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**Yogesh Kumar Gupta** India

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*Updates in Dentistry***



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# Editorial

Warm greetings to the readers!

It is my great honour to present this issue as it provides a potpourri of topics in a comprehensive way. With each issue we are trying to upgrade the standards of our journal and we are thankful to the authors and reviewers for their active participation.

One of the important point which I want to bring to the notice to all the dental fraternity is that in October 2017, the Indian Council for Medical Research has released the new and revised National Ethical Guidelines for Biomedical and Health Research involving human participants and Ethical Guidelines for Biomedical Research involving children. This document is a complete guideline for conduct of medical research. It also has guidelines for composition and role of each member of Ethics Committee. It also touches upon research involving special conditions and process of taking consent in details. To the best of my knowledge, this is the most comprehensive and detailed document on Biomedical Ethics in the World. I hope that these guidelines will help the International Strategy for Disaster Reduction (ISDR) members in conducting Ethical Research and also help institutions in having meaningful Ethics Committees.

Our researchers will be glad to know that ISDR has several awards for the young and senior members, and details of the same are available on the website. The IADR also institutes some of the awards/fellowships/travel grants, which are available to all IADR divisions including India. However, some of the awards need nominations through the Head Office of IADR-India Division.

I appeal to all experienced and young dentists to take advantage of these schemes and awards, to bring India to higher platforms of Dental Sciences and Research.

Happy reading!



*Yogesh Kumar*

Dr. Yogesh Kumar  
*Editor in chief*  
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## Original Article

### PREVALENCE OF EARLY CHILDHOOD CARIES AMONG PRESCHOOL CHILDREN OF LOW SOCIOECONOMIC STATUS IN BIKANER CITY

Niketa Bansal, Simarpreet Singh, Neha Gupta, Manu Batra, Vikram Aggarwal, Yogesh Garg

#### ABSTRACT

**Introduction:** Dental caries is one of the major issues which interfere with the healthy life of an individual, especially in children. The presence of one or more decayed, missing (due to caries) or filled tooth surfaces in any primary tooth in a preschool-age child between birth and 71 months of age is termed as Early Childhood Caries (ECC). The aim of current study is to assess the prevalence of ECC among preschool children of low socioeconomic status in Bikaner city

**Material and methods:** A cross-sectional study was designed among preschool children belonging to low socioeconomic status in Bikaner city. Children were selected from various Anganwadicentres in Bikaner city. Total of 18 anganwadis were selected via cluster sampling, covering the whole of Bikaner city. The total sample comprised of 466 24–59 months old children attending the selected anganwadis. Caries experience was recorded using deft index.

**Results:** The prevalence of ECC was 39.9% (186 out of 466). Out of 186 (100%) with ECC, 102 (54.8%) were boys and 84 (45.2%) were girls. Prevalence of s-ECC was significantly higher among 24–35 months old children as compared with other groups ( $\chi^2 = 26.44, P = 0.000$ ). The overall mean deft for ECC was  $1.80 \pm 3.18$ .

**Conclusion:** Currently Anganwadis comes under State Government, based on the results of current research a public-private partnership between the government, Dental colleges, and NGOs can be suggested for beneficial toward providing oral health care to children.

**Keywords:** Children, dental caries, early childhood caries

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**Source of Support:** Nil **Conflict of Interest:** Nil

#### INTRODUCTION:

Dental caries is one of the major issues which interfere with the healthy life of an individual, especially in children. Due to its high prevalence worldwide, caries in children has often been described as a 'pandemic' disease characterized by a high proportion of untreated carious cavities causing pain, distress and functional restrictions. In addition, these untreated carious lesions have a considerable impact on the general health of children, which influences the social and economic well-being of communities. It has been observed that untreated caries among children is more widespread in developing than in developed countries.<sup>1</sup>

Dental caries among children remains a serious problem. In preschool children, this disease is called Early

Childhood Caries (ECC), but is commonly known as "baby bottle tooth decay" or maxillary anterior caries. As defined by the American Academy of Pediatric Dentistry (AAPD), ECC is the presence of one or more decayed (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces (dmfs) in any primary tooth in a preschool-age child between birth and 71 months of age. In children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC).<sup>2</sup> Dental caries is the most prevalent oral disease among children in the global scenario.<sup>3</sup> About 90% of school children worldwide experience dental caries with the disease being most prevalent in Asia and Latin American countries and least prevalent in African countries. In the United States, dental caries is the most common chronic childhood disease and it is at least 5 times more common than asthma.<sup>3</sup> In India according to national oral health survey and fluoride mapping (2003), the prevalence of dental caries among 5 year age group was 51.9%.<sup>4</sup>

There is a lack of definite data on prevalence of ECC in Bikaner city. Hence, this study was undertaken with the aim of assessing prevalence of ECC among preschool children of low socioeconomic status in Bikaner city.

#### MATERIALS AND METHODS:

A cross-sectional study was designed among preschool children belonging to low socioeconomic status in Bikaner city. The study was approved by the institutional Ethical Committee of Surendera Dental College and Research Institute. Children were selected from various Anganwadicenters in Bikaner city. Permission and list of anganwadis was obtained from the Director, Women and Child Welfare Department, Bikaner, from that list, 18 anganwadis were selected via cluster sampling, covering the whole of Bikaner city. The total sample comprised of 466 24–59 months old children attending the selected anganwadis. Those parents who gave the informed consent were included in the study. Children absent on the day of examination and those suffering from systemic disease were excluded from the study. Informed consent was obtained from parents prior to the beginning of the study. Clinical examination was carried out at Anganwadicenters by a single calibrated examiner using mouth mirror and explorer under natural light, on an ordinary chair. The Kappa value for single examiner for assessing dental caries was 0.78. Caries experience was recorded using deft index (Greubbell, 1944)<sup>5</sup>. Caries of all the three-enamel, dentin, and pulp were included. Data was analyzed using SPSS version 20.0 software. Chi-square, t test, and ANOVA were used to find significant age and gender wise differences. P value < 0.05 was considered as statistically significant.

**RESULTS:**

Of the 466 children examined, 229 (49.1%) were boys and 237 (50.9%) were girls; 280(60.1%) were between 24 and 35 months, 172(36.8%) were between 36 and 47 months and 14 (3.0%) were between 48 and 59 months of age. The prevalence of ECC was 39.9% (186 out of 466). Table 1 shows age and gender wise prevalence of ECC.

**Table 1:** Age and gender wise prevalence of ECC

	Age in months									Total
	24-35			36-47			48-59			
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
N	128	152	280	90	82	172	11	3	14	466
ECC(N)	54	39	93	45	42	87	3	3	6	186
ECC(N%)	42.2	25.7	33.2	50	51.2	50.6	27.3	100	42.9	39.9

Out of 186(100%) with ECC, 102 (54.8%) were boys and 84 (45.2%) were girls. No significant gender differences were observed in percentage of ECC ( $\chi^2 = 1.085$ ,  $P = 0.29$ ). Whereas prevalence of ECC was significantly higher among 36–47 months old children as compared with other groups ( $\chi^2 = 14.03$ ,  $P = 0.001$ ).

Out of 186 with ECC, 172 (92.5%) had s-ECC, including 96 (55.8%) boys and 76 (44.2%) girls. Table 2 shows age and gender wise prevalence of s-ECC. No significant gender difference was found. In percentage of s-ECC ( $\chi^2 = 0.55$ ,  $P = 0.557$ ). But prevalence of s-ECC was significantly higher among 24–35 months old children as compared with other groups ( $\chi^2 = 26.44$ ,  $P = 0.000$ ).

**Table 2:** Age and gender wise prevalence of s-ECC

	Age in months									Total
	24-35			36-47			48-59			
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
N	54	39	93	45	42	87	3	3	6	186
s-ECC(N)	54	36	90	41	38	79	1	2	3	172
s-ECC(N%)	100	92.3	96.8	91.1	90.5	90.8	33.3	66.7	50	92.5

Table 3 shows mean caries experience of ECC and s-ECC cases. The overall mean deft for ECC was  $1.80 \pm 3.18$  ranging from 0 to 17 teeth. t Test showed no significant differences in mean caries experience of boys and girls ( $P = 0.840$ ). But mean deft was significantly higher in 36–47 months age group as compared with others ( $F = 10.89$ ,  $P = 0.000$ ). Mean deft for s-ECC was

significantly higher in 36–47 months age group as compared with others ( $F = 4.04$ ,  $P = 0.019$ ).

**Table 3:** Mean deft of ECC and s-ECC cases

Mean deft	Age in months		
	24-35	36-47	48-59
ECC	$1.26 \pm 2.50$	$2.31 \pm 3.95$	$1.74 \pm 3.38$
s-ECC	$4.02 \pm 2.54$	$5.28 \pm 4.13$	$4.15 \pm 3.92$

**DISCUSSION:**

Anganwadis are government run day care centers, which cater to the needs of children from 0 to 6 years of age of low socioeconomic status and most of them are located in slums. Anganwadis function from 10am to 2pm on all days and provide free food and informal education to these children. Hence, most of the children of preschool age belonging to low socioeconomic status attend anganwadis. As many studies have shown a high ECC prevalence in low income groups<sup>6</sup>, anganwadis were chosen for the study.

The prevalence of ECC in the present study was 39.9%. This is comparatively high compared with that in other places in India as per some Indian studies.<sup>7,8</sup> Studies in Udupi and Davangere showed a prevalence of 19.4% and 19.2%, respectively.<sup>7,8</sup> However, a study in Kerala showed caries prevalence of 44% among 8–48 months old children.<sup>9</sup> The prevalence of ECC worldwide is highly variable ranging from 2.1% in Sweden to 85.5% in rural Chinese children according to a systematic review of Ismail and Sohn<sup>10</sup>. While the prevalence in USA is reported to be 11%–53.1%, the prevalence in UK is 6.8%–12%.<sup>11</sup> This could be attributed to differences in case definitions and diagnostic criteria of ECC apart from risk factors.

An important finding of this study was that about 92.5% of children with ECC showed s-ECC and all the deft was due to untreated caries. There was not a single filled tooth and all the children required treatment. This is indicative of a total lack of awareness about oral health among parents, lack of accessibility, and affordability for oral health care in this section of people which is quite alarming.

The present study showed a significant increase in the prevalence of ECC with increasing age ranging from 33.2% among 24–35 months old to 50.6% and 42.9% among 36–47 and 48–59 months old children, respectively. Some caries prevalence studies in Brazil, South Africa, and others have showed a similar pattern.<sup>12</sup> However, s-ECC was more prevalent in 24–35 months age group.

The mean deft for s-ECC cases was also significantly higher in 36–47 months age group with a mean caries experience of

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5.28 ± 4.13. This is higher than the mean caries experience of children with s-ECC in Haryana (dmfs = 5.08 ± 5.56) as reported by a study.<sup>13</sup> Many studies have shown a higher prevalence of ECC among girls than boys, which has not been significant.<sup>12,13</sup> The present study showed a higher prevalence among boys than girls, which did not reach significance.

In the present study, there could be a slight underestimation of caries experience. As the study was carried out at anganwadis with minimum instruments and light, few of the initial lesions may have been missed, especially on the proximal surfaces of the posteriors and also because of limited mouth opening experienced with very young children, especially those between 2 and 3 years of age.

#### **CONCLUSION:**

There is an urgent need to implement Preventive and Curative Oral health programs for children. As anganwadis are run by State Government, a public-private partnership between the government, Private Dental colleges, and NGOs would prove useful toward providing oral health care to these children.

