutment teeth by acting as a stress breaker.

In the presented case the main challenge was that the ridge was not in a single plain. The attachment bar was sectioned and contoured to the ridge resulting in a three plane design of the bar attachment.

In case of compromised arches due to Seibert's class III ridge defect along with multiple missing teeth rehabilitation, Andrew's bridge system can restore the aesthetics and function, along with that it will improve the accessibility to maintain hygiene.

► Conclusion

The Andrew's design is particularly indicated for patients with extensive supportive tissue loss, where conventional treatment options cannot fulfil the objectives of a prosthesis. In case of oro-nasal defect patients, these fixed partial denture design can provide adequate access for cleansing with removable pontic design. Degree of retention and stability that aid for patient adaptation and comfort is not compromised in this design. Taken into account the periodontal conditions of teeth adjacent to these defects, this design provide a stress breaking effect to forces acting on the denture. Frequent wear of attachments, especially in case were retentive clips are given in two different planes often calls for periodical review and replacement of attachments. In this case, modified Andrews bridge design adapted well to the basic objectives for rehabilitation of ridge defects.

► References

1. McCracken, W. I. Partial Denture Construction, ed. 2, St. Louis, 1964, The C. V. Mosby Company, pp. 63-65
2. Ramstad, T.: Post-orthodontic Retention and Post-prosthetic Occlusion in Adult Complete Unilateral and Bilateral Cleft Subjects, Cleft Palate J. 10: 34-50, 1973.
3. Andrew JA, Bigg WF. Andrew's bar and sleeve retained bridge: a clinical case report. Dent Today 1999;18:94-6, 98-9.
4. Everhart RJ, Cavazos E. Evaluation of a fixed removable partial denture: Andrews bridge system. J Prosthet Dent 1983;50:180-4.
5. Fields H, Birtles JT, Shay J. Combination prosthesis for optimum aesthetic appearance. J Am Dent Assoc 1980;101:2276-9.
6. Immeleus JE, Aramany M. A fixed—removable partial denture for cleft palate patients. J Prosthet Dent 1975;34:286-91.

Gingival enlargement associated with chronic periodontitis: a case report

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Abstract

Inflammatory gingival enlargement, also known as gingival hyperplasia or gingival hypertrophy, can be defined as an abnormal growth of gingival tissues. Plaque-induced inflammation can be the sole cause of gingival enlargement or can be the secondary cause. It can also be associated with chronic periodontitis. Gingival enlargement can cause a functional and aesthetic disparity, therefore periodontal therapy to control gingival enlargement

is essential. The present case report describes a case of long standing gingival enlargement in a systemically healthy, young male involving the anterior and posterior region of both the arches. Radiographic evaluation revealed generalized moderate alveolar bone loss. Histopathological investigations revealed inflammatory infiltrate with dense fibro-collagenous tissue and atrophic epithelium. Surgical periodontal therapy was carried out to

provide a good aesthetic and functional outcome.

Keywords: Gingival enlargement, Inflammatory enlargement, Chronic Periodontitis

KDJ 2020 | Vol. 43 | No. 2 | Pg 109-111

► Introduction

Gingival overgrowth (GO) or gingival enlargement (previously called gingival hyperplasia or gingival hypertrophy) is characterized by enlarged gingival tissue with lobulated appearance that gradually extends along the labial, lingual, and coronal aspects to cover the entire anatomic crown of teeth. It may often associate with pain and bleeding gums, which in advanced cases may cause interference with speech, mastication, and aesthetics. Gingival enlargement can facilitate plaque accumulation by increasing the depth of gingival sulcus and by interfering with effective oral hygiene measures.¹ The secondary inflammatory changes further increase the size of the pre-existing gingival hyperplasia and may cause alveolar bone loss in untreated cases. This paper presents a case of idiopathic gingival enlargement associated with chronic periodontitis and its management.

► Case report

A 34-year-old male reported to the outpatient Department of Periodontics, Mahe Institute of Dental Sciences, Mahe, India, with the chief complaint of swollen and bleeding gums, bad breath, and aesthetic deformities of the face. Patient noticed swollen gums 2 years back. Since it was asymptomatic, patient neglected it. The lesion started as a small painless, beadlike

enlargement. As the enlargement progressed it resulted into a massive tissue fold covering considerable portion of the crowns, interfering with mastication and speech. Bleeding of gums and bad breath were noticed since 6 months which was progressive in nature. It decreased by salt water rinse. Besides these, no other complaints were present, such as pain. Patient's medical, and drug history were non-contributory. Further questioning revealed that none of his family members were affected with any form of gingival enlargement, nor was there any familial history of aggressive periodontitis, hypertrichosis, mental retardation, or epilepsy. His height and weight were within normal limits. On extraoral examination the patient had incompetent lips with convex facial profile.

► Clinical Examination

On clinical examination, marginal and papillary and attached gingiva appeared red and enlarged in the maxillary and mandibular arches, which were more prominent in the labial and buccal aspect as compared to palatal and lingual aspect. Gingiva appeared to friable and soft with smooth and shiny surface [Figure 1-5]. Exudate was present in relation to multiple teeth, bleeding on probing, and generalized pockets were present.

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Radiographic Examination

Radiographic investigation revealed alveolar bone loss indicating moderate form of periodontal disease [Figure 6]. Examination of immediate family members of the patient revealed that, none of his family members were affected with any form of periodontal disease suggesting a negative history for aggressive periodontitis.

Hematological Examination

Routine hematological investigations revealed hemoglobin 12.6% and differential leucocyte count of polymorphonuclear leukocytes 75%, lymphocytes 23%, monocytes 0%, eosinophils

2%, and basophils 0% and random blood glucose level was 98mg/dl.

Histopathological Investigation

Incisional biopsy was performed which showed atrophic parakeratinized stratified squamous epithelium with the dense avascular fibro-collagenous tissue. In few areas, flattening of the rete ridges was seen whereas in other areas they appeared elongated. Few chronic inflammatory cells mainly consisting of lymphocytes were seen dispersed throughout the section. Areas of small- to medium sized endothelial lined blood vessels were also evident.



Fig 1: Labial view



Fig 2: Right lateral view



Fig 3: Left lateral view.



Fig 4: Maxillary arch



Fig 5: Mandibular arch



Fig 6: Panoramic view



Fig 7: After scaling and root planning



Fig 8: Anterior Mandibular gingivectomy



Fig 9: Anterior maxillary gingivectomy



Fig 10: Right Lateral view



Fig 11: Left lateral view



Fig 12: 2 week Post-surgical labial view



Fig 13: 1 month Post-surgical maxillary occlusal view



Fig 14: 1 month Post-surgical mandibular occlusal view

► Diagnosis

In the present case, the enlargement was not related to hereditary syndromes, drugs, or endocrine related problems. Severity of gingival enlargement was consistent with the amount of local factors present and diagnosis of idiopathic gingival enlargement with generalized chronic periodontitis was made.

► Treatment

In Phase I periodontal therapy, thorough scaling and root planning was done and patient was prescribed Chlorhexidine 0.2% mouthwash and Doxycycline 100mg for 7 days. Clinical inflammation was minimal after 2 weeks following scaling and root planning [Figure 7]. Surgical therapy included internal bevel gingivectomy combined with the open flap debridement under local anesthesia [Figure 8-11]. After removal of excess tissue and elevation of mucoperiosteal flap, roots surface was debrided and the area was irrigated. The flaps were approximated and sutured. A periodontal dressing was applied which was removed after a week. Antibiotics and Chlorhexidine 0.2% mouthwash were prescribed. The recovery period was uneventful [Figure 12-14].

► Discussion

Gingival disease associated with dental plaque, hormonal disturbances, drugs and systemic diseases shares many characteristics. The main characteristics of these gingival conditions include: clinical signs of inflammation, presence of bacterial plaque to initiate and exacerbate the severity of the lesion disease and reversibility by means of etiology elimination. The clinical signs of gingival inflammation include enlarged gingival contours due to edema or fibrosis, transition to a reddish or bluish-red hue, bleeding upon probing and increase of gingival exudates.

Gingival enlargement is most commonly associated with various drugs, conditions, syndromes, and hereditary disorders.²⁻⁸ The present case report describes a case of idiopathic gingival enlargement with chronic periodontitis. Clinically and histologically, it is difficult to differentiate between idiopathic, hereditary, and drug induced gingival enlargement. In the present case diagnosis of idiopathic gingival enlargement with chronic periodontitis was made, because the enlargement was not related to hereditary, syndromes, drugs, conditions, or endocrine problems. The presence of thick band of subgingival calculus, deep periodontal pockets, and negative family history for severe form of periodontal disease supports the diagnosis of chronic periodontitis.⁹⁻¹⁰ Histological appearance of the surgically removed tissue supports the diagnosis of idiopathic

gingival enlargement. When massive gingival enlargement causes aesthetic disparity, interferes with normal mastication and maintenance of proper oral hygiene, a periodontal intervention must be done. Once the Phase I therapy has been performed and gingival tissue does not return back to normal stage, surgical therapy should be considered. The surgical therapy consists of either gingivectomy procedures or/and flap operation. If the tissues are soft and edematous, gingivectomy procedures are preferred and if the tissues are firm and fibrotic the preferred treatment option is flap operation. Maintaining good oral hygiene is important as the presence of inflammation and infection can be associated with a risk of recurrence of the gingival enlargement.