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**ABSTRACT**

**Aims and Objectives:** To evaluate the clinical performance of three gingival retraction systems- ULTRAPAK Retraction Cord, roeko Stay-put, Magic Foam Cord on the basis of ease of placement, time taken for placement, bleeding, remnants in gingival sulcus, dilatation of sulcus, patient comfort, quality of impression and the amount of Gingival Retraction achieved with each of these gingival retraction systems. The Objective of this study was to find out an efficient gingival retraction system that could be clinically recommended to retract the gingiva for the purpose of tooth preparation as well as to accurately record the tooth preparation margins.

**Materials and Methods:** Twenty four teeth requiring indirect fixed restoration were prepared following standard protocol. Three Gingival Retraction systems i.e.ULTRAPAK retraction cord (Ultradent Products Inc.), roeko Stay-put (Coltene/Whaledent Inc.) and Magic Foam Cord (Coltene/Whaledent Inc.) were used randomly on these prepared teeth such that each gingival retraction system was used on eight prepared teeth. During use of these systems, clinical performance of each gingival retraction system was noted by using a Pre-formulated evaluation criterion. Pre-retraction and Post-retraction Type IV gypsum casts were made for each tooth. Both casts were sawed out and sulcus width was measured under an optical microscope. Amount of retraction was calculated by subtracting the measured width(gingiva to tooth) before retraction from the one which was measured after retraction. The data so obtained was compiled, tabulated and put to statistical analysis.

**Results:** All the three systems were effective in displacing the gingival tissues. Statistically, there is no difference in the amount of gingival retraction among the three groups. Magic Foam Cord performed clinically better than ULTRAPAK and roeko Stay-put except for the amount of visually observable gingival sulcus displacement.

**Conclusion:** All the three groups were clinically useful so finally it is operator's judgment to choose the technique and material according to the clinical situation and imply best of his/her efforts

to manage these soft tissues.

**Keywords:** Gingival retraction, magic foam cord, roeko Stay-put, ultrapak

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**INTRODUCTION**

Indirect restorations are routinely used to restore defective teeth. The clinical success and longevity of these indirect restorations depends on careful and accurate placement of preparation margins. For accurately recording the margins of tooth preparation via the agency of impression materials, effective gingival retraction is required to open a space surrounding the preparation margin and leave a clean dry field in which the impression can be made.

One of the most challenging aspects of crown and bridge dentistry is the management of gingival tissues when making an impression. Tissue management includes placing the gingival tissues away from the preparation margins, so they can be impressed combined with providing for hemostasis when the gingival tissues are susceptible to bleeding. The rationale for tissue management is a critical aspect of impression making whether the impression is made with a conventional impression material or by a digital impression technique so that all tooth preparation margins are captured in the impression to assure an excellent marginal fit of a laboratory fabricated restoration.<sup>1</sup> Therefore, effectively managing the gingiva prior to making an impression is a crucial preliminary step in process of fabricating restorations.

The different purposes of Gingival Retraction are:

1. It helps in placement of subgingival finish line during tooth preparation by enhancing access and preventing trauma to gingival tissues.
2. To provide adequate lateral displacement of gingiva to provide access for low viscosity impression material to reach the subgingival margin and to adequately record the finish line.
3. It aids during cementation of the restoration for easy removal of

excess cement without tissue damage.

4. It helps dentist to visually assess the marginal fit and caries if any present.

Most commonly used methods include: Mechanical Methods, Mechanochemical Methods, Rotary Gingival Retraction Method and electrosurgical Methods.

Conventional techniques damage the periodontal tissues by causing degeneration of the tissue underlying the gingival retraction system and delay wound healing. Also, these systems are time consuming, technique sensitive and have a risk of mucosal or osseous necrosis as in cases of rotary gingival curettage and electrosurgical techniques. These limitations of the above mentioned methods led to the development of newer systems which are listed as below:

- i) Cordless retraction systems: pastes, gels, foams
- ii) Matrix impression system
- iii) Newer Retraction cords (with metal filament)
- iv) Lasers

These newer systems claim to save time, enhance patient comfort, while being minimally invasive and providing adequate displacement of gingiva.

Therefore, a study was planned with the purpose to evaluate clinical efficacy of three gingival retraction systems based on amount of gingival retraction achieved, ease of placement, time taken for placement, hemorrhage control, patient comfort, quality of impression and ease of handling by the clinician.

#### **MATERIALS AND METHODS:**

The study subjects were selected from the patients seeking various types of indirect fixed restorations reporting to the Outpatient Department of Prosthodontics and Crown & Bridge at Government Dental College and Hospital, Patiala. From among these subjects, twenty four teeth requiring indirect fixed restorations were selected for the study. The three gingival retraction systems i.e. Ultrapak retraction cord, roeko Stay-Put and Magic Foam Cord (**Figure-1**) (**Table -1**) were used on 24 prepared teeth randomly such that each system was used eight

times.

The patients were selected according to the following inclusion and exclusion criteria:

Table 1- Materials used in study

GROUP NUMBER	GINGIVAL RETRACTION SYSTEM	NATURE/TYPE OF RETRACTION SYSTEM
Group 1	Magic Foam Cord	Expanding addition type polyvinyl siloxane material
Group 2	ULTRAPAK (#000)	Non-impregnated retraction cord (knitted type)
Group 3	roeko Stay-put(0)	Copper wire reinforced non-impregnated cord (braided type)

Figure 1: Showing materials used in the study.



#### **INCLUSION CRITERIA:**

1. Subjects above 18 yrs of age.
2. Absence of periapical or any other intraoral infection.
3. Individuals with healthy gingiva and periodontal status and gingival sulcus depth between 0- 2 mm and no bleeding on probing.
4. Patients with no relevant medical history, non-smoker or has quit smoking for at least 6 months prior to the study.

#### **EXCLUSION CRITERIA:**

1. Subjects below 18 yrs of age.
2. Pregnancy
3. Gingival and periodontal disease.
4. Patients with uncontrolled diabetes and other systemic diseases which can influence the clinical outcome of the study.

Informed consent was taken from each patient participating in the study prior to commencement of procedure.

## GINGIVAL RETRACTION PROCEDURE:

A total of twenty four teeth were prepared for indirect fixed restorations according to the standard guidelines. Two impressions were made for each tooth: one after tooth preparation prior to gingival retraction and the other after gingival retraction. Three gingival retraction systems (ULTRAPAK, roeko Stay-put, Magic Foam Cord) were used randomly. For one prepared tooth, one gingival retraction system was used so that each system was used on eight prepared teeth. No anesthesia was used prior to packing/placing the gingival retraction systems to evaluate the clinical performance of these systems i.e. whether they are painful to the patient or not.

The clinical performance of these three retraction systems was also noted with pre-formulated evaluation criteria (Table 2).

### IMPRESSION MAKING:

A standardized protocol was followed for impression making. Putty wash technique of impression making was used using polyvinyl siloxane putty- AFFINIS putty super soft- Addition silicone impression material ( Coltene/ Whaledent AG ,Switzerland ) with cellophane sheet spacer first, followed by polyvinyl siloxane light body wash impression - AFFINIS PRECIOUS - Addition silicone impression material ( Coltene/ Whaledent AG ,Switzerland). A close visual inspection of the final impression was done with a magnifying glass followed by fabrication of both definitive casts with type IV gypsum product (Kalrock,kalabhai). Therefore, two casts were obtained for each prepared tooth, one pre-retraction cast and the other was post-retraction cast.

### SECTIONING AND MICROSCOPIC EXAMINATION:

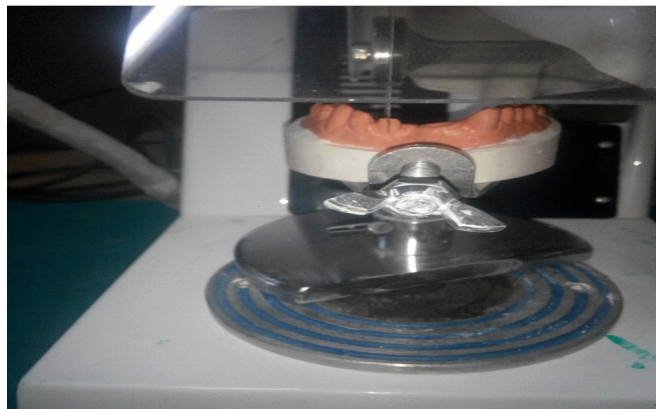
Both Pre-retraction and Post-retraction undamaged casts were sawed out faciolingually, from facial to lingual at the centre of the tooth with the help of a die cutter. The centre of the tooth was determined by measuring the mesiodistal width of the prepared tooth on both the pre-retraction and post-retraction casts, and then a line was marked on the facial surface with a pencil passing through this central point. Then the casts were fixed to the platform of the die cutter(sirio) with the screw assembly and the

Table 2- Evaluation Criteria for Clinical Performance

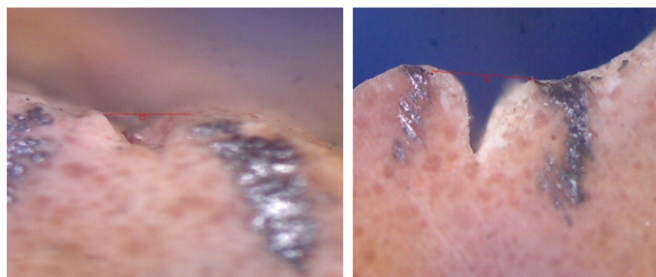
S.NO.	QUESTION	ANSWER
1.	Is it easy to pack/place the gingival retraction system?	Easy: Packing of cord/foam into sulcus once and without displacement  Difficult: Packing of cord/foam into sulcus takes more than one attempt
2.	How much time is taken for packing/placement of the gingival retraction system?	Time Saving: Time needed to pack/place the system is short  Acceptable: Time needed to pack/place is not short but still acceptable  Time Consuming: Significant amount of time is needed to pack/place the system.
3.	Is bleeding evident during packing/placement of gingival retraction system?	Yes: Presence of bleeding during placement/packing  No: Absence of bleeding during placement/packing
4.	Is bleeding evident during removal of gingival retraction system?	Yes: Presence of bleeding during removal  No: Absence of bleeding during removal
5.	Any remnants in gingival sulcus after removal of gingival retraction system?	Yes: Presence of debris after removal  No: Absence of debris after removal
6.	Is the gingival retraction system painful to the patient?	Yes:  No:
7.	What is the quality of gingival margins on the impression?	Perfect: Absence of voids or bubbles and perfect reproduction of preparation finish line  Acceptable: Minimal defects not involving preparation finish line(up to 2mm in diameter)that could be corrected by technician on cast  Unacceptable: Impression with bigger voids or bubbles (more than 2 mm)or defects involving preparation finish line
8.	Are there any side effects?	Yes: Trauma to gingiva, discoloration of gingiva  No: No trauma, No discoloration
9.	Did Gingival sulcus dilate?	Yes: Observable separation of gingival tissue from tooth surface on visual examination  No: No observable separation of gingival tissue seen on visual examination

platform was tilted anteroposteriorly or mesiodistally so that the cutting blade was parallel to the pencil mark on the facial surface of the prepared tooth(**Figure-2**). Sectioning of casts was followed by measurement of the width of the gingival sulcus under an optical microscope (50x) with image analyzing software (META Lite). The sulcus width was measured as the distance from the tooth to the crest of gingiva in horizontal plane(**Figure-3,4,5**). The amount of retraction was calculated by subtracting the measured width (gingiva to tooth) before retraction from the one which was measured after retraction.

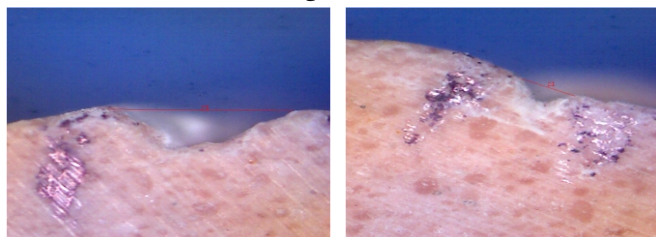
**Figure 2: Showing sectioning of casts under die cutter**



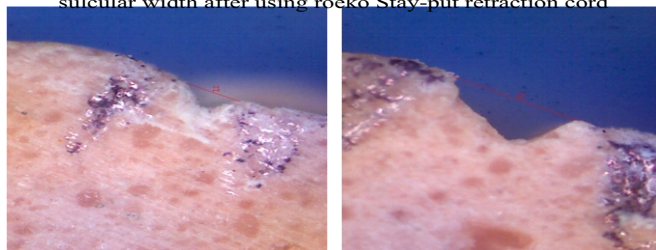
**Figure 3- Showing microscopic view of pre-retraction sulcular width and post-retraction sulcular width after using Magic Foam Cord**



**Figure 4- Showing pre-retraction sulcular width and post retraction sulcular width after using ULTRAPAK retraction cord**



**Figure 5- showing pre-retraction sulcular width and post-retraction sulcular width after using roeko Stay-put retraction cord**



**OBSERVATIONS AND RESULTS :** The results of the present study showed that mean gingival retraction with roeko Stay-put system (group 3 ) is 0.298 mm, mean gingival retraction with Ultrapak ( group 2) is 0.267 mm of and mean gingival retraction with Magic Foam Cord (**Group 1**) is 0.234 mm.(**Bar diagram no-1**) These results are also statistically significant (**Table - 3**).

**Table 3- Mean gingival retraction by each gingival retraction system**

MEAN OF GINGIVAL RETRACTION WITH THREE GINGIVAL RETRACTION SYSTEMS	MEAN( IN MICRONS)	MEAN( IN MILLIMETERS)
GROUP 1 -MAGIC FOAM CORD	234.424	0.234
GROUP 2 -ULTRAPAK	267.893	0.267
GROUP 3 -ROEKO STAY- PUT	298.617	0.298

All the three systems displaced the gingiva more than the minimal critical value that is required for any fixed partial denture impressions(0.2mm).<sup>2,3</sup> Though there is difference in the amount of retraction among the different groups, but this difference is statistically non significant(**Table -4**).

**Table 4- Anova test for comparison between the groups and within the groups**

		Sum of Squares	df	Mean Square	F	Sig.
Gingival Retraction by use of gingival retraction systems	Between Groups	16493.084	2	8246.542	2.381	.117
	Within Groups	72744.227	21	3464.011		
	Total	89237.311	23			

Clinical performance of these three systems was also evaluated. Out of nine evaluation criteria, variations in seven criteria i.e. ease of packing/placement (p=0.003),time taken for packing/placement (p<0.0001),bleeding during packing/placement (p=0.0055),bleeding during removal (p<0.0001),is system painful to the patient (p=0.0002),side effects (p=0.0003) and dilatation of the sulcus (p=0.037) are statistically significant (p<0.05).The difference in remaining two criteria i.e.

quality of gingival margins in the impressions( $p=0.2231$ ) and remnants in gingival sulcus ( $p=1$ ) are statistically non significant.(Table no-5) From the results of the study, it was observed that clinically Magic Foam Cord can be considered more effective and patient friendly than the other two systems as it took less time, was easy to place, showed no bleeding upon placement and removal and displaced the gingiva to minimum required value.

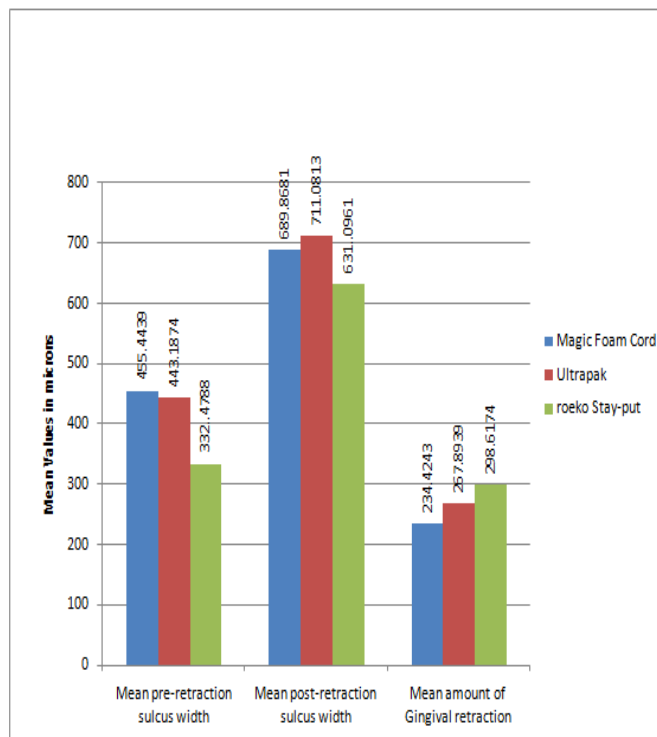
Table 5- Chi square test for evaluation criteria

Groups	Ease of placement/ Placement		Time taken for Placement		Bleeding ev ident during Placement		Bleeding ev ident during removal		Remnants in Gingival sulcus		Was system painful to patient?		Quantity of Gingival Margins		Any side effects		Did retraction system displace?		
	Easy	Difficult	Time Saving	Acceptable	Yes	No	Yes	No	Yes	No	Yes	No	Perfect	Acceptable	Yes	No	Yes	No	
1.Magic Foam Cord	8	0	8	0	0	8	0	8	0	0	8	3	5	0	8	4	4		
2.Ultrapak	0	8	0	4	4	6	2	8	0	0	8	7	1	3	5	2	6	7	1
3.roeko Stay-put	3	5	0	7	1	5	3	7	1	0	8	7	1	6	2	0	8	8	0
$\chi^2$	16.45		27.93		10.41		20.23		0		16.8		3		16		6.57		
p-value	0.0003		<0.0001		0.0055		<0.0001		1		0.0002		0.2231		0.0003		0.037		

Table 6- Paired t test for comparison within the groups

Group	Pair	Paired Differences	Paired Differences				t	df	Sig.	
			Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
						Lower				Upper
1-Magic Foam Cord	1	Width of the gingival sulcus POST RETRACTION - Width of the gingival sulcus PRE RETRACTION	234.42425	25.30001	8.94491	-255.57559	-213.27291	26.208	7	<.001**
2- ULTRAPAK	1	Width of the gingival sulcus POST RETRACTION - Width of the gingival sulcus PRE RETRACTION	267.89388	62.00628	21.92253	-319.73242	-216.05533	12.220	7	<.001**
3-roeko Stay-put	1	Width of the gingival sulcus POST RETRACTION - Width of the gingival sulcus PRE RETRACTION	298.61738	76.85807	27.17343	-362.87233	-234.36242	10.989	7	<.001**

Table 7- Bar Graph showing mean values of pre-retraction sulcus width, post-retraction sulcus width and amount of gingival retraction of the three groups



## DISCUSSION:

Various studies investigated the effects of different retraction techniques on the gingival and periodontal health<sup>4,5,6</sup> but few studies tested the effectiveness of gingival displacement. This study focused on lateral/horizontal displacement of free gingiva with the use of newer retraction systems i.e. roeko Stay-put (Coltene Whaledent) and Magic Foam Cord (Coltene Whaledent) compared to ULTRAPAK (a conventional retraction system). The ability of retraction system to displace gingiva was indirectly measured by the width of retracted gingival sulcus.<sup>7</sup>

Table -3 shows the amount of gingival retraction among the three groups. There is variation between the amount of gingival displacement between the groups, but this difference between the groups was not statistically significant ( $p = 0.117$ ) (Table.- 4). This is in accordance with the study conducted by Purwaretal<sup>4</sup>, in their study, they compared the mean gingival retraction of ULTRAPAK and stay -put retraction cord. They stated that though mean gingival retraction in stay -put system was higher compared to that in ULTRAPAK, the difference between the two systems was not statistically significant. Although this difference was not

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statistically significant; the study, however, reveals that all three retraction systems are reasonably acceptable as per the results, as all three provide retraction more than the minimum amount of retraction (0.22 mm) required for any fixed partial denture impressions.<sup>2,3</sup>

Finger et al<sup>8</sup> found a positive correlation between the reproducibility of the impression and the width of the sulcus. Baharav et al<sup>9</sup> stated that impression accuracy may be greater in sulci wider than 0.15 mm at the level of the finish line. In the present study, by the use of these three systems, gingival retraction definitely occurs and these results are also statistically significant (Table -6). Raghav et al<sup>10</sup> compared three retraction systems- Magic Foam Cord, Expasyl and aluminium chloride impregnated retraction cord (ULTRAPAK). They found that though the maximum retraction was produced by aluminium chloride impregnated retraction cord and even there were statistically significant differences in the width of retracted gingival sulcus among three systems except between Expasyl paste and impregnated retraction cord, which was insignificant but enlargement achieved in all three systems was more than the minimum required. The quantitative results of our study are in conformation with this study. But in the present study, greater amount of gingival sulcular widening was seen with Stay-put retraction cord than ULTRAPAK and Magic Foam Cord. The reason for this difference may be due to the fact that ULTRAPAK used in their study was chemically impregnated with aluminium chloride and the second reason being that its comparison with stay-put cord was not done in that study.

In the study by Purwaret al<sup>4</sup>, where stay-put cord was compared with non impregnated ultrapak cord, they concluded that roeko Stay-put showed slightly higher amount of gingival retraction than ULTRAPAK. In our study, roeko Stay-put cord (0.298mm) showed higher retraction than ULTRAPAK (0.267mm). So, our results are again similar to the study by Purwaret al.<sup>4</sup>

In the present study, the clinical performance of the three gingival retraction systems was evaluated using pre-determined criteria.

Very few studies regarding the criteria for evaluating the clinical performance of gingival displacement methods are available in the literature. **Weir and Williams**<sup>11</sup> evaluated bleeding after cord displacement. **Al Hamad et al**<sup>12</sup> investigated the effects on both periodontal health and bleeding; **Jokstad**<sup>5</sup> determined 6 evaluation criteria for the clinical performance of displacement cords; **Kumbuloglu et al**<sup>13</sup> modified these criteria and evaluated both clinical performance and impression quality; and **Beier et al**<sup>14</sup> evaluated only impression quality. In the present study, the evaluation criteria of **Jokstad**,<sup>6</sup> **Kumbuloglu et al**,<sup>13</sup> and **Beier et al**<sup>14</sup> and **Acar et al**<sup>15</sup> were unified, and a total of 9 evaluation criteria were used to assess the clinical performance of these three gingival retraction systems. (Table no-2)

Clinically,

(i) Magic Foam Cord was easier to place than ULTRAPAK and roeko Stay-put. ULTRAPAK is difficult to place than roeko Stay-put. Both ULTRAPAK and roeko Stay-put are relatively difficult to pack in the gingival sulcus. (**Table -5**)

(ii) Magic Foam Cord took less time for placement than roeko Stay-put and ULTRAPAK. ULTRAPAK takes more time than Magic Foam Cord and roeko Stay-put. (**Table -5**)

(iii) In the present study, Magic Foam cord showed no bleeding during the placement and removal. **Al Hamad et al (2008)**<sup>12</sup> investigated the effects of cordless and conventional retraction techniques on periodontal and gingival health. They concluded that cordless techniques did not induce bleeding during and after retraction. Hence, our results are in agreement with the results of study by **Al Hamad et al**.<sup>12</sup> With ULTRAPAK and roeko Stay-put groups, in majority of the cases, bleeding was evident during packing of cords. Almost all the cases showed bleeding during removal of the cords with both ULTRAPAK and roeko Stay-put. (**Table-5**)

(iv) No remnants were found in the gingival sulcus after removal of the gingival retraction system in all the three groups. This result is similar to the findings of study by **Kumbuloglu et al (2007)**<sup>13</sup> where they also found no remnants in the gingival sulcus after removal of ULTRAPAK cord.