► Conclusion

The treatment protocol varies with each type of gingival enlargement. Combinations of surgical and nonsurgical therapy are prevalent and used according to the need of the patient. The functional and esthetic demands should also be kept in mind. Maintaining good oral hygiene is important as the presence of inflammation and infection can be associated with a risk of recurrence of the gingival enlargement, therefore periodic periodontal recall is a must.

► References

1. F. A. Carranza, "Gingival enlargement," in Glickman's Clinical Periodontology, F. A. Carranza, Ed., pp. 125-148, WB Saunders Company, Philadelphia, Pa, USA, 7th edition, 1990.
2. Zackin SJ, Weisberger D. Hereditary gingival fibromatosis: Report of a family. *Oral Surg Oral Med Oral Pathol.* 1961;14:828-36.
3. Thomas D, Rapley J, Strathman R, Parker R. Tuberous sclerosis with gingival overgrowth. *J Periodontol.* 1992;63:713-7.
4. Heijl L, Sundin Y. Nitrendipine-induced gingival overgrowth in dogs. *J Periodontol.* 1989;60:104-12.
5. Thomason JM, Seymour RA, Ellis JS, Kelly PJ, Parry G, Dark J, et al. Determinants of gingival overgrowth severity in organ transplant patients: An examination of the role of HLA phenotype. *J Clin Periodontol.* 1996;23:628-34.
6. Kato T, Okahashi N, Kawai S, Kato T, Inaba H, Morisaki I, et al. Impaired degradation of matrix collagen in human gingival fibroblasts by the antiepileptic drug phenytoin. *J Periodontol.* 2005;76:941-50.
7. Holzhausen M, Ribeiro FS, Gonçalves D, Correa FO, Spolidorio LC, Orrico SR. Treatment of gingival fibromatosis associated with Zimmermann-Laband syndrome. *J Periodontol.* 2005;76:1559-62.
8. Holzhausen M, Gonçalves D, Correa Fde O, Spolidorio LC, Rodrigues VC, Orrico SR. A case of Zimmermann-Laband syndrome with supernumerary teeth. *J Periodontol.* 2003;74:1225-30.
9. Flemming TF. Periodontitis. *Ann Periodontol.* 1999;4:32-8.
10. Papapanous PN. Risk assessment in the diagnosis and treatment of periodontal disease. *J Dent Educ.* 1998;62:822-39.

Management of intracanal separated instrument with combined use of ultrasonic and Masserann kit: A Case Report

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Abstract

The fracture of endodontic instruments is a procedural problem creating a major obstacle to normal routine therapy. The separated instrument, particularly a broken file, leads to metallic obstruction in the root canal and impedes efficient cleaning and shaping. When an attempt to bypass such

a fragment becomes difficult, it should be retrieved by mechanical devices. Masserann kit is one such device for orthograde removal of intracanal metallic obstructions. This clinical case demonstrates the combined use of ultrasonics and Masserann kit in removal of separated instrument in the

posterior tooth.

Keywords: Instrument retrieval; instrument separation; Masserann technique.

KDJ 2020 | Vol. 43 | No. 2 | Pg 112-115

► Introduction

The instrument separation during endodontic therapy is a troublesome event with incidence ranging from 2% to 6% of the cases investigated. Occasionally a separated instrument in a canal may obstruct access to the apical terminus during non-surgical root canal treatment. These instruments include usually some type of file or reamer and also can include Gates-Glidden or Paeso drills; the tips of hand instruments, like explorers or spreaders, lentulo spiral paste fillers; thermo mechanical gutta-percha compactors etc¹.

Instrument separation is most commonly reported during the treatment of molars (77% - 89% of all cases) with greater risk of separation occurs in lower molars (50% - 55%), as compared to upper molars (25%-33.3%).²

Several views have been raised as whether instrument separation has any role on the prognosis of endodontic therapy. Prognosis for a tooth with separated instrument depends on the presence of a periapical lesion, the microbial load of the

root canal during the time of separation and the quality of the obturation.

Instrument separation may occur due to improper use, inadequate access, limitations in physical properties, unusual root canal anatomy, and possibly manufacturing defects.¹ The improper usage of NiTi rotary instruments has increased the occurrence of instrument separation during the procedure which hinders the effective debridement and the complete obturation of the root canals leading to hopeless prognosis³. As it affects the final outcome of the root canal therapy, an attempt should be made to bypass or retrieve the instrument before leaving it in the canal and obturating to the level of separation or undertaking surgery⁴.

Preventive measures decreasing the incidence of fracture includes clinician's experience of a system, case selection, limiting file re-use, and the technique of the operator. It is reported that repeated usage can significantly reduce flexural fatigue resistance and the torque necessary to cause failure. Therefore ideally, single or limited usage of files is advocated⁴

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There are different techniques for separated instrument retrieval including the use of forceps, file and broaches, chemical solvents, hypodermic surgical needles and Masserann kit.⁵

Masserann technique is one of the most widely used methods of removal of foreign objects from the root canal. This technique is very useful in retrieval of broken files, silver points and posts from the canal¹;

Masserann kit (Micro Mega, France) contain an assortment of colour coded, end cutting trepan burs of increasing size. End cutting trepan burs are rotated anti clockwise to create space around the coronal end of the fragment by cutting surrounding root canal dentin and two sizes (1.2 and 1.5 mm in outer diameter) extractors to be inserted into the created space.

The extractor is tube like with a plunger rod (stylet) which is screwed inside the extractor and it locks the exposed coronal end of the fragment against internal embossment just short of the end of the extractor.⁶

This clinical case demonstrates the combined usage of ultrasonics and Masserann technique in removal of separated instrument in posterior tooth.

► Case Report:

A 33-year-old woman presented with acute pain in the lower left back tooth region since 1 week. History reveals that patient

had severe intermittent pain which aggravates during night. On clinical examination, deep caries was seen distoocclusally in relation to 37. Radiographic examination revealed deep caries involving distal pulp horn in relation to 37. There were no periapical changes (fig 1).

On vitality testing, patient gave hyper response which led to the diagnosis of symptomatic irreversible pulpitis in relation to 37.

Root canal treatment was initiated. Access opening was done under rubber dam in 37. Three canals were located in 37. Working length was determined using electronic apex locator (Root ZX Mini Morita). During cleaning and shaping, a Hero shaper 20 4% file was separated in mesiolingual canal in 37 (fig 2). A radiograph was taken to confirm the level of separation of the instrument. The instrument was found to be separated at the coronal third extending till the middle third of the root canal.

In the treatment plan, it was decided to retrieve the metallic obstruction by using a Masserann Kit (fig 3) (Micro Mega, Besancon, France).

On the next appointment, the coronal access in tooth 37 was refined using diamond points (Shofu Preparation Kit, Japan). The ultrasonic tip Acteon Satelec ET20 (fig 4 & 5) was activated to trephine dentin around the broken fragment. Canal was irrigated with normal saline intermittently to flush



Fig 1: Pre-operative



Fig 2: instrument separation



Fig 3: Masserann Kit



Fig 4



Fig 5



Fig 6&7: After instrument retrieval

out the debris from the canal and act as a coolant. Ultrasonic tip was used in a counter clockwise direction to trough around the coronal aspect of a separated instrument in order to expose coronal few millimetres of fractured segment. The canal is filled with EDTA solution to enhance the ultrasonic effect.

Since the size of the obstruction was not known, end cutting trephans having an appropriate diameter was selected by superimposing it over the obstruction on the radiograph. The trephan was run at slow speed in anticlockwise direction to cut the radicular dentin around the obstruction. The apical advancement of the trephan was radiographically monitored.

When coronal portion of the obstruction was freed from the dentin, extractor tube of 1.2 mm diameter was guided into the canal to encircle and grip the obstruction. The encirclement of the obstruction by the extractor tube was radiographically confirmed and the plunger rod of the tube was rotated in a clockwise direction to snugly grip the obstruction against the wall of the extractor tube.

Following the confirmation of gripping the obstruction using tactile sense, the extractor tube was gently turned in back and forth motions to loosen and retrieve the obstruction from the canal. Retrieval of the obstruction from the canal of tooth 37 was radiographically confirmed (fig 6& 7).

A ledge was detected apical to the site of obstruction in tooth following the retrieval of the obstruction. The ledge was negotiated using size 10 K-file. Following canal negotiation, Canals were shaped and cleaned in a crown down manner using NiTifiles (ProTaper F2, Dentsply Maillefer) till the working length which was determined earlier. Irrigation was carried out using 2.5% sodium hypochlorite and 2% of chlorohexidine. Calcium hydroxide (RC Cal, Prime Dental) was used as an intracanal medicament.

On the next appointment after one week, canal was obturated with gutta percha and zinc oxide eugenol sealer (Fig 8 & 9).

► Discussion

Instrument separation compromise the outcome of endodontic treatment by preventing access to the apex thereby impeding thorough cleaning and shaping of the root canal. Hence clinician should make every attempt to bypass or retrieve the separated instrument.⁷ Strindberg et al reported that when separated instruments were present there was a 19% decrease in the rate of healing of periapical tissues⁸.

The orthograde retrieval depends on many factors like length, cross sectional diameter, curvature, dentin thickness and morphology of the root, composition, cutting action (clockwise or anticlockwise) of the instrument, length, location and amount of binding of the fragment in the canal.

It was Richman in 1957 who first described the use of ultrasonics in endodontics.⁹ Heat generates due to the friction of ultrasonic tips against canal wall dentine or fractured instrument which may lead to tip breakage, so ultrasonic tips should be used at low power settings of the ultrasonic unit and shorter application times.⁹ As given in a review by Ahmad A Madarati et al, fragment removal using ultrasonics in clinical trials had a success rates ranging from 67% by Nagai et al to 88% and 95% reported recently by Cuje et al and Fu et al, respectively.¹⁰

With the trephining action and the vibration being transmitted to the separated fragment, the latter often begins to loosen and floats out of the root canal. The ultrasonic tip is placed in the space between the exposed end of the file and canal wall and it is vibrated around the obstruction in a counter clockwise direction that applies an unscrewing force to the file as it is being vibrated.⁵

Masserann Kit has been in use for over 30 years as a device for instrument retrieval and has a success rate of 73% and 44% regarding its use in anterior and posterior teeth respectively. However it should be used in a well-controlled manner with ample convenience form and with frequent radiographic monitoring. The use of relatively large and rigid trephans



Fig 8: Mastercone Radiograph



Fig 9: Obturation

lead to removal of substantial amount of root dentin leading to weakening of the teeth or root perforation limiting its application in posterior teeth, especially teeth with thin and curved roots⁷.

It is stated that Masserann technique can be used for retrieval of both stainless steel and NiTi fragments. It has lesser success rate compared to ultrasonics and conventional methods of instrument retrieval. Even though this technique is considered as inferior to ultrasonics and more time consuming, requiring 20 min to several hours, it is said to be still effective in selected cases and often has been a method of choice for retrieval over ultrasonic vibration. Masserann technique is useful in removing metal obstructions from anterior teeth having thick, straight roots. Contraindications include teeth with thin roots, curved roots or more apically due to the risks associated with it.¹¹

However, Masserann technique can be modified by combining with ultrasonics to be more effective. Takashi Okiji in a case report described some modifications in the usage of this device for effectively removing tightly bound intracanal broken instruments whose diameter is relatively large at the coronal end. The extractor was modified to create a wider space between the tube and plunger. It was performed by grinding the small extractor with a carborundum point and cutting off approximately 0.5 mm from the tip of the tube and sharpening the tip of the plunger. The modifications of the Masserann technique ensured firm gripping and loosening of tightly wedge obstructions and also resulted in increased retention without further removal of root dentin or reducing the diameter of the exposed end of the fragment with circumferential grinding.¹²

In order to reduce the frictional resistance as well as increase the efficiency of the instrument, continual lubrication of the canal with either irrigating solutions or lubricants is required. EDTA solution is put into the canal to take advantage of cavitation and acoustic streaming effects for instrument retrieval. The use of an ultrasonic tip as an adjunct with EDTA solution enhances the canal wall cleanliness.¹³

► Conclusion

Prevention of the instrument separation is the best strategy to avoid any stress and anxiety associated with it. In case of separation, safe retrieval or bypassing should be carried out. One needs to take care that every necessary step must be taken to prevent instrument separation by employing preventive

techniques. Among the retrieval methods, Masserann technique despite of its clinical limitations is employed widely in routine dental practice and with proper knowledge coupled with skills of the operator, separated files can even be retrieved. Use of various other technique like ultrasonics with the operating microscope for effective management of such cases have also been attempted.

► References:

1. Retrieval of a separated instrument using Masserann technique; Arun Kulandaivelu Thirumalai, Mahalaxmi Sekar, Sumitha Mylswamy J Conserv Dent | Jan-Mar 2008 | Vol 11 | Issue 1
2. Separated Instrument in Endodontics: Frequency, Treatment and Prognosis; Triantafyllia Vouzara, Maryam el Chares, Kleoniki Lyroutdia; REVIEW PAPER (RP) Balk J Dent Med, 2018; 123-132
3. Retrieval of fractured instrument from root canal: a case report 1, Dr. Aneri Doshi, 2Dr. Chandni Doshi, 3Dr. Minal Desai, 4Dr. Hitesh Doshi International Journal of Development Research Vol. 07, Issue, 06, pp.13388-13391, June, 2017
4. Endodontic instrument fracture: Causes and prevention; M. B. McGuigan, 1 C. Louca and H. F. Duncan; BRITISH DENTAL JOURNAL VOLUME 214 NO. 7 APR 13 2013
5. Retrieval of Separated Instrument using Ultrasonics in a Permanent Mandibular Second Molar: A Case Report : 1Rithima Sokhi, 2 MV Sumanthini, 3Vanitha Shenoy; Journal of Contemporary Dentistry, January-April 2014; 4(1):41-45
6. Management of Intracanal Separated Instrument Using Masserann Technique: A Case Report Dr Aditi Sahni1, Dr Manoj G. Chandak2 IOSR Journal of Dental and Medical Sciences (IOSR-JDMS). Volume 14, Issue 12
7. Retrieval of a separated file using Masserann technique: A case report; Pai ARV1, Kamath MP2, Basnet P3 Kathmandu University Medical Journal (2006), Vol. 4, No. 2, Issue 14, 238-242
8. SEPARATED INSTRUMENTS- A MIND-SET BETWEEN HJ. ARD AND ROCK- A REVIEW; Geeth Deepika1, Suresh Mitthra2, Balasubramaniam Anuradha3, Arumugam Karthick4; Evolution Med. Dent. Sci./eISSN- 2278-4802, pISSN- 2278-4748/ Vol. 6/ Issue 87/ Oct. 30, 2017
9. Retrieval of separated instrument from the root canal using ultrasonics: Report of three cases Ashtha Arya, Anshul Arora, Gourav Thapak; Endodontology 2019; 31:121-4.
10. Management of Intracanal Separated Instruments; Ahmad A. Madarati, PhD, MSc, BDS,*† Mark J. Hunter, MSc, BDS,‡ and Paul M.H. Dummer, PhD, MSc, BDS§
11. Retrieval of a metallic obstruction from the root canal of a premolar using Masserann technique; R. Vivekananda Pai, Shuguftha Mir, Rachit Jain Contemporary Clinical Dentistry | Oct-Dec 2013 | Vol 4 | Issue 4
12. Modified Usage of the Masserann Kit for Removing Intracanal Broken Instruments Takashi Okiji, DDS, PhD; JOURNAL OF ENDODONTICS; VOL. 29, NO. 7, JULY 2003
13. Kenneth M Hargreaves' Louis H Berman; Cohen's Pathways of the pulp; First South Asia edition 2017; Chap 19; Management of iatrogenic endodontic events; page no; 727

CDE Report



Dr Faizal C P
CDE Chairman, IDA Kerala State

Council on Dental Education, IDA Kerala state had outlined a plan to conduct State CDE programmes and hands-on sessions involving all branches to enhance the knowledge and skills and to keep pace with the modern technologies, development and research. Due to the Covid19 social distancing, we had to change our plans and therefore conducted online programmes through Webinars.

Following webinars were conducted

1. 19 April 2020

“Whats Up Doc”- Soft skills in dental practice

Dr Sharath Ashokan MDS, PhD, Professor & Head, Dept of Pediatric & Preventive Dentistry, KSR Institute of Dental Science and research, Tiruchengode, Tamil Nadu

2. 26 April 2020

Importance of stress Management in Dental Practice

Dr Abdul Latheef KH, BDS, MSc (Psychology),

3. 3 May 2020

Management of Endodontic Emergencies

Dr Ajay Logani, Professor & Head, Dept of Endodontics, CDER, All India Institute of Medical Sciences, New Delhi

4. 10 May 2020

Know your Enemy – All about Covid 19 (A Panel Discussion)-

Dr Anoop Kumar AS, Chief Critical care Medicine, Baby Memorial Hospital, Kozhikode

Panelists- Dr Ram Manohar, Dr Shaji K Joseph, Dr Anil Kumar S, Moderator – Dr Dinesh KR

5. 17 May 2020

Management of Tooth Avulsion- Clinicians perspective

Dr Nitesh Tewari, Asso Professor, Dept of Pediatric Dentistry CDER, All India Institute of Medical Sciences, New Delhi

6. 31 May 2020

What lies Beneath – The science behind predictable composite Restorations

Dr Yohan Chacko, Prof & Head, Endodontics, Asan Dental College, Tamil Nadu

7. 07 June 2020

Legal Aspects of Dental Practice – Current Covid Scenario

Adv Shyam Padman, Legal Consultant, IDA Kerala State

8. 14 June 2020

Dental Lasers- An approach to enhance clinical practice

Dr Premila Selvi Suganthan, BDS, MSc (Laser) Chennai

The participation from all the members were overwhelming. These programmes are also available at the Youtube channel of IDA Kerala State <https://www.youtube.com/channel/UC6fMoOe5XZ7y1YraggLMUIQ/featured>

More than 90 webinars were conducted by local branches since March 2020. We would also like to appreciate the involvement and efforts of all the branches in conducting continuing educational programmes.