(v) Magic foam cord was not painful to the patient whereas ULTRAPAK and roeko Stay-put were painful to the 7 patients out of 8 patients. (Table-5)

(vi) Quality of the gingival margins in the impression was perfect in majority of cases with roeko Stay-put (75%) than Magic Foam Cord and ULTRAPAK. (Table-5)

(vii) With ULTRAPAK, minor side effects (discoloration of gingiva) were seen only in one case. With Magic Foam Cord and roeko Stay-put, no side effects were observed. (Table-5)

(viii) Gingival sulcus displacement was also observed visually. Noticeable gingival sulcus displacement was seen with roeko Stay-put in the entire cases. In ULTRAPAK group, gingival sulcus displacement was noticeable in 7 out of 8 cases whereas with Magic Foam Cord, gingival sulcus displacement was seen clinically in 4 out of 8 cases. (Table-5)

From the above results, it can be concluded that all the three gingival systems definitely retract the gingiva to clinically acceptable levels but clinically Magic Foam Cord performed better than ULTRAPAK and roeko Stay-put except for the amount of visually observable gingival sulcus dilatation. This is also analogous to the study of Gupta A et al (2013)<sup>15</sup> who clinically evaluated the three gingival retraction systems- Expasyl, Magic Foam Cord and Stay-put and mentioned the better clinical performance of Magic Foam Cord as it was painless and is quick and easy to place and displaced the gingiva to minimum required value. Therefore, saving chair side time. Finally, the choice of gingival retraction systems/technique to be used still depends on the clinical conditions and operator's preference.<sup>16</sup>

#### CONCLUSION:

Within the limited scope of the study, it might be concluded that

1.) All these three systems (Magic Foam cord, ULTRAPAK and roeko Stay-put) are effective in displacing the gingival tissues, as all the three systems displaced the gingiva more than the minimal critical value that is required for any fixed partial denture impressions. So, they can be clinically recommended to retract the gingiva for the purpose of tooth preparation and to accurately record the tooth preparation margins via the agency of impression material by providing

adequate space for the impression material to flow, by carrying out optimum widening of gingival sulcus.

2.) Magic Foam Cord performed clinically better than ULTRAPAK and roeko Stay-put except for the amount of visually observable gingival sulcus displacement.

3.) Statistically there is no difference in the amount of gingival retraction among the three groups, so finally it is the operator's judgment to choose the technique and material according to the clinical situation and imply best of his/her efforts to manage these soft tissues with minimal trauma.

Though all the possible care was taken to standardize all aspects of the study, but certain clinical conditions potentially influence the gingival displacement. Every patient's physiology may have differed and hence the response of the gingiva to the retraction material. There are certain limitations to this study, which include the phenotype of gingiva, clinical accessibility, and compliance of the patient, and, consequently, the reported results should be interpreted with caution.

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**EPIDEMIOLOGY OF MALOCCLUSIONS AND ASSESSMENT OF ORTHODONTIC TREATMENT NEED FOR THE POPULATION OF SRI GANGANAGAR**

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

**ABSTRACT:**

**Aim:** To evaluate the prevalence of dental and skeletal malocclusions in population of Sri Ganganagar and estimate the treatment need.

**Method:** Two thousand one hundred ninety-two children aged between 12 and 15 years were clinically examined for evaluation of skeletal malocclusion, via dental camps in different schools. Angle's classes of malocclusion were evaluated and their orthodontic treatment need was assessed using the Index of Orthodontic Treatment Needs (IOTN) (Dental Health Component) on the study models.

**Results:** The IOTN (DHC) showed the following distribution: Grade 1:16.02%, Grade 2: 14.7%, Grade 3: 25.77%, Grade 4: 24.67%, and Grade 5: 18.84%. Grades 3 and 4 were more commonly observed followed by Grades 5 and 1. The mean age was not related to any specific malocclusion.

**Conclusion:** Dental class I malocclusion was the most common, while dental class III was the least prevalent. The Class II and Class III malocclusions were mostly skeletal in origin, concluding requirement of treatment at an early age.

**Keywords:** Epidemiology, index, malocclusion \

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**Source of Support:** Nil, **Conflict of interest-** Nil.

**INTRODUCTION:**

Population-based surveys of dental diseases are a prerequisite for systematic planning of the oral health needs of the society and to estimate the efficacy of the preventive and therapeutic measures introduced. The earlier surveys on dental diseases were mainly focused on dental caries and periodontal disease while malocclusion received comparatively much less attention. The reasons could be a lack of the uniform criteria in recording the malocclusion which is not a disease but a variation of the normal

morphology, a large spectrum of its presentation in several traits and difficulties in assessment of the real treatment needs superimposed with the social and ethnic curtains. However lately, much information on malocclusion and treatment needs is being made available from around the world.<sup>1</sup>

Angle's classification of malocclusion has been used in population surveys to report on the prevalence and distribution of the different types of malocclusion. There are obvious limitations to this classification, in that it does not reveal the severity of the malocclusion, the patient's profile and also the skeletal relationship.<sup>1</sup> However, Angle's classification is perhaps the most well-known and simple method of recording the malocclusion. Variations in prevalence of malocclusion have been found between different races or ethnic groups. Only a few surveys on children and young adults have been done to record malocclusion using samples representative of the population in terms of size or distribution.<sup>2</sup> It is, therefore, recommended that a malocclusion survey should be conducted during the late mixed to permanent dentition stage. By this time facial growth is close to completion and permanent dentition up to the second molars are present, while maxillary canines are erupted or erupting, therefore occlusion or malocclusion is nearly fully established.

A major issue with recording a malocclusion in its true objective sense and severity of the problem lies in its recording and its validity during mixed dentition period. The occlusion changes dramatically from mixed to permanent dentition and on several occasions, it may improve and not necessarily worsen. The index of recording malocclusion should be valid with time and should exclude symptoms of normal developmental changes in occlusion. It should be 'sensitive' to record basic orthodontic defect.<sup>3</sup> Therefore, an index which records a basic defect score of malocclusion, should exhibit either an increase in score (worsening of malocclusion) or remain constant (malocclusion does not worsen), presuming that self-correction of the basic defect of malocclusion does not occur from transitional stage to permanent dentition stage.<sup>1</sup>

Index of orthodontic treatment needs (IOTN) was developed in

UK by Shaw et al and is another mechanism of prioritizing and thereby classifying malocclusions according to treatment needs. This is particularly useful where the resources available for treatment are limited. This index ranks malocclusion in terms of the significance of various occlusal traits for the person's dental health and perceived aesthetic impairment, with the intention of identifying those persons who would be most likely to benefit from orthodontic treatment. The index incorporates a dental health component (DHC) and aesthetic component (EC).<sup>4</sup>

Of the two parts of the IOTN, DHC is in most frequent use. This represents an attempt at synthesis of the current evidence for the deleterious effects of malocclusion and the potential benefits of orthodontic treatment.<sup>5</sup> Each occlusal trait thought to contribute to the longevity and the satisfactory functioning of the dentition is defined and placed into five grades, with clear cut-off points between the grades.

**AIM:** The aim of the present study was to evaluate the prevalence of dental and skeletal malocclusions in population of Sri Ganganagar, and estimate the treatment need among 12 to 15 year old children.

**MATERIALS AND METHOD:**

This study was conducted after ethical clearance from institutional review board, Surendera Dental College and Research Institute of Health Sciences and permission from concerned school authorities. Consent was obtained from all parents before recording data. Two thousand one hundred ninety two children aged between 12 and 15 years were clinically examined for evaluation of skeletal malocclusion, via dental camps in both public and private schools. Those who were undergoing orthodontic treatment or who had completed orthodontic treatment earlier or suffering from any other systemic diseases were excluded from the study. The examiner and recording assistant were trained prior to the commencement of the study to ensure reliability. A validation exercise was conducted during the study and subsamples of 10% were re-examined to check intra examiner variability, which was found to be satisfactory (Kappa value = 0.8). The examination for

malocclusion was made according to the molar relationship (Angle) and the criteria laid down by DHC of IOTN. In addition, the presence of anterior spacing, a feature overlooked by the DHC was evaluated. The orthodontic treatment need was assessed. All the data was analyzed with SPSS software (Version 16.0 for Windows @ 2007 SPSS INC., NY, USA) and descriptive statistics were calculated.

**RESULTS:**

Out of 2192 children selected for the study, 62 did not return the signed parental consent document, 36 were not interested, and 15 had already started orthodontic treatment. The age distribution of the remaining 2079 children, according to the gender, was presented in Table 1. Most children exhibited some type of malocclusion.

Sex	N	%	Mean Age
Male	1137	54.69	13.5
Female	942	45.31	12.8
Total	2079	100	13.1

Table 1. Age and gender distribution of the study participants.

Angle's class I malocclusion was found in 44% of all children, class II div. 1 in 28.6%, class II div. 2 in 12.1%, class III in 2.6%, and normal occlusion in 12.7%. Crowding was the most common type of malocclusion presented by the study group (19.75%) followed by increased overjet (17.51%) and deep overbite (13.23%). Features like scissor bite (0.81%), reverse overjet (1.62%), and open bite (1.8%) were least noticed in the study group. The IOTN (DHC) showed the following distribution: Grade 1—16.02%; Grade 2—14.7%; Grade 3—25.77%; Grade 4—24.67%; Grade 5—18.84%. Grades 3 and 4 were more commonly observed followed by Grades 5 and 1 (Table 2).

IOTN	Percentage
Grade 1- no need for treatment.	16.02
Grade 2- mild/little need.	14.70
Grade 3-moderate/borderline need.	25.77
Grade 4-severe treatment need.	24.67
Grade 5-extreme treatment need.	18.84
Total	100

Table 2: Relationship between the IOTN (DHC) grades

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## DISCUSSION

A quantitative method of evaluation of the extent of abnormality from a given standard requires grading the abnormality and assigning a score based on the severity of problem, which is perceived by the degree of aesthetic/ functional impairment produced. Each index is designed with a definite purpose and should be valid in its applications. Significant occlusal changes during transitional dentition make it difficult to assign an index of potential tooth displacement. The index of orthodontic treatment needs (IOTN) is practical in clinical settings and possibly could be used for epidemiological surveys. This index was primarily developed for recording malocclusion in surveys.<sup>6</sup>

Malocclusion one of the major health problem afflicting oral health and facial aesthetics, which should be addressed by health authorities within reach of common people.<sup>5</sup> The DHC have a reproducible and reasonable accuracy and it also has the advantage of being an index of rapid implementation. The present study was designed to provide information about the prevalence of malocclusion and orthodontic treatment needs among 12 to 15 year old school going children.

In this study, crowding was the most common individual malocclusion. The high prevalence of crowding can partially be explained by the great incidence of carious lesions and extractions of deciduous molars which favours migration of the first permanent molars as well as inclinations and rotations. However, scissor bite was the least common malocclusion in this study. The present investigation showed a greater frequency of Grades 3 and 4 which is moderate and severe treatment needs. This is due to a greater frequency of impacted, submerged deciduous teeth and hypodontia; further differences in sample size, study design, and ethnicities of the sample may account for differences in result.

The same type of malocclusion falls into different levels of orthodontic treatment need according to its severity. Therefore, the degree and priority of orthodontic treatment need among populations, which are important factors in public health planning, cannot be fully known by just evaluating the malocclusion prevalence.<sup>7</sup> If no specific index is used, determination of who really needs treatment becomes difficult

and arbitrary, particularly among dentists and paediatric dentists, who end up inappropriately referring their patients to orthodontic treatment.

In the present study, however, the normative evaluation based on the Index of Orthodontic Treatment Need may not be enough because of the often-inherent elective nature of this treatment. As a result, other factors such as perceptual, functional, and social needs may interfere with treatment demand and service planning since those factors does not always coincide with the professional evaluation of treatment need.<sup>8</sup> Therefore, further studies investigating the patient's perception and his or her concern regarding orthodontic treatment should be carried out in order to enhance the IOTN efficacy.

This index places emphasis on the alignment of teeth alone. In certain ethnic groups, like in India class I bimaxillary protrusion is a common finding and treatment need is essentially for aesthetic reasons, to improve the profile whereas arch alignment and the intra-arch relationships are normal. Second major limitation is that all the children with cleft lip and palate are graded as grade 5, i.e. the most severe malocclusion irrespective of the type and severity of the defect.<sup>9</sup> In some instances, a cleft lip and alveolus case may present only with a minor disturbance in occlusion like a rotated lateral or central incisor. Such a minor malocclusion would be categorized to grade 5 owing to the associated cleft lip and palate deformity.

## CONCLUSION

- Dental class I malocclusion was the most common, while dental class III was the least prevalent.
- The Class II (61.3%) and Class III (38.70%) malocclusions were mostly skeletal in origin, concluding requirement of treatment at an early age.
- Further this population exhibited a higher number of Grade 4 treatment needs, emphasizing on treatment need at an early age.

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**NEWER ROOT CANAL IRRIGANTS:A REVIEW***Ram Narayana Reddy Molluru, Veerendra M uppin, MadhuPujar, DeeptiKhanchandani, AsimJamadar***ABSTRACT:**

Bacteria and their metabolic byproducts are the main reason of endodontic diseases and periapical lesions. Combination of mechanical instrumentation and chemical irrigation can thoroughly disinfect all physically inaccessible areas. The incapability to remove smear layer and cytotoxicity at higher concentrations of NaOCl, leads to the introduction of several alternative irrigants in endodontics. Several antibiotics, antiseptics, herbal products have been tried as an irrigation solution to debride and disinfect the root canal systems. Present review article introduced briefly all the newer irrigants that has been introduced in the past recent years.

**Key words:** Root canal irrigants, sodium hypochlorite

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**INTRODUCTION:**

Bacteria and their metabolic byproducts are the main reason of endodontic diseases and periapical lesions. It is difficult to eliminate microorganisms completely from the root canal system with mechanical preparation alone because of the anatomical complexity of the root canal system.<sup>1</sup> Combination of mechanical instrumentation and chemical irrigation can thoroughly disinfect all physically inaccessible areas.<sup>2</sup> An irrigant should be capable to disinfect and debride the root canal spaces, provide lubrication during instrumentation and remove smear layer and dissolve organic tissue remnants without causing any tissue reaction.<sup>3</sup> Among all of the above properties tissue dissolving capability is the most important property of an irrigation solution to enhance root canal cleansing.<sup>4</sup>

- Sodium hypochlorite (NaOCl) has been accepted as the gold standard irrigant in endodontics for being a good antibacterial and excellent tissue dissolving solution.<sup>5</sup> The incapability to remove smear layer and cytotoxicity at higher concentrations of NaOCl lead to the introduction of several alternative irrigants in endodontics.<sup>6</sup> Therefore, several irrigation solutions have been recommended for use in combination with root canal preparation.<sup>7</sup> Several antibiotics, antiseptics, herbal products has been tried as an irrigation solution to debride and disinfect the root canal systems. Some of these products had shown better results in in vitro conditions. So the aim of this present review article is to introduce briefly all the newer irrigants

that has been introduced in the past recent years.

**DISCUSSION:**

**Chitosan :** Chitosan is a natural polysaccharide obtained by alkaline deacetylation of chitin, which is the major component of crustacean exoskeletons.<sup>8</sup> Chitosan is a biocompatible product with not only having antimicrobial activity against gram positive, gram negative bacteria and fungi but also have chelating capability.<sup>9</sup> Chitosan is a nontoxic, biocompatible, biodegradable material with chelating property and limited solubility. Carboxymethylation of chitosan is an option to overcome its limited solubility action.<sup>10</sup> The antibacterial action of chitosan is by altering the cell wall permeability by its electrostatic interactions between NH<sub>3</sub><sup>+</sup> of chitosan that binds to the cell surface components of bacteria resulting in the leakage of intracellular components and cell death.<sup>11</sup> 1% chitosan can be an effective natural antimicrobial substitute for synthetic irrigants as it is as effective as 3% NaOCl, which shown greater effectiveness than 2% chlorhexidine.<sup>12</sup>

0.2% chitosan effectively removed smear layer from the middle and apical thirds of the root canals and showed high chelating capacity towards different metallic ions.<sup>13</sup> Demineralization effect of 0.2% chitosan on root dentin was similar to 15% EDTA, 10% citric acid and 1% phytic acid but less compared to 17% EDTA.<sup>14</sup> Combination of 0.2% Chitosan and ultrasonic agitation have better retrievability of calcium hydroxide intracanal medicament than 17% EDTA.<sup>15</sup>

**Octenisept:** Octenisept is a new antiseptic agent used in disinfection of mucosal membrane and in treatment of surgical or burn wounds. Octenisept mouth wash contains octenidine hydrochloride (OCT) and phenoxyethanol. OCT is a broad spectrum antimicrobial agent against gram positive and gram-negative bacteria, fungi, yeasts and some virus species. As a cation active substance OCT interacts with the bacterial cell wall and intracellular components and destroys its cell membranes.<sup>16</sup> Mixture of OCT and NaOCl solutions results in formation of a whitish precipitate that is correlated to the structure of phenoxyethanol (PE).<sup>17</sup> The prolonged bacterial anti-adhesive activity and susceptibility of OCT is as effective as chlorhexidine.<sup>18</sup> Based on its antimicrobial effectiveness and lower cytotoxicity OCT has been suggested as an endodontic irrigant.<sup>19</sup>

**MTAD:** MTAD is a mixture of tetracycline isomer, an

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acid, and a detergent. It has the ability to disinfect the root canal system and simultaneous elimination of inorganic smear layer.<sup>20</sup> MTAD is a biocompatible solution with tissue dissolving capacity comparable to EDTA and better than Chlorhexidine.<sup>21</sup> MTAD shown to remove smear layer comparable to the malic acid and EDTA at coronal and middle third of the root but better in the apical third than the rest.<sup>22</sup> Combination of 3% NaOCl and MTAD for 1 min can remove smear layer and eliminates the remnant bacteria and their by-products, enable better penetration of intracanal medicaments and offer better sealing of sealer cement on the canal wall.<sup>23</sup>

**QMix 2in1:** QMix 2in1 (Dentsply Tulsa, Tulsa Dental Specialties, OK, USA) is a recently introduced irrigation solution to remove the smear layer and kill pathogenic bacteria.<sup>24</sup> QMix 2in1 contains EDTA, CHX, a non-specified detergent, and water.<sup>25</sup> QMix 2in1 have both long-term antimicrobial properties of CHX and smear layer removal ability of EDTA. Surfactant in QMix 2in1 decrease the surface tension thereby increases the wettability of canal walls for better intracanal delivery of the solution.<sup>26</sup> It offers a fast working time of 60-90 seconds for complete effectiveness. It is premixed and ready to use straight from the bottle with easy chair-side handling. QMix 2in1 does not form any precipitate unlike mixture of EDTA and CHX forms the white precipitate and CHX in combination with NaOCl forms potentially carcinogenic brown/orange precipitate.<sup>27</sup>

**Herbals:** Indian traditional medicines are extracted from herbs and their products. These herbals products are gaining attention in recent years because of its advantages like availability, inexpensive, less side effects and lack of microbial resistance. Neem extract, Garlic extract, Grape seed extract, Green tea extract, turmeric, lemon, mustard, clove and Morinda citrifolia juice etc. are the herbal products, which has already proven their antimicrobial efficacy against several endodontic pathogens.<sup>28</sup>

**Ozone:** High antimicrobial action without developing of drug resistance makes ozone to be as a possible current alternative antiseptic agent in root canal therapy. Ozone is antimicrobial as well as biocompatible.<sup>29</sup> Ozone is a powerful oxidizing agent that directly reacts with the fatty-acids in the cell walls of the microorganisms. Studies have proven its ability to interact effectively with microbiota in the root canal system and therefore to eliminate microorganisms. Ozone has direct affect on healing process as it helps in increased production of adenosine triphosphate (ATP) by mitochondria, which leads to a metabolic improvement and causes better healing of inflammatory/

infectious processes. Ozone is a powerful disinfection agent used to eliminate bacteria in root canals. Due to its low level of toxicity and the high level of biocompatibility, ozone therapy is proposed to be as a co-adjuvant to Endodontic therapy.<sup>30</sup>

Ozone prevents growth of the resistant strains. Gaseous or aqueous form of ozone can eliminate microorganisms in root canal system.<sup>31</sup> Recent studies had shown aqueous ozone as a powerful antimicrobial agent, which can eliminate the oral resistant microorganisms when used at different doses.<sup>32</sup> Highly concentrated gaseous and aqueous ozone was shown to be dose, strain and time-dependent on microbial suspension and on tested biofilm models.<sup>33</sup> Currently in endodontics ozone gas of 4 microgm-3 concentration is used, at this concentration it is slightly less cytotoxic than 2.5% NaOCl. Aqueous ozone (up to 20 microgm-1) shown to be non toxic to oral cells in vitro<sup>34</sup>. Most important drawback of aqueous ozone is its unstable concentration over a period of time; hence it should be used as soon as possible after obtaining the ozone. These properties of aqueous ozone are beneficial in many branches of dentistry; hence some authors recommended use of ozone for the treatment of endodontic infections.<sup>35</sup>

Zan et al. tested antibacterial effect of 4 mg/L aqueous ozone against *E. faecalis* in root canals for 180 seconds and concluded that aqueous ozone showed a good antibacterial effect but not equal to that of traditional NaOCl.<sup>36</sup> Combination of 2% CHX and 24 s of gas ozone showed complete elimination of both *C. albicans* and *E. faecalis*.<sup>37</sup> Root canal disinfection of high concentration aqueous ozone induced by an ultrasonic technique showed similar antibacterial efficacy as 5.25% NaOCl. High bactericidal activity and suitable clinical irrigation time, made the combination of aqueous ozone and ultrasonic technique to be recommended as a disinfective regimen in endodontic treatments.<sup>30</sup>