CDH Report



Dr Susanth B
CDH Chairman, IDA Kerala State

The Dentist Day Celebration of IDA Kerala State hosted by IDA Coastal Malabar Branch was held on March 6th 2020 at Sreevalsam Auditorium, Payyannur.

The programme started with a Rangapuja by the Students of Govt Dental College, Kannur.

Hon. Secretary, IDA Kerala State Dr. Deepu J. Mathew adorned the presidential collar to the President, IDA Kerala State Dr. Joseph C.C and the function was called to order at 3.20 pm. Dr. Sudha Santhosh, President IDA Coastal Malabar branch welcomed all the dignitaries and members to the programme. Hon. Secretary, IDA Kerala State Dr. Deepu J. Mathew briefed about the significance of Dentist Day. President Dr. Joseph C.C, in his presidential address spoke about the current situation of Dental practice in Kerala. Dr. Ria Abraham



introduced the Chief Guest. The Chief Guest, Honourable MLA. Sri T.V. Rajesh inaugurated the State Event by lighting the lamp along with the other office bearers of IDA Kerala State and the host branch.

Chief Guest, in his Inaugural address congratulated IDA for celebrating Dentist Day in a grand manner. IDA Kerala State has selected 2 members from each local branch to receive IDA Excellence Awards in 2 categories which were presented as a part of the State level Dentist Day Celebrations.

1. A senior member, who has rendered meritorious services to the IDA branch.

2. A promising young dentist who has joined IDA in the past 5 years and has actively participates in all Local Branch Programmes.

Chief Guest distributed IDA Excellence Awards to the members of IDA Trivandrum, IDA Attingal, IDA Quillon, IDA Pathanamthitta, IDA Thiruvalla, IDA Mavelikkara and IDA Alappuzha branches on this occasion. Dr. Santhosh Sreedhar, Past National Vice President of IDA handed over the memento to the Chief Guest.

IDA Kerala State - President Elect Dr. Shibu Rajagopal, Immediate Past President Dr. Abhilash G.S and CDH-Chairman Dr. Susanth B offered felicitations. This was followed by a flash mob by students of Government Dental College, Kannur.

Dr. Sapna Sreekumar introduced the Celebrity Guest-Film Actress and National Award winner, Ms. Surabhi Lakshmi to the gathering. Ms. Surabhi Lakshmi, in her speech, mesmerized the gathering with her on the spot wit and she took the crowd with the typical kozhikodan slang which she had portrayed in m80 moosa, a comical serial. And she did appreciate the enthusiasm and hard work of our fraternity.



Ms. Surabhi Lakshmi released the first issue of the journal of IDA Coastal Malabar Branch MIRROR and handed over the first copy to Dr. Joseph C.C President and Dr. Anjana G, Hon. Editor - IDA Kerala State. After that she presented the IDA Excellence Awards to the following IDA Branches: IDA Central Kerala Kottayam, IDA Green valley, IDA Malanad, IDA Adoor, IDA Kochi, IDA Greater Kochi, IDA Smart City and IDA Kunnamkulam. Dr. Terry Thomas, Vice President of IDA Kerala State handed over the memento to the celebrity Guest Ms. Surabhi Lakshmi.

IDA Kerala State Vice President - Dr. Ahamed Shafi, Hon. Editor - Dr. Anjana G, Hon. Treasurer - Dr. Fasil V. Hassan handed over the Appreciation Certificate to Kannur Dental College, Century Institute of Dental Sciences, Poinachi, Kasargod and Govt. Dental College, Kannur respectively; for their support and cooperation extended towards the state level dentist day celebrations.



Students from Govt. Dental College, Kannur entertained the audience with variety of programmes including Group song, group dance etc. The Participation Certificate to students of Govt. Dental College Kannur was presented by Dr. Prabhath T, Hon. Secretary IDA Coastal Malabar Branch.

Mr. Sibi Thomas, Cine Actor and Circle Inspector of Police was the other Celebrity Guest for the Function. Dr. Reshmi Haridas introduced the Celebrity Guest Mr. Sibi Thomas to the gathering. In his speech, he thanked the organisers for inviting him for the Dentist Day Celebrations. Mr. Sibi Thomas handed over the IDA Excellence Awards to the following IDA Branches: IDA Kodungallur, IDA Nedumbassery, IDA Thripunithura,



IDA Chalakudy, IDA Trichur, IDA Palakkad, IDA Valluvanad and IDA Eranad. Dr. Faizal C.P CDE- Chairman IDA Kerala State handed over the memento to Mr. Sibi Thomas.

This was followed by entertainment programme by students of Century Institute of Dental Sciences, Poinachi, Kasargod. Dr. Ranjith Ravindran, Programme Co ordinator of Dentist Day Celebrations handed over the Participation Certificate to students of century Dental College. This was followed by entertainment programme by the members of IDA Coastal Malabar Branch. Dr. Girish Kumar T.P, Dr. A.V Madhusoodhanan, Dr. Suresh, Dr. Rathesh, Dr. Vivek, Dr. Athul Santhosh participated in the skit. Dr. Sreedevi Nighil performed a classical dance. The audience was entertained with a western dance performed by Dr. Suja Vinod, Dr. Shilpa, Dr. Revathy, Dr. Kavya and Dr. Shyamili. Dr. M. Raveendranath, Past National Vice President of IDA presented a token of appreciation to the members of IDA Coastal Malabar who participated in the entertainment programmes.

Dr. Varun Nambiar introduced the Guest of Honour to the gathering. The Guest of honour for the programme was Sri. T. V. Subhash Babu,



IAS, Kannur District Collector. In his talk, he shared his life experience that made him successful and also quoted dreams are to be chased and fulfilled. Sri. T. V Subhash Babu, IAS, handed over the IDA Excellence Awards to the following Branches: IDA Malappuram, IDA Kondotty, IDA Wayanad, IDA Malabar, IDA Vadakara, IDA Thalassery and IDA

WDC Report

Dr Priya Rajendran
Secretary



Dr. Mili James
President



The IDA KSB women's dental council activities for the year 2020 have been planned with the theme "Go green", as WDC recognises the need for reforms to start right at home. Programmes aimed at reducing plastic consumption and waste generation will be planned through the year.

The National WDC meet was conducted along with IDC 2020 on 24th January, and was graced by National leaders of IDA, Dr. Janak Sabharwal, Dr. Vineetha Chugh and Dr. Ravinder Singh. Over 100 WDC members from across the nation attended. The new national WDC President Dr. Shrabani Dasgupta addressed the gathering. Two stalwarts of the dental profession, Dr. Sobha Kuriakose and Dr. Lali D. S. were honoured with lifetime achievement Awards. There was also an awareness talk on Breast cancer by Dr. Reji (Assoc Prof, Sree Gokulam Medical college, Venjarammoodu, Trivandrum) for the attendees.

Various CDE and CDH programmes have been organised with the active involvement of WDC at the respective local branches. Further, many of the branches are gearing up to celebrate Dentist's Day and Women's Day, in a bid to set up higher benchmarks for the rest of the year.



Coastal Malabar. Dr. A.V. Madhusoodhanan, CDH Representative of IDA Coastal Malabar Branch handed over the memento the guest of honour on this occasion.

This was followed by entertainment programme by Students of Govt. Dental College, Kannur. Dr. Sreejan C.K, Programme Convenor handed over the Participation Certificate to students of Govt. Dental College, Kannur. Dr. Ahamed Shafi, Programme Coordinator proposed

the Vote of Thanks. After the National Anthem, meeting was adjourned at 9 pm, for fellowship and dinner. The sponsors of programmes were Amana Motors, Group Pharmaceuticals, Sumanges Pharmaceuticals, S M Dental Studio and Al Ameen Surgicals. More than 320 members attended the programme and every one very well appreciated the time management, punctuality and excellent arrangements made for this State Level Dentist Day Celebrations.



► Quilon Branch

President, Dr. Ciju P Cherian and his team of office was installed on a grand ceremony, inaugurated by Prof. (Dr.) M. K. C. Nair former VC (KUHS); graced by Dr. Abhilash.G.S. (President, IDA KSB), Dr. Jinu Mathew Vaidyan (VP, IDA KSB) and dignitaries from neighbouring branches; followed by a family meet.