**Nanoparticles :** Several nanoparticles have gained attraction as antimicrobial agents as a result of their biocompatibility and broad spectrum of activity.<sup>38</sup> Recently, Nano particulate materials are using to disinfect root canals. Nanoparticles have high degree of interaction with the bacterial cell because of its polycationic/polyanionic nature, higher surface area and charge density. Antimicrobial efficacy of Nano particulates depends on its particle size, with smaller particles showing higher efficiency than the macro scaled ones.<sup>39</sup> Chitosan nanoparticles have been used as a carrier for the delivery of drugs and gene to treat various systemic diseases in various fields of medicine. Chitosan nanoparticles are biocompatible

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materials with low levels of cytotoxicity primarily used as an antimicrobial agent in the treatment of bacterial biofilms.<sup>40</sup>

**Chitosan nanoparticles** removed smear layer effectively when used along with the sodium hypochlorite and EDTA than the counterparts alone. CNPs have the ability to chelate the dentin. Due to its anti-biofilm action and dentin chelating nature some authors proposed chitosan nanoparticles as a final irrigant as an alternative to EDTA in root canal therapy.<sup>41</sup>

**Silver Nanoparticles:** Usage of Inorganic metal such as silver (Ag) or metal ions such as silver ion (Ag<sup>+</sup>) or zinc ions as an alternative to antibiotics is gaining popularity because they possess broad spectrum bactericidal effects and show no evidence of tolerance and resistance by target bacteria.<sup>42</sup> AgNPs as a medicament showed potential to eliminate residual bacterial biofilms during root canal disinfection and its antibiofilm activity depends on mode of application (solution or gel). Ag NP with a positive surface charge was active in very lower concentrations compared to NaOCl, CHX and had the smallest MIC against planktonic *E. faecalis*. Positive-charged Ag NPs at  $5.7 \times 10^{-10}$  mol L<sup>-1</sup> with contact time of 5 min completely inhibit the growth of *E. faecalis*, comparable to that of 0.025% NaOCl. Ag NPs were not inhibited by dentine at any concentration used.<sup>43</sup> At lower concentration Silver nanoparticles dispersion was more biocompatible.<sup>44</sup>

**LASERS:** The potential use of lasers in eradicating the root canal microbes has been the focus of interest for many years. Neodymium: Yttrium-aluminium-garnet (Nd: YAG), diode and carbon dioxide (CO<sub>2</sub>) lasers have proved effective in cleaning and disinfecting the root canal and lateral dentinal tubules. Hard tissue lasers like Er: YAG and Er: YAG underwent further development resulting in delivery systems also usable for endodontic application.

**CO<sub>2</sub> Laser:** CO<sub>2</sub> lasers operate in a gated waveform or continuous waveform at a wavelength of 10.6µm. Le-Goff et al (1999) in their study evaluated the efficacy of CO<sub>2</sub> laser for endodontic disinfection and concluded that there was 85% decrease in bacterial counts using CO<sub>2</sub> laser.<sup>45</sup> Takeda et al (1999) showed that the CO<sub>2</sub> laser to be useful in removing smear layer on the instrumented root canal walls.<sup>46</sup>

**Nd: YAG Laser :** The Nd: YAG laser with high-intensity pulsed waveform which operates at a wavelength of 1.064µm. Nd:YAG with 1.5W shown better bactericidal

effect with less risk of thermal damage to the tissues.<sup>47</sup> In a study done by mortiz et al., Nd:YAG showed 99.16% elimination of *E. faecalis*.<sup>48</sup>

**The Nd:YAP laser** is a laser using yttrium aluminium perovskite doped with neodymium crystal as active laser medium. It operates at a wave length of 1.3 µm near infrared, which is close to that of Nd: YAG laser. Nd: YAP laser has 20 times more absorption rate of water than the Nd: YAG laser.<sup>49</sup> Flexible fiber optic allows better way of delivering energy in severe curved root portions than ultrasonic instrumentation. Hence Nd: YAP laser can be successfully used for removal of the smear layer in root canals.<sup>50</sup>

**Er: YAG laser** The Er: YAG laser has predominant applications in dentistry as a hard tissue layer. The Er: YAG laser operates at a wavelength of 2.94µm and in a pulsed waveform. Schoop et al (2002) concluded that the Er: YAG laser can be used to eliminate bacteria from root canals.<sup>51</sup> In combination with sodium hypochlorite Er:YAG showed good bactericidal effect on *Enterococcus faecalis*.<sup>52</sup> Takeda et al 1999 had compared smear layer efficacy of Er:YAG laser energy with 17% EDTA and 6% phosphoric acid and concluded that the Er:YAG laser was the most effective in removal of the smear layer from root canal walls.<sup>46</sup>

**Er,Cr: YSGG laser ( Water lase, Biolase)** The erbium, chromium: yttrium-scandium gallium garnet (Er,Cr:YSGG) is a water-absorbing infrared laser, which operates at a wavelength of 2.78µm. It works with different output powers of 1–3W in cleaning of root canal walls.<sup>53</sup> Er,Cr:YSGG laser at 1.5W output power has smear layer removal ability similar to that of conventional treatment with EDTA and NaOCl irrigation.<sup>54</sup>

**Photodynamic therapy:** Photodynamic therapy (PDT) has been used to kill microorganisms in root canals; it is suggested to be an adjunct to existing endodontic disinfection techniques. On exposure to a light of a particular wavelength photosensitizer in PDT gets activated in the presence of oxygen. Reactive chemical species such as singlet oxygen and free radicals which are obtained by energy transformed from activated photosensitizer to water demolishes proteins, lipids, nucleic acids, and other cell components of the microorganisms.<sup>55</sup> Various photosensitizers used in this technique are toluidine blue, methylene blue, malachite green, chlorophyll a, etc.<sup>56</sup> Photosensitizers like methylene blue and malachite green with photodynamic therapy of more than 60 seconds was found to be effective against *E. faecalis* strains.<sup>57</sup> Combination of 6%

NaOCl and photodynamic therapy showed better elimination of *E. faecalis* than light emitting diode.<sup>58</sup> Though PDT is proposed as a key adjunct to antimicrobial substances, challenges like physiology and susceptibility to different microorganisms should be considered. Energy dosage, photosensitizer concentration, exposure and time of pre-irradiation are the important parameters of PDT for its maximum effectiveness.<sup>59</sup>

**Oxidative potential water:** Oxidative potential water (OPW) is electrochemically formed, highly acidic water that has been used comprehensively in agricultural and household disinfection in Japan for the reason that it is safe and bactericidal action. It prevents the growth of microorganisms by forming an environment with high oxidation-reduction potential and low pH (less than 3).<sup>60</sup> Low toxicity and lack of tissue irritation and to soft tissues are the reasons for using Oxidative potential water is root canal treatment. It is completely safe as a root canal irrigant as it loses its high oxidation-reduction potential soon. As an irrigant OPW removed the smear layer effectively from the prepared root canal walls in a Scanning electron microscopic study done by Hata et al. OPW irrigation used after flushing the instrumented canals with 5% NaOCl removed smear layer and debris as effective as 15% EDTA.<sup>61</sup>

**Electro-chemically activated:** Electro-chemically activated water (ECA) is produced with a new anode-cathode system predominantly from tap water and low-concentrated salt solutions.<sup>62</sup> During first 48h of production it exists in a metastable state with high oxidation-reduction potential.<sup>63</sup> At this state it contains many free radicals and a variety of molecules. After 48 h the solution becoming inactive on returning to the stable state. In the metastable. In comparison with 3.5% sodium hypochlorite, electro-chemically activated water was found to be not effective in inhibiting anaerobic bacteria from the root canal system in a study done by J.T. Marais and W.P. Williams.<sup>64</sup> Another study by Gulabivala K et al (2004) electrochemically activated acolyte solutions when ultrasonicated found to be not effective than 3% sodium hypochlorite.<sup>65</sup> In a scanning electron microscope study done by solovyeva et al (2000) on smear layer efficacy of electrochemically activated water (catholyte and anolyte) and NaOCl (3%), root canal surfaces treated with ECA removed the smear layer and produced surfaces as clean as those for the NaOCl group.<sup>66</sup>

## CONCLUSION

Root canal irrigants can be used alone or in combinations. Several

newer root canal irrigants has been introduced in recent years, every product has its own benefits and flaws. The clinician should have a thorough knowledge about the material to be used and should pick the one which is apt for the particular clinical condition.

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**CLEFT LIP AND PALATE: A REVIEW***Rohini Sharma, Seema Gupta, Sachin Ahuja, Eenal Bhambri*

**ABSTRACT:** The aim of the review is to make the point in literature knowledge about cleft lip and/or palate (CL/P). A review of the international literature have been made to discuss about the epidemiology, the genetic and environmental factors, the anatomical features, the diagnosis and the treatment of this deformities. It results that Cleft lip and/or palate fall within the most common congenital abnormalities of the craniofacial region. There are a lot of phenotypes and clinical features of this malformation, which differ according to the different anatomical structures involved. The etiology is multifactorial, genetic and environmental conditioned, and not already known. To provide a correct diagnosis and treatment is necessary a multidisciplinary study and intervention, that is why is really important the presence of a clinical team to solve this pathology. The interactions between different clinical professional figures guarantee an adequate support for patients and their families. The surgical treatment is the most common treatment use for this pathology, together with the orthodontic treatment. However, today the optimal treatment is difficult to find because of the large variability of this pathology and the subjective response of each patient to the therapy.

Keywords: Cleft lip, cleft palate, orofacial clefts

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**INTRODUCTION:** The most common congenital malformations occurring in the craniofacial region are Cleft lip and/or palate (CL/P). These pathologies have a worldwide incidence about 1/700 live births.<sup>1,2</sup>

Several studies, from the international literature, have shown that both genetics and environmental factors are involved in the etiology of these pathologies, even if it is one of the most studied and interesting subject of research yet.

CL/P does not fall within the most common cause of mortality in developed countries, but it is an abnormality closely linked and related with impact and burden both social and economic. Social integration, speaking, hearing and feeding could be only some of the problems caused by CL/P. Every problems, caused by CL/P, could be correct at varying degrees by surgery, dental treatment, speech therapy and psychosocial intervention. It is clear the necessity of a multidisciplinary team management of these patients, with a close contact and support for the families, in specific and dedicated specialist centers.

The pediatrician is the main figure with the primary and global approach task for children with CL/P in association with professional figures from: radiology, genetic counseling,

audiology, maxillofacial surgery, dentistry, orthodontics, otolaryngology, psychology, social work and speech pathology.

The aim of this review was to focus all the knowledge in literature about CL/P, describe the skeletal and dental aspects associated and the treatment of the pathology from early age to adulthood.

**MATERIALS AND METHODS:** The analysis of the literature was conducted in according to research in google scholar. The search was performed in the PubMed database up to December 2018. Only articles regarding epidemiology, role of genetics, anatomical features, environmental factors, diagnosis and treatment were considered for this review, while all the other articles regarding specific aspects of the pathology or a specific treatment of one aspect have been excluded.

**RESULTS:** Each argumentation has been divided by considering the different issues listed above:

**Epidemiology:** CL/P have a worldwide incidence of 1/700 live births.<sup>2</sup> The highest birth prevalence rate (1/500 live birth) is reported for the Asian and Amerindian population. An intermediate prevalence rates (about 1/1000 live birth) is reported in European populations, while the African populations have the lowest prevalence (1/2500 live birth).<sup>3,4,5</sup>

Cleft palate could be the only one pathology affecting the subject, while cleft lip could be associated or not with cleft palate. About 70% of all the CL/P cases and 50% of cleft palate only fall within non-syndromic pathologies. All the other cases are linked to cardiac, limb, ophthalmological syndromes and other.

**Role of genetics:** CP and CL/P are influenced by the action and the modification of several and multiple genes. The environment can also be responsible of the alteration of the genes or interact with hereditary alterations that cause the pathology. The manifestation of the disease (syndromic and non-syndromic) have been linked to some defects of grow factors and their receptors,<sup>6</sup> such as FGF8 and FGFR1 genes.

TGF $\beta$  is another family gene involved in the formation of the oral cleft, in particular: TGF $\beta$ 3, with the inactivation of its receptor TGF3 $\beta$ R27 and the inactivation of BMP<sup>7,8,9</sup>

Different authors demonstrated the involving of transcription factors in the pathogenesis of cleft lip and/or palate: mutation in MSX1,<sup>10,11</sup> TBX22<sup>12</sup> and IRF6.<sup>13</sup>

**Anatomical features:** The deficiency or the not-fusion between maxillary and medial nasal processes (36th/37th day of gestation) causes labiomaxillary clefts.<sup>14</sup> This can lead to different phenotypes and clinical showing of the malformation.

Cleft Lip (CL): This problem can affect only one (unilateral) or the two (bilateral) sides of the upper lip. It can be complete or

incomplete. The complete form, tissue interruption extends between free border of upper lip and nose base with problems in skin, mucosa, bone and muscles entirety and asymmetry of nose.<sup>1</sup> The incomplete form affects only the free border of the lip without involve the nose and the entirety of the surrounding tissues.

Cleft Lip and Palate (CLP): this form is characterized by a fissuration that concerns upper lip, maxillary bone, alveolar bone and hard/soft palate. There are two forms: the unilateral (UCLP) and the bilateral form (BCLP). The unilateral form is characterized by a fissuration of the alveolar bone between the lateral incisor and the canine directing to the nasopalatine duct; from here cleft is in the middle of hard and soft palate creating an oro-nasal communication due to the muscle activity of tongue on the palatal processes.<sup>1</sup> The BCLP is characterized by the fissuration of the two sides meet in correspondence of the nasopalatine duct going on palate always in the middle<sup>1</sup>

Cleft Palate (CP): this problem involves only the palate: cleft hard and soft palate or cleft soft palate only. Frequently, fissuration departs from nasopalatine duct up to soft palate.

To understand this kind of alteration is extremely important to determine and understand the skeleton growth and the possibilities of intervention on the tissues involved and compromised by the pathology.

Studies demonstrated how the UCLP and BCLP forms have a significantly greater tissues deficiency than the unilateral CL and CP,<sup>15</sup> so they could be considered as the most serious forms to face in the multidisciplinary rehabilitation.

**Environmental factors:** The environment can strictly influence the spread of this pathology.

Maternal smoking in the early peri-conceptional period can cause the modification of certain genes, influencing metabolic pathways and the development of the pathology.<sup>16,17,18,19</sup> High doses of maternal alcohol consumption in short period of time can increase the risk,<sup>20</sup> and teratogens such as valproic acid can be associated with CP.<sup>21</sup>

Even nutritional factors can influence the risk of CL/P, for example folate deficiency,<sup>22</sup> but wider studies are required, in the future, to clarify this aspect and to evidence the real effects.

Other environmental exposure such as infections, radiation, stress, obesity and hyperthermia can cause CL/P.<sup>23,24,25</sup>

**DIAGNOSIS:** The diagnosis of CL/P can be made in different periods: antenatal and perinatal periods.<sup>1</sup> It requires a multidisciplinary approach, because several specialists could be involved in the diagnosis.

Using ultrasound scanning is now possible to diagnose CL in utero from about 17 week of gestation, even if false positive and missed

defects have been reported. This method can fail in case of small CL/P, that is why orofacial clefts are often not discovered until birth. It is clear how the gynecologist plays an important role for an early diagnosis.<sup>26,27</sup>

During the antenatal period, submucous clefts of palate may be present, but it is very difficult to diagnose early.<sup>28</sup> The early diagnosis in antenatal period allows to steer parents to a multidisciplinary care team for an adequate counseling and help. If CL/P is diagnosed in antenatal period it would be helpful to arrange for a neonatologist or a pediatrician to be available at the time of delivery to recognize possible respiratory difficulties or other congenital anomalies.<sup>1</sup>

Pediatricians have the role to identify and confirm the anatomical defects and to determine the clinical form of the abnormality. In the perinatal period the oral cavity and the whole palate should be well examined. The use of a tongue depressor and palpation are useful methods to perceive sub mucosal alterations. The presence or absence of teeth, degree of hard and soft palate clefting, presence or absence of the uvula, evidence of pitting of the lips or palate, nasal regurgitation of fluids, a bifid uvula or a translucent central zone in palate are other important signs for the pediatrician.<sup>29</sup>

Other physical anomalies are sometimes associated with CL/P such as velopharyngeal insufficiency (VPI); if the specific investigations used to reveal this pathology are positive, surgery is recommended. It is clear the importance of a careful examination of the infants in delivery room, to identify any airway or physical problems that can suggest an associated genetic disorder.<sup>30</sup>

**TREATMENT:** The few days of life are the optimal time for the first evaluation of the child by CL/P team.

The eventual treatment plan of care is formulated in a team meeting and communicated to the family of the child. Regular monitoring by the care team is recommended, to observe the growth and later ear, nose and throat, speech and developmental issues.<sup>31</sup>

It is important to promptly advise the parents about the birth of a child with a congenital defect. Consultants or a pediatrician should help them and communicate the news as soon as possible. Ideally the parents should be put in touch with a member of the multidisciplinary care team within 24 hours of birth.<sup>31</sup>

In the first period after the delivery, the most important problems that can be experienced are respiratory and feeding difficulties. Special instruction and assistance should be given to parents, and a lactation consultant or speech therapist should work with parents.<sup>29</sup>

The fabrication of baby plates (presurgical orthopedics)<sup>32</sup> is

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claimed as a helpful system for feeding improvement and facilitation of CL/P repair. Now there is no evidence to support or discredit any of these claims and the practice remain empirical. Other ways to help child and parent with feeding problems are special bottles and teats, produced in a wide variety, attesting the persistent difficulties experienced by clinicians. Nasogastric feeding is not always required and it should be avoided if possible. Instead, a nasopharyngeal airway is required in case of obstruction and either severe respiratory difficulties due to the anatomical abnormalities.

The optimal timing and approach for the surgical intervention varies depending by the center examined. Most of the British center repair lips 3 months after birth and palate between 6 and 12 months. The presurgical orthopedic techniques may be used. Molding devices are placed to help remodel the alveolar segments. These may be employed in conjunction with the skin redraping with nasal alveolar molding.

Another diffuse method is the "functional repair" by Delaire.<sup>33</sup> Lots of oral-maxillofacial surgeons advocates this method reach better outcomes for midface growth compared with techniques usually applied by plastic surgeons. Anyway, cross study in Europe demonstrated a poor result for the function method compared to the usual method performed by plastic surgeons.

An important part of the lip repair includes nasal recontouring and reconstruction of the sphincter of the lip. In addition, attempts are made to re-establish the nasal width if necessary.<sup>1</sup>

Repair of the cleft palate is usually performed after 9 months of age. In the past, surgery was performed around 4-6 years of age, but this was deleterious for the patient's speech development. It is recommended to perform surgery when the child begins to develop plosives "b, d and g" in speech (at about 11-12 months of age).<sup>1</sup> Surgical revision may be necessary, but they have to be performed after the complete healing has occurred and inflamed tissues have softened.<sup>31</sup>

In preschool years the major problems are: speech and language development, ear nose and throat monitoring, somatic growth and development, and general dental welfare.

In some patients, even after surgery, subsequent speech disorders can occur, requiring many interventions (about 75% of patients) throughout childhood and adolescence to achieve acceptable speech production and language competence.<sup>31,29,34</sup>

Factors that can cause speech disorders are: dental and occlusal problems, oronasal fistulas, hearing problems and velopharyngeal insufficiency. Children with cleft palate are subject to the same factors that influence the speech and language development in patients without clefts: neurological, cognitive, developmental,

environmental, and emotional influences.<sup>35</sup>

The therapy of speech and language disorders can be surgical or nonsurgical, using palatal training appliances, speech bulb, biofeedback speech treatment or an obturator.

Normally the speech development occurs around 6 years of age, and this is the best moment to start speech therapy and to monitor speech development constantly with an orthodontic and surgical management.<sup>36</sup>

The orthodontic management of dental anomalies usually begins in the school age years, until adulthood. Initially, no active orthodontic treatment is required, but the orthodontist can be involved in the construction of a palatal obturator to help in feeding during infancy. The orthodontist is strictly involved in the therapy with the eruption of the primary and permanent dentition. In particular, if the cleft involves the alveolar process the teeth could be abnormal, malformed, supernumerary or absent. A regular attendance at the dentist and good oral hygiene is recommended.

An active occlusal manipulation is to avoid until permanent dentition is established.<sup>37</sup> During the school years orthodontic management, alveolar bone grafting and psychological support are the main intervention in patients with CL/P. The alveolar bone grafting permits the creation of a normal alveolar architecture through which teeth can erupt and subsequently be moved orthodontically. During this procedure the surgeon can also repair and modify fistulas and the appearance of the nose. In patients with multiple lip and palate operations the maxillary growth can be modified and resulting in a hypoplastic maxilla and fattened midface.

The minor cases can be treated only with an orthodontic appliance, while the major and severe maxillary deficiencies are treated with Le Fort I advancement (the same technique for small and larger discrepancies).

This kind of intervention is usually performed after the complete growth and develops of the face, to avoid a second intervention. During the school age, the orthodontist has an important role. The definitive orthodontic treatment can precede three or four years after bone grafting phase (around 12-13 years). Treatment of the early mixed dentition often includes maxillary partial braces and maxillary expansion. Often patients with CL/P develop a maxillary retrusion that can be treated with an anterior orthopaedic protraction.

Expansion before bone grafting is better considered, and lead to best results in particular in severely constricted arches.<sup>31</sup> In the school age, all the psychological problem and difficulties in social relations must be treated with a self-acceptance therapy and

positive relationship with parents. During adolescence, the orthodontist can treat with orthodontic appliances all the remaining problems concerning teeth alignment. In this period can be also appear some disharmony not evident before. Some studies on adults shown that the early palatal surgery can be responsible for such growth problem of the face, but this treatment is necessary for an adequate speech develop during childhood.<sup>37</sup> Nowadays the ideal timing for the first surgical treatment to reduce the risk of problems in the facial growth and to improve speech development in unknown.