IDA Quilon carried out the following programmes : 3 Executive Committee Meetings
2 CDE, 5 CDH, 2 WDC
1 General Body Meeting



► Chalakudy Branch

20/02/2020- seed distribution
Seed to all members given on branch's installation day and the inauguration was done by WDC chairperson.
25/02/2020-deworming day
Tablets were given to children by WDC chairperson DR. SHEJEENA.
06/03/2020-Dentist day
Program held at Perambra church.
a) Free dental checkup and blood checkup to 300 patients.
b) Tooth fairy charitable fund formation done.
c) Dental awareness class by DR. JOJI PETER.
d) WDC conducted a program to support psychologically recovered female inmates at Puthenchira ladies orphanage and awareness class also was given to them by DR.SHEJEENA
08/03/2020_international womens day
Celebrated with some awareness classes and honouring ceremony.
a) Womens safety centric topic.
b) Class about menstrual hygiene.
c) Photo contest among WDC members about most inspirational

women in your life.

d) Honouring ceremony of most respected women in the society.
01/04/2020
Our wdc chairperson DR.SHEJEENA produced and distributed around 60000 masks to public.
04/04/2020
Tik-tok challenge by members.
09/04/2020
A short story started by our member DR.CIJO JOSE and narration continued by other members named "Nakshathrangalkuveedundo".
11/04/2020
Our president DR. SIJO VARGHESE supplied grocery items to community kitchen Muriyad gramapanchayath.
12/04/2020
Video was done by our member named "Lockdown with family".
28/04/2020
Our WDC members done a program named "Lockdown dance".



► Kodungallur Branch

First Executive Meeting of IDA Kodungallur Branch (15/01/2020)-Mapranam
Second Executive Meeting of IDA Kodungallur Branch (17/02/20)-Kodungallur
CDE No.1 LEARN THE BIOCLEAR WAY -(12/01/2020 at Rotary Hall, Kodungallur. Faculty was Dr Shibu Sreedhar MDS.
CDE No.2.Post Endodontic Restorations -Changing Concepts (28/02/20) at IMA Hall, Kodungallur. Faculty was Dr. George Jacob MDS and Dr Vijit Narayana.
CDH No.1 Camp at Thonniyakavu NSS Auditorium, North Paravur (05/01/20)
CDH No.2 Camp-oral cancer and check up camp SRADDHA Project, Irinjakuda Kudumbasree (27/01/20)
CDH No.3 Campat AIMC College, SN puram (01/02/20)
CDH No.4 Camp at St Annes Public School, Aloor Anathadam (04/02/20)
CDH No.5 Camp at Govt LP School, North Paravur (07/02/20)
CDH No.6. Camp at SN vidyaBhavan, Chentrapinni (12/02/20)
CDH No.7. Camp at RMLP SCHOOL, Kizhuthani (14/02/20)
CDH No.8. Camp at Perinjanam East UP SCHOOL, Perinjanam (26/02/20)
IDA KERALA STATE DENTISTS DAY AWARDS 2020 (06/03/20)



DR GOKUL K G AND Dr ALDIS PETER RECEIVED THE IDA KERALA STATE DENTIST AWARDS FROM IDA KODUNGALLUR BRANCH when DENTIST DAY DAY CELEBRATION was held at Payannur on 06/03/2020..
World Oral Cancer Day (04/02/20)
Camp at St Annes Public School, Aloor Anathadam (04/02/20)
Women's Day Celebrations (08/03/20)
Conducted a Sraddha Awareness Class (CDE Program) on Womens' Day, "Respect For Women".

Karunagappally Branch

- INSTALLATION AT IMA HALL KARUNAGAPPALLY BY Dr.Jinu Mathew Vaidyan (state first vice president) on 2/2/2020
- AWARENESS PROGRAMME ON CORONAVIRUS AND CONTACT PRECAUTION PROTECTION AT YMCA HALL ON 14/02/2020

- Oral Health awareness programme by WDC IDA Karunagappally on 8/03/2020
- A Family get together and Dentist day celebration at Green channel Black water resort at Alumkadaku Karunagappally.



Pala Branch

Inauguration Report

Indian Dental Association Pala Branch was inaugurated on 14th of April, 2020, through online platform by IDA Kerala State President Dr Joseph C.C. IDA Pala becomes the first branch inaugurated through online portal.

Inaugural meeting was called on 14th of April, 2020 at 02.00p.m on Zoom online platform. IDA kerala State President Elect Dr Shibu Rajagopal delivered welcome speech and invited all the dignitaries online.

IDA State President Dr Joseph C.C delivered presidential address and Inaugurated IDA Pala Branch as 37th branch of IDA Kerala state.

Past President of IDA Kerala Dr. Abhilash G.S addressed the meeting and installed Dr Ittyvirah Babu as the President of IDA Pala. Dr Ittyvirah Babu delivered acceptance speech and installed the branch office bearers.

Hon. Secretary of IDA Kerala State Dr. Deebu J Mathew addressed the gathering and handed over the Constitution of Indian Dental association to the Branch Secretary Dr Jeo Tom Charls through e-mail.

Kerala Dental Council President Dr Shaji K Joseph addressed with felicitation.

Nearly 100 participants attended the meeting including state office bearers, past presidents of IDA Kerala, Branch presidents of various branches and senior dental practitioners in Kerala.

Meeting was concluded with vote of thanks by Branch Secretary Dr Jeo Tom Charls.



► Eranad Branch

7th Installation ceremony of IDA ERNAD for the year 2020-21 conducted on 19th January 2020 at Shifa Convention Centre Perinthalmanna, Dr. Balakrishnan (President) & Dr. Sanal Babu K (Hon.Secretary) and 87 members participated. Chief guest was Dr. Joseph CC the president elect of IDA KERALA 2019 and Installing officer was Dr.George Abraham.

CDE PROGRAMMES

ORAL HEALTH AWARENESS CAMPAIGN

1. Combined District wise campaign (IDA Eranad Branch and IDA Malappuram Branch) SHRADDHA conducted on 9th January 2020 at Malappuram. Inaugurated by Sri. Ubaidullah MLA. Dr. Sanal Babu.k has taken the awareness class.

2. At AGAPE CHILDREN HOME Aruvakkode, Nilambur on 11th January 2020. Inaugurated by Paster Alexander. Dr.Anoos Dr.Rosemary And Dr.Keerthi has taken the awareness class.

3. At POOVATHIKANDI ANKANAVADI, Areakode on 19th February 2020. Inaugurated by Dr.Balakrishnan. Dr. Anoos and Dr. Arshad has taken the awareness class.

4. At KOOMBRA ANKANAVADY, Areakode on 6th March 2020 (INTERNATIONAL DENTIST DAY). Inaugurated by Dr. Arshad and Dr. Anoos has taken the awareness class.

5. At VEDAGAYATRY BALIKA SADANAM,Wandoor on 8th March 2020. Inaugurated by Dr. Balakrishnan. Dr.Anoos has taken the awareness class. (WOMENS DAY CELEBRATION)

ORAL SCREENING CAMP AND DENTAL KIT DISTRIBUTION

1. At AGAPE CHILDREN HOME Aruvakkode, Nilambur on 11th January 2020. Oral check up done by Dr Anoos Dr. Sanal babu Dr.Rosemary and Dr. Keerthi. 25 Students and 28 Parents has participated; 2. At POOVATHIKANDI ANKANAVADI, Areakode on 19th February 2020. Oral check up done by Dr.Anoos and Dr.Arshad. 26 Students 32 Parents has participated; 3. At KOOMBRA ANKANAVADY, Areakode on 6th March 2020. Oral check up done by Dr Anoos and Dr Arshed. 70 students has participated (NATIONAL DENTIST DAY CELEBRATION); 4. At VEDAGAYATRY BALIKA SADANAM,Wandoor on 8th March 2020. oral check up and dental kit distribution done by Dr.Anoos Dr.Balakrishnan Dr.Sanal babu Dr.Rosemary Dr.Keerthi Dr.Sharhana Dr.Preetha Dr.praseera Dr.Rohit . 42 students were participated.(WOMENS DAY CELEBRATION)

BUDS SCHOOLS CAMPS

1. KARUNYABHAVAN HSS FOR THE DEAF Vazhakkad

Program was inaugurated by Dr Panchayath Seceretary. Oral awareness class has taken by Dr Anoos Dr Rosemary and Dr Keerthi. Oral health checkup and Dental kit distribution done by Dr Anoos Dr Rosemary Dr. Balakrishnan Dr. Umer Hasoon Dr. Arshiya Dr. Shafna and Dr.Rafna Dr keerthi on 30th January 2020 Inaugurated by Dr Sanal Babu. and has taken oral health awareness class. were participated. 120 students were participated.

2. PEARLS BUDS SCHOOL FOR DIFFERENTLY ABLED Vattiparamb Program was inaugurated by Dr Sanal babu. Oral awareness class has taken by Dr Anoos p Dr Rosemary and Dr Nafsal, Oral health checkup and dental kit distribution done by Dr Anoos Dr Nafsal Dr Sanal babu Dr Rosemary Dr Keerthi Dr Umaima Dr Shamna Dr Sherhana on 26th february 2020. 35 students and 30 parents has participated.

3. BUDS SCHOOL FOR THE HEARING IMPAIRED, Valillapuzha Nilambur. Program was inaugurated by Sareena (School principal). Oral awareness class has taken by Dr Anoos p Dr Rose Mery. Oral health checkup and dental kit distribution done by Dr Anoos Dr Sanal babu

Dr Rose mery Dr Keerthi Dr Akash Dr Ayisha on 3rd March 2020.

TRIBAL COLONY DENTAL CAMPS

1. PANAPPOYIL ANKANAVADI AKAMPADAM NILAMBUR

Program was inaugurated by Dr Anoop (Medical Officer, Chaliyap Panchayath). Oral cancer awareness class has taken by Dr Anoos P Dr Rose Mery Dr Keerthi. Oral health checkup and dental kit distribution done by Dr Sanal Babu Dr Anoos p Dr Rose mery Dr Keerthi Dr Akash on 3rd February 2020. (WORLD CANCER DAY)

2. AMBUMALA TRIBAL COLONY

Program was inaugurated by Dr Anoop (Medical Officer, Chaliyap Panchayath). Oral awareness class has taken by Dr Anoos P Dr Rose Mery Dr Keerthi, Oral health checkup and dental kit distribution done by Dr Sanal Babu Dr Rose Mery Dr Anoos P Dr Keerthi Dr Arshad on 12TH February 2020.

FREE PALLIATIVE DENTAL CARE CLINIC

Opening on all THURSDAYS from 9:00 am (Free check up and treatment)

ADOPTION OF ORAL HEALTH CARE OF FEDERATION OF BLIND

ARYA DEVI TEACHER: Done FPD with relation to 13 12 11 21 22 23 34 33 32 31 41 42 43 44

VISHALAM: Done FPD with relation to 41 42 43 44

FREE ORTHODONTIC TREATMENT

Fixed orthodontic treatment for 15 students of NAJATH ORPHANAGE Karuvarakundu.

CDE PROGRAMMES

Conducted CDE Programme on 9th February 2020(Class with live Demo and Hands-on); Topic : Class 2 composite restorations the injection moulding technique

Speaker: Dr. Rajeev S Pillai; No of participants 43.

WDC REPORT: WDC Representatives Dr. Rose Mary and Dr. Keerthi conducted 10 Oral Health awareness class, 9 oral screening camps, world cancer day observation at Panapoyil Anganwadi and WOMENS DAY celebration at VEDAGAYATHIRI BALIKA SADANAM Wandoor.

SPORTS: IDA Eranad conducted sports festival (LUMINANCE 2020) on March 5 and 8th 2020 at Unity Womens College, Manjeri 90 Members participated and items were 1) Cricket 2) Football 3) Throgh Ball 4) Athletics 5) Chess 6) Carroms 7) Badminton Etc

DENTIST DAY CELEBRATION: Dentist Day Celebrated on 06/03/2020 at Indian Hotel Wandoor. Honoured our senior Members Men1) Dr.Jikku Francis & Lady 1) Dr. Ajitha Anand and 32 members participated.

EXECUTIVE MEETING: 1st Executive Meeting Held at Opus Canto Hall Manjeri on 1/02/2020 and 17 members were present.



► Greater Kochi Branch

CDE programmes

The first CDE of IDA Greater Kochi branch (inter branch CDE) was held on 01-03-2020 at Cochin Suburban Club, Kakkanad on ethics and law in dentistry by Dr. Chandrasekharan Janakiram

CDH programmes

Five CDH camps were conducted by IDA Greater Kochi branch. Dental check up and awareness camps were conducted by President Dr. Prasanth Antony, Secretary Dr. Monish Krishnan & CDH chairman Dr. Jithin John.

Distribution of IDA GREATER KOCHI free Personal protection kits to its members by President Dr. Prasanth Antony and Hon. Secretary Dr. Monish Krishnan.



► Malappuram Branch

INSTALLATION: Installation ceremony of IDA Malappuram was done on 9th Feb 2020 at Rydges inn Kottakkal. Dr. Mahesh K Joy was elected on the president for the year 2020.

MCL (Mida Cricket League): Mida Cricket league was conducted on 29/02/2020 MIDA Challengers were declared as champions.

MEETINGS: 1st executive committee meeting was held at Rydges Inn Kottakkal, 22 members attended the meeting.

CDH Reports: 3rd CDH Programme (15/01/2020) (Pain and Palliative day Observation)

Pain and palliative day observation was done at MIDA charity dental clinic, Thavanoor old age home around 20 patients were examined.

4th CDH Programme (04/02/2020) (World Cancer Day Observation): An oral health check up and awareness class was taken of AMINA ITI Kadungathukund around 80 patients were examined.

5th CDH programme (19/02/2020): An oral health checkup and awareness class was conducted at bench mark international school Tirur around 200 students were screened.

6th CDH Programme : An oral health checkup and awareness class was conducted at HALP school pookattiri around 80 students were screened.

7th CDH Programme: An oral health checkup and awareness class was conducted at ALPS Nedungotoor, Valancheri.

DENTIST DAY OBSERVATION: Dentist day observation was done in association with Manjeri municipality and and Vayomithram project. An oral health care check up and awareness class was taken at Naellikuthu. PHC around 60 patients were screened.

CDE Programmes: 1st CDE Programme (08/03/2020); Topic: periodontal diagnosis demystified; Faculty : Dr Dilshi Ishan. Around

35 members attended the programmes

WEBINARS: IDA Malappuram conducted four webinars

1st webinar - Minor oral surgery simplified (06/04/2020)

Faculty (Dr Praveesh Vishnudas)

2nd webinar - what after lock down (08/04/2020)

Faculty (Dr Civy polayath)

3rd Webinar - Mal occlusion and Airway issues in children(16/05/2020)

Faculty (Dr Dave Xavier)

4th webinar - Rubber Dam in daily dental practice (17/05/2020)

Faculty (Dr Jose Thomas)

WDC Report: IDA Malappuram observed women's day on 08/03/2020. Conducted a CDE programme and introduced paper pens and paper files for CDE Programmes under 'Project go GREEN' Topic - Periodontal diagnosis demystified; Faculty : Dr. Dilshi Ishan.



► Alappuzha Branch

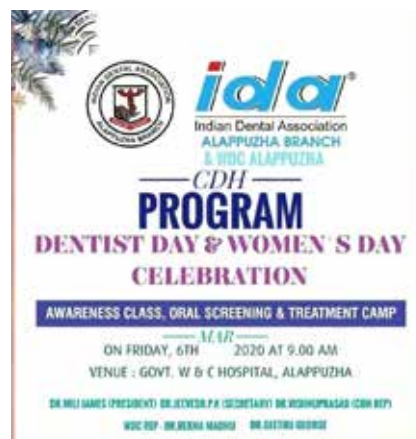
CDE

IDA Alappuzha CONDUCTED 1ST PRIVILEGE CDE on the topic 'IN BLACK AND WHITE CBCT DEMYSTIFIED' at Ramavarma club hall on 2.2.2020. Faculty was Dr. Anu Sushanth MDS assistant professor dept. of oral medicine and radiology, educare institute of dental sciences. About 30 members the lecture session in the morning. Hands-on session was in the afternoon with attendance of 15 members. The program started at 9am and ended at 4pm.



CDH

IDA Alappuzha branch and WDC Alappuzha conducted camp at women's and children hospital in association with rotary club of Alleppey as women's and dentist day celebration on 6.3.2020. The program was inaugurated by Alappuzha municipal chairman Mr. Illickal Kunjumon. Dr. Rupesh S. took an awareness class for the public. About 80 persons had undergone oral screening and also were given free oral hygiene kits.



► Kochi Branch

Scientific Sessions

10 WEBINARS were done for members
1st Webinar: Topic : Guidelines for providing dental care during covid 19, 28 th April, 2020; Speaker : Dr Prashanth Pillai
2nd Webinar: Speaker: Dr George Jacob; Topic: Rubber dam isolation - Tips and tricks; 03.May.2020
3rd Webinar: Speaker: Ranjith Warriar, Topic: Healthy finances healthy living. 10. May. 2020
4th Webinar: Speaker: Anupama Roy; Topic: Dressing right 17.May.2020:
5th Webinar, Speaker: Dr Binoy S Babu, Topic: Co existence with covid, 24.May.2020
6th Webinar: Speaker: Dr Noorudeen AM, Topic: Gingival depigmentation simplified, 07.June.2020
7th Webinar: Speaker: Dr Eldo Koshy, Topic: Pocerlain laminate veneers - quick look at the clinical aspects, 14.June.2020
8th Webinar: Speaker: Dr Meera Gopalakrishnan, Topic: Diastema Dilemma Demystified, 21.June.2020
9th Webinar: Speaker: Dr Santosh Ravindran, Topic: New trends in post endodontic restorations and material applications, 28.June.2020
10 th Webinar: Speaker :Mr Shameem Rafeek, Topic:Face lift your Practice, 05.07.20

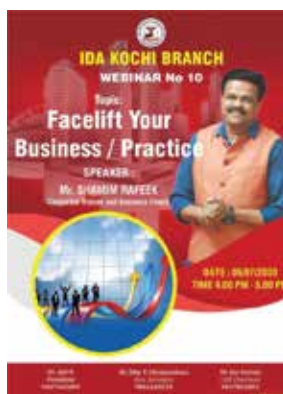
CDH PROGRAMME

World no tobacco day e-poster making competition among high school students and given cash prizes to winners.