Pre-surgical nasolabial moulding provides the surgeon with a foundation to repair the defect of the alveolar arch and the surrounding soft tissues affected by the cleft, including the cartilage of the nose. These effects simplify the first lip operation. Some studies have demonstrated the effectiveness of this treatment using analyses of 3D facial images and maxillary alveolar casts; however, to date, there have been little objective estimation including the quantitative assessments of the effects of PNAM treatment. Nasolabial tissues are connected to the maxillary arch. Thus, the effects of PNAM on the maxillary arch might be expected to be associated with the changes to nasal and labial tissues.<sup>38</sup>

The surgeon directly affects the incidence of revision surgery through the quality of their initial repair. For surgeons looking to reduce the need for revision, an important finding of this review is that vermilion asymmetries are the most common indication for revision of the cleft lip. There is an anatomic basis for these vermilion asymmetries; vermilion height asymmetries 1 mm between the medial and lateral lip height occur in 89% of patients with unilateral cleft lip (Sitzman and Fisher, 2013). Techniques for correcting the natural asymmetry in vermilion height have been discussed (Millard, 1960; Noordhoff, 1984; Stal and Hollier, 2002; Stal et al., 2009), yet a minority of surgeons routinely employ them (Sitzman et al., 2008). The nuance to choosing the point of closure on the lateral lip element has also been highlighted (Noordhoff, 1984; Losee et al., 2003). The high prevalence of vermilion asymmetries at revision surgery suggests that changing the surgical approach to closing the vermilion may improve results of primary surgery and thus reduce the need for lip revision.<sup>39</sup>

**CONCLUSIONS:** Cleft lip and palate are birth defects that affect different structures and functions such as language, breathing, nutrition, esthetics, growth and development of the craniofacial district. The real etiology is still unknown, but environmental and genetic factors are involved in this pathology. There is not only one phenotypes or clinical picture concerning this pathology, and

this is why is still so difficult to find a unique way to solve and treat this abnormality. The manifestation can be different and depending by the individual, and even the treatment can lead to different results depending by each subjects conditions, even in patients with the same malformation. Probably there are various techniques to obtain a good result. All surgeries can determine scar tissues that can be modify and inhibit the normal facial growth. The timing of the surgical intervention is dictated by functional and esthetics aspects, and also by the growth period. It is clear that a surgical intervention to reconstruct the abnormal structures is necessary to guarantee an adequate growth and function development. Best results are obtained with surgical and orthodontic treatment combined.

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## CALCIUM HYDROXIDE IN ENDODONTICS: A REVIEW

Asim Jamadar, Veerendra M uppin, Madhu Pujar, Ram Narayana Reddy

### ABSTRACT:

Calcium hydroxide has been used in dentistry over several decades. It has been used in a number of applications in the field of endodontics such as root resorption, intracanal medicament and root canal sealers. Although this material exhibits several advantages, it also has some limitations. Objectives: To review the role of calcium hydroxide in the field of endodontics, focusing on its mechanism of action antimicrobial effects, different applications, cytotoxicity or biocompatibility, and its removal from the root canals.

**Keywords:** Calcium hydroxide, endodontics, root canal treatment

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### INTRODUCTION:

Calcium hydroxide has been used for over a century by dentists in the clinical practice.<sup>1</sup> Herman introduced calcium hydroxide to dentistry as a pulp-capping material in 1920. But today it is used widely in the field of endodontics.<sup>2,3</sup> Calcium hydroxide is a white odourless powder with the chemical formula  $\text{Ca}(\text{OH})_2$  and a molecular weight of (7.08). Chemically, it is classified as a strong base in contact with aqueous fluids (its PH is about 12.5 - 12.8), and dissociate into Calcium and hydroxyl ions.<sup>4</sup> Calcium hydroxide is used and supplied in various forms: As a paste in which Calcium hydroxide is suspended in methyl cellulose. Another form of calcium hydroxide is marketed as a base and a catalyst. By using the catalyst, calcium Hydroxide reacts faster and forms a hard, amorphous compound within matter of Minute in the oral environment. Finally, calcium hydroxide supplied as a paste contains a polymer resin that can be hardened when exposed to illumination from a hand held blue light source.<sup>2</sup>

Calcium hydroxide is widely used in the field of endodontics due to its properties, advantages & disadvantage as mentioned below:

### PROPERTIES<sup>4</sup>

#### STRUCTURE:

1. Arrangement= amorphous matrix, crystalline fillers.
2. Bonding= covalent; ionic.
3. Defects=pores, cracks.
4. Setting reaction= acid base reaction.

### PHYSICAL PROPERTIES:

1. L.C.T.E= low.
2. Thermal conductivity= insulator.
3. Electrical conductivity= insulator.

### CHEMICAL PROPERTIES:

1. Solubility- 0.3-0.5

### MECHANICAL PROPERTIES:

1. Elastic mod=588
2. Compressive strength >24 hr=138

### BIOLOGIC PROPERTIES:

Biocompatible: The purpose of this literature review is to focus on the role of calcium hydroxide in the field of endodontics including a brief explanation of its mechanism of action, different applications, antimicrobial effects, cytotoxicity or biocompatibility, and finally removal of calcium hydroxide from the root canals.

### ADVANTAGES<sup>5</sup>:

- 1) Bactericidal effect then bacteriostatic
- 2) Promotes repair and healing
- 3) PH stimulates fibroblasts
- 4) Stops internal resorption
- 5) Inexpensive and easy to use.

### Disadvantages<sup>5</sup>:

- 1) Exclusively stimulate reparative dentin.
- 2) Primary tooth resorption
- 3) Degrades upon tooth flexure
- 4) Does not adhere to dentin or resin restoration
- 5) Marginal failure with amalgam condensation.

### MATERIALS AND METHODS

The following database was done using: PubMed, and Google Scholar. The online searching was conducted following these keywords: "Calcium hydroxide"; "endodontics"; "root canal treatment"; "applications in endodontics"; "mechanism of action"; "cytotoxicity"; "biocompatibility"; "removal of calcium hydroxide from the canals". Out of 2664 articles, only 33 articles have been selected to be included in this review because they are directly related to the topic and also these articles have been chosen based on the inclusion criteria: "Language: English" and "Year: 2000- 2017.

### MECHANISM OF ACTION:

The release of hydroxyl ions in an aqueous environment is essential for the activation of calcium hydroxide against microbes. These ions reacted intensively with several biomolecules due to their

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highly oxidant free radicals. As this reactivity is unspecified, the free radicals most likely gathered at the sites of generation. Hydroxyl ions have fatal effects on bacterial cells. They may damage the cytoplasmic membrane of bacteria, denature their proteins, or damage the DNA. It is difficult to prove which of these three mechanisms is mainly involved in the death of bacterial cells after their exposure to a strong base. Since enzymatic sites are located in the cytoplasmic membrane of bacteria, hydroxyl ions from calcium hydroxide exert their mechanism of action there. Extracellular enzymes favor digestion, and through hydrolysis act on nutrients, carbohydrates, proteins, and lipids, whereas intracellular enzymes act on the respiratory activity of the cellular wall structure. The high concentration of hydroxyl ions from calcium hydroxide alters the pH gradient of the cytoplasmic membrane damaging its protein. The integrity of the cytoplasmic membrane is altered by the high alkalinity of calcium hydroxide by acting on the organic components and transporting the nutrients or by a saponification reaction in which the phospholipids or unsaturated fatty acids of the cytoplasmic membrane are destructed during the peroxidation process<sup>6</sup>

### 3.1. Antimicrobial Effect of Calcium Hydroxide

Endodontic infections occur as a result of microbial mixtures containing bacteria represented by *Enterococcus faecalis*.<sup>7</sup> and fungi which are especially represented by *Candida Albicans*.<sup>8</sup> Anaerobic bacteria with their endotoxins on their cell walls also predominant in this microbial diversity and can be detected especially gram negative.<sup>9</sup> The complete removal of bacteria from the root canal system is difficult even with the new endodontic techniques. Combining procedures to eliminate bacterial infection can be obtained. These including mechanical root canal debridement by proper shaping, irrigation by chemical agents such as sodium hypochlorite (NaOCl) or hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) in addition to the intracanal medicament containing antimicrobial agents such as calcium hydroxide.<sup>10,11</sup>

### 3.2. Antibacterial Effect

The antibacterial activity of calcium hydroxide is a major concern to most of the scientists.

Cook et al. evaluated the quality of root canal filling with or without calcium hydroxide application prior to the root canal filling or 2% chlorhexidine on the persistence of bacterial infection on the dentinal tubules, they found that the use of 2% chlorhexidine followed by root canal filling was more effective in

removing the bacterial infection especially *E. faecalis* than placement of calcium hydroxide or immediate canal filling.<sup>12</sup> Peters et al. claimed that the number of positive gram bacteria increased in root canal system after dressing with calcium hydroxide.<sup>13</sup> Other studies showed that calcium hydroxide could not reliably remove bacteria from the root canal system or change the culture from gram-negative to gram-positive.<sup>14</sup> It has been reported that the 7 days application of calcium hydroxide is effective in bacterial elimination while the 10 minutes application was not effective.<sup>11</sup>

### 3.3. Antifungal Effect

The presence of Fungi represented by *C. albicans* was detected in primary root canal infection but is more common in failed endodontic treatments. Their occurrence varies between 1% and 17%. It was reported that *C. albicans* cells are more resistant to calcium hydroxide than did *E. faecalis*. Since *C. albicans* survives at a wide range of pH values, high pH of calcium hydroxide may not have any effect on *C. albicans*. Additionally, calcium hydroxide pastes provide Ca<sup>2+</sup> Ion that is essential for the growth of *C. albicans* which explained the limited or no effect of calcium hydroxide to fungal infection.<sup>11</sup>

## 4. APPLICATIONS OF CALCIUM HYDROXIDE IN ENDODONTICS:

### 4.1. Intracanal Medicaments

Endodontic treatment requires the use of suitable intracanal medicaments that simultaneously eliminate bacteria, prevent their growth, stop their ingress and cut off their nutrient supply.<sup>15</sup> Calcium hydroxide is most commonly used as an intracanal medicament for disinfection of the root canal system.<sup>2</sup> As mentioned above, the application of calcium hydroxide paste at intervals of at least 7 days is able to eliminate and/or reduce the total number of bacteria surviving even after biomechanical preparation.<sup>6</sup> It has a wide range of antimicrobial activity against bacteria, but has limited effect against *E. faecalis* and *C. albicans*. It is also an effective anti-endotoxin Agent<sup>2</sup> Calcium hydroxide has a little or no effect on the intensity or severity of postoperative pain following endodontic treatment. In contrast, application of corticosteroid paste in the canal reduces the postoperative pain.<sup>16</sup> The Effect of calcium hydroxide on pro-inflammatory cytokines was studied and concluded that it leads to denaturation of these pro-inflammatory mediators such as interleukin-1 $\alpha$  (IL-1 $\alpha$ ), tumor necrosis factor $\alpha$  (TNF $\alpha$ ) and calcitonin gene-related

peptide (CGRP) that is a potential mechanism by which calcium hydroxide contributes to the resolution of periradicular periodontitis.<sup>17</sup>

Different techniques can be used for the placement of calcium hydroxide in the canals. Tan et al. compared the use of syringe and #25 finger spreader (group 1), syringe and #4 rotary lentulo spiral (group 2), specially designed paste carrier (group 3), they found that, the specially designed paste carrier was more effective than other tested techniques in the intracanal placement of calcium Hydroxide.<sup>18</sup>

#### 4.2. Root Canal Sealer

The main objective of root canal obturation is to achieve a tight seal of the root canal system which in turn enhance the healing process of periapical and apical regions after endodontic therapy.<sup>19</sup> It is well clear that some forms of cement are required when filling the root canals to fill the minor spaces between the core material and the dentinal walls of the canal to prevent leakage. The outcome of endodontic treatment may be influenced by sealer selection.<sup>2</sup> The properties of an ideal root canal sealer were outlined by Grossman (Table 1)<sup>20</sup> The dissociation of calcium hydroxide into  $\text{Ca}^{++}$  and  $\text{OH}^-$  is necessary for its therapeutic effect. Therefore, dissolving an endodontic sealer based on calcium Hydroxide resulted in the loss of its solid content and consequently obturation voids are formed.<sup>2</sup>

The antibacterial activity of some calcium hydroxide based sealers such as Real Seal, Seal