Free Kit distribution for Kochi members at time of covid
IDA Kochi had distributed free kits to all members at the time of covid along with saplings to celebrate world environment day.

The free kit of face shield, 5nos N 95 masks, 3 nos Surgical gowns, 2 bottles of surface disinfectant were distributed for all members.

Plant Saplings were distributed on world Environment Day
There were 2 EC meetings online in April and May.



► Malabar Branch

Hosted 1st State event- CDH Project 'SHRADDHA 2020': In association with IDA KSB and Kudumbasree State Mission, IDA Malabar conducted an Awareness programme for Kudumbasree coordinators at Mahila Mahal, Kozhikode on 07.01.2020

Meeting with DMO by District Committee & Branch Executives: On Feb 4th DMO Kozhikode called a meeting with Medical, Dental and Ayush fraternities at Civil Station Kozhikode to discuss preventive protocols against Covid -19 infection.

Installation of branch office bearers - IDA Malabar 2020 and 1st family meet: Dr Shaju Mandoli installed as the new president of IDA Malabar 2020 by Dr Joseph C C, the President of IDA KSB on 16.02.2020 at Hotel Malabar Palace. We're honoured to have Sri M K Raghavan M P as the chief guest of the function. The guests of honour were Dr Deebu J Mathew, Hon. Secretary IDA KSB, Dr Abhilash G S, IPP IDA KSB.

Hosted 2nd State Event- President Secretary Seminar 'PRESIDE 2020': IDA Malabar hosted the IDA KSB's President Secretary Seminar – PRESIDE 2020 at Hotel Yash International, Kozhikode on 22.02.2020

Hosted 3rd State Event - 2nd State Executive Meeting of IDA KSB.: IDA Malabar also hosted IDA KSB's 2nd State Executive Meeting of year the 2020 at Hotel Yash International, Kozhikode on 23.02.2020

1st executive meeting of the branch office 2020: 1st executive meeting of IDA Malabar for the year 2020 was held at IDA Hall Ashokpuram, Kozhikode on 28.02.2020

Dental Check-up Camp at Model Higher Secondary School Mananchira: IDA Malabar conducted the 1st CDE programme of 2020 at Model higher secondary school, Mananchira on 23.02.2020.

Dental Check-up Camp at Janamithri Police Station, Marad: In association with Janamithri Police, Rotary club and Kadalora Jagratha Samithi conducted a Dental Check-up Camp at Marad Police station on 08.03.20

Treatment camps at Home of Love, Nethaji Nagar Kozhikode: IDA Malabar branch interacted and treated geriatric and mentally challenged inmates at the Home of Love on 27.02.2020.

Dental Check-up Camp At Sowhridam Residence Association, Thondayad: IDA Malabar branch in association Sowhridam residents association, Thondayad conducted a dental check up camp on 01.03.2020

Observed Dentist day: IDA Malabar members visited Government Juvenile Home, Vellimadukunnu on Dentists' day 06.03.20. Our CDH convenor Dr Nikesh Babu presented an awareness talks for the inmates on Dental Health and Children. Past president Dr Dinesh K R and IPP Dr Susha C N interacted with children. Dentist day message was aired on Real FM 103.6 as radio talks by our executive members Dr Antony Thomas and Dr Sethu Siv Sanker. Dentist Day Photo contest conducted for the promotion for use of PPEs.

Observed Women's day: IDA Malabar celebrated womens day in association branch's Wdc wing on 08.02.2020. WDC representative Dr Sheby Shaju delivered a short lecture on Gender equality, and the need for women empowerment. We also organized a CDE programme by the WDC wing to commemorate women's day. IDA Malabar branch WDC wing along with female dentists of our local branch participated in the Calicut SHETHON 2020- Women night fun marathon. The WDC wing of IDA Malabar branch released an awareness poster on COVID 19 – the new pandemic that has affected many people.

Charity Programs

At Govt. Juvenile Home

We visited Govt. Juvenile Home, Vellimadukunnu and delivered

various Educational materials, kitchen utensils and Gifts to all inmates.

One Day meal programme for lockdown sufferers: IDA Malabar sponsored to contribute 'One Day meal programme' for the poor and quarantined people in and around Kozhikode at Community Kitchen run for Public on Corona Lockdown period as requested earlier by authorities through Kozhikode District Collector and Mayor.

Awareness programs: Dental Awareness Talk for Migrant Workers

Dr Amit Kumar taken awareness talk and interacted with Migrant labourers during our 1st CDH programme conducted at Model HSS, Mananchira on 23.02.2020

Dental Awareness Talk for Inmates of Ashaniketan: IDA Malabar in association with Rotary club of Koyilandy conducted a Dental Awareness talk lead by Dr Rakesh.J.S on 27.02.20 for 50 inmates of Ashaniketan, Nandi Bazar.

Covid 19 Public Awareness Poster: On 08-03-2020 Dr Susha CN, Immediate Past President of IDA Malabar branch handed over the first copy of the poster to Dr Joseph C C, State President (IDA Kerala)

Women Centric Awareness Poster: The WDC wing prepared & displayed a poster at Govt. Hospital Calicut Beach for female patients pertaining to the dental hygiene education, awareness and motivation, highlighting the myths existing during the pregnancy period on dental care and reality in a question answer format.

1st CDE programme: 1st CDE "Micro esthetics in Anterior Composite Restorations" Lecture, Live Demo and Hands-on conducted at Marina Residency on 8.3.2020 by the faculty Dr Jose Thomas MDS.

2nd CDE programme: 2nd CDE was conducted by WDC wing on 8.03.2020 at Hotel Marina Residency Dr Sameera G Nath, WDC representative. Faculty explained the different physiological and pathological alterations in women during reproductive years, and its impact on oral health. This was followed by a second lecture by Dr Sinu Jayaprakash.

CDE programs as Webinars: As social distancing was to be maintained during the Lockdown Period, further CDEs were hosted as webinars via online ZOOM platform. We had conducted 15 webinar CDEs including 4 WDC CDEs till April 30th.

Other WDC activities

- WDC core committee meeting conducted on 09.04.2020 & 24.04.2020;
- Reach to mass campaign by WDC member DR LIJ.M.P through IDA Malabar's YouTube channel ON 19.04.2020;
- Published Handbook for Dental Auxiliaries on 22.04.2020 which was adopted to IDA Kerala state publication on COVID 19;
- Dr Sameera G Nath, our WDC representative given lecture on Crown Lengthening As faculty at IDA Smart City Branch on 22.04.2020

Sports activity - Intra Branch football Turf Tournament

Branch conducted an intrabranh turf football tournament for our members on 03.03.2020 at Pachakil, Kozhikode.



► Kunnankulam Branch

Installation ceremony and Christmas - New Year celebrations

The Installation ceremony of the new office bearers of IDA-Kunnankulam 2020 was held on 5th January 2020 at Hotel Sopanam Heritage, Guruvayur. Dr. Ciju A. Paulose, Immediate Past President IDA Kerala State was the Chief Guest and Dr. Alias Thomas, Past President IDA National H.O was the Guest of Honor. Dr. Ciju.A.Paulose installed Dr. Bastian Varkey as the President of IDA Kunnankulam branch. Dr. Aazam Ahammed is the Hon. Secretary and Dr. Gigu.K.Joy is the Treasurer. The ceremony was followed by Christmas-New Year celebrations with cultural extravaganza.

Executive meetings

- The first executive meeting was held on 10th January 2020.
- EOGM was conducted on 16th January 2020.
- The second executive meeting was held on 3rd March 2020.

C.D.E Programs

- 1st CDE program was conducted on 13th February 2020 on the topic PERIO 20-20. Dr. Manikandan G.R. was the speaker.
- 2nd CDE program was conducted on 1st March 2020 on the topic Implantology Simplified. Dr. Sabish Shivadas was the speaker.

C.D.H Activities

- 1st C.D.H program was conducted on 11th February 2020 at

Emerging Buds School, South Punnayur with Oral Health screenings, healthy teeth competition and awareness programs.

-2nd C.D.H program was conducted on 13th February 2020 at Bethsaida Agathimandiram, Elavally, Kappara with Oral Health check up for inmates and staff of old age home.

-3rd C.D.H program was organized on 18th February 2020 at E.B.S, Vadakekkad with dental screenings, Good Oral Hygiene Contest, Oral Health Awareness sessions and Teacher's Training.

-4th C.D.H program was on 24th February 2020 at M&T Auditorium, Nalamkallu, with an elaborate Parent Awareness session for E.B. School parents, Vadakekkad.

-5th C.D.H program (DENTIST'S DAY CELEBRATION) was conducted on 6th March 2020 at M.U.A.L.P School, Paluvai road, Pavaratty with Dental Awareness Session, Free Dental Check Up, Good Oral Hygiene contest and Dental kit distribution.

W.D.C Activities

- 1st W.D.C and the 6th C.D.H program (INTERNATIONAL WOMEN'S DAY CELEBRATION) was conducted on 8th March 2020 in association with Lions Club of Pavaratty Royal at Royal College of Medical Technology, Pavaratty. Program included a Breast cancer awareness class, self defense awareness program and Dental Awareness session for Kudumba Sree Unit of Pavaratty.



► Thrissur Branch

Camp 1

Date: 17.1.2020 (Friday); Venue: St Augustine Convent L P School, Kakkala; Time: 1.30 pm to 4 pm. Doctors participated: Dr Davis, Dr Shuhaib, Dr Jesus George, Dr Preethi; Number of Students examined: 170

Dental Health Education: Dr Davis. Samples distributed. Tooth brush and tooth paste

Camp 2

Date: 29.1.2020 (wednesday); Venue: Tharakans High School, Arnattukara, Thrissur; Time: 1.30 pm to 4 pm; Doctors participated: Dr

Davis, Dr Shuhaib, Dr Jesus George, Dr Bobby, Dr Sanoj, Dr Preethi; Number of Students examined: 250; Dental Health Education: Dr Sanoj; Samples distributed, Tooth brush and tooth paste

Camp 3

Date: 23.2.2020 (Sunday); Venue: Chinmaya Mission College, Kolazhy, Thrissur; Time: 9.30 am to 1.00 pm; Doctors participated: Dr Shuhaib Dr Joseph E Jacob, Dr Gravin, Dr Ignatius; Number of participants examined: 100; Dental Health Education: Dr Shuhaib. Samples distributed. Tooth brush and tooth paste



► Kottayam Branch

1) A camp was conducted at Kumarakom Kottayam by Ladies circle 48 & I.E.M trust in association IDA Kottayam Branch on 11-01-2020. Dr Jeev Thomas Cherian & Dr Hima Thomas attended the camp

2) Kottayam Branch & Central Kerala Branch jointly conducted IDA Kerala State Branch SHRADDHA 2020 at Kottayam District Panchayat Hall on 13-01-2020. Dr Sabu Kurian, Dr Jeev Thomas Cherian Dr Anukesh & Dr Nithin Joseph attended the meeting

3) Our IDA Kottayam Branch installation ceremony of Dr Biju Mathew & his team was on 15-02-2020. Chief guest was DR G S Abhilash IPP, IDA Kerala State..



► Trivandrum Branch

IDC 2020, the 73rd National Conference was held from 23rd to 26th of January at Kovalam. IDA Trivandrum also hosted a Dental Exhibition.

Installation ceremony of IDA Trivandrum was held on 15th February 2020 at SP Grand Days. Dr. Shibu Rajagopal was the Chief Guest. Dr. Tarun Jacob sworn in as new President and Dr. Siddharth V Nair as the Secretary.

This year the WDC- IDA, Trivandrum branch celebrated International Women's Day with the children and staff of SMSS, Hindu Mahila Mandiram, Poojappura. The guest speaker was Dr. Manju Renjit, who enlightened the children on various aspects of oral health. The children were enthralled with the demonstration of basic

tooth brushing and dental hygiene. They were given tooth pastes, gift packs, and pamphlets on Dental Health. The Institution was presented with books on Basic Oral Care in Malayalam and English.

Dentists day celebration was conducted at Golf club. Cultural Club of IDA Trivandrum branch IDA Srishti was inaugurated by famous Film actress Saranya Mohan. This was followed by violin by Aravind Haridas and performances by IDA Trivandrum members and their family.

New Updated IDA SAMRIDHI SMART privilege card was also launched during the event.

An amount of Rs 25000 was contributed to mayors relief fund on 1st April 2020.



► Mavelikkara Branch

The year 2020 of IDA Mavelikkara was started with an Installation Ceremony on January 19th 2020 at Hotel Royal Regency, Oachira. The programme was inaugurated by Hon MLA Shri Ramesh Chennithala. Installing officer was Dr OVSanal, Vice President, Kerala Dental Council. Dr Cherthala Venugopal and cine artist Dr Jayan were the Guest of honors.

On the same evening WDC launched its projects and logo in the presence of State WDC Chairperson Dr Milli James and Cherthala Dr Venugopal cine lyricist. 20 WDC members attended the colourful programme.

On Feb 12th 2020, both CDH and WDC of IDA Mavelikkara combined and observed International Women's Health day by conducting an awareness programme for ASHA workers on Dental Health and Care on aged patients. The Programme was inaugurated by Municipal chairman Smt Leela Abhilash and two classes were taken by Dr Rakhee Rajesh and Dr Divya Bhadrar.

WDC wing of IDA Mavelikkara observed National Women's Day on Feb 13th at Oachira Panchayath Hall. Dental Awareness talk was given by Dr Rakhee Rajesh for Asha workers and CDS team of Oachira gramapanchayat. The PHC Katoor team health inspector Mr Madhu gave awareness on the prevention of Corona Virus infection.

Our first CDE for the year was conducted on Feb 16th named

"Handle Your Curves" by Dr Vijit Narayana. It was followed by demo session also. Around 30 doctors had attended the CDE.

On Feb 25th we conducted a dental camp at Govt UPS, Nagiarkulangara and Thekekkara Govt LP school. The programme was inaugurated by Sri Kaatti I Sathar (Standing committee Chairman, Haripad Municipality). A dental awareness class was taken by Dr Rakhee Rajesh for the students. An oral checkup was conducted for the students of both schools, around 250 students were there and around 15 doctors were attended the screening camp.

Dentist Day Celebration was conducted on March 6th at Azhakiyakavu Devi Temple, Pullikanakku, Kayamkulam. The Programme was inaugurated by Sri Sulfikar Mayoore (Chairman KAIC). A dental awareness seminar was taken by Dr Rakhee Rajesh and screening camp was done for around 100 patients.

On March 8th we conducted our second CDE programme named as, The Biological Width, by Dr Yuvaraj Marudhappan. MDS. It was followed by a hands-on session in the afternoon. Around 60 doctors were attended the programme.

On the same day after the CDE Programme the WDC wing of IDA Mavelikkara had conducted women's day by honouring senior dentists, cake cutting, video presentation of WDC members and activities. Our president inaugurated the GO GREEN project by distributing oxygen rich plant saplings to all WDC members.



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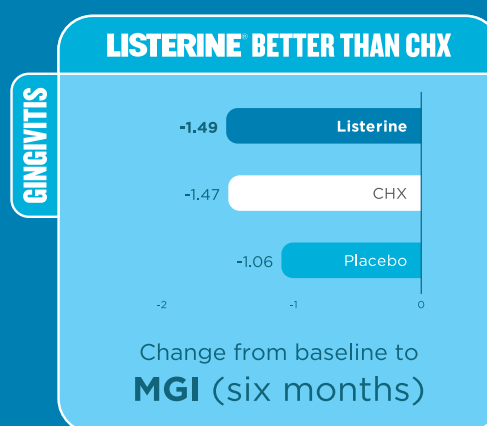
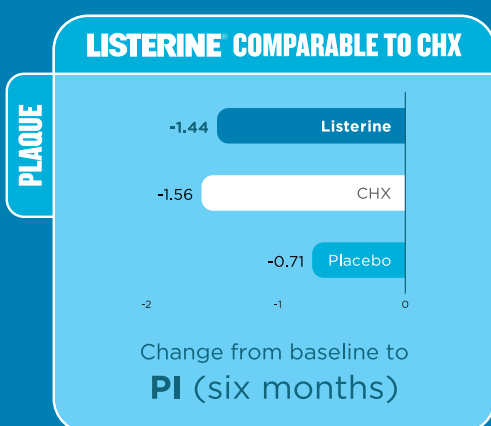
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Sensodyne Repair & Protect

LISTERINE® MOUTHWASH GIVES AN EQUIVALENT PERFORMANCE TO CHLORHEXIDINE^{1,2,3,4}

The unique essential oils formulation of **LISTERINE** gives an equivalent performance to Chlorhexidine without any long term side effects.^{1,2,3,4}



SAFETY	LISTERINE®	CHX
No Tooth staining	✓	✗
No Calculus Formation	✓	✗
No toothpaste interaction	✓	✗
No taste alteration	✓	✗
IDEAL FOR DAILY, LONG TERM USE	✓	✗



LISTERINE®
For daily, long-term use

1. Overholser CD, et al. J Clin Periodontol. 1990;17(8):575-579. 2. L.G. De Paola et al. J Dent Hygiene 2007, Supp: 13-25 3. Peridex (0.12% chlorhexidine gluconate) Oral Rinse [prescribing information]. Phoenix, Ariz: Zila, Inc; 2004 4. Barkvold P, et al. J Clin Periodontol. 1989; 16:593-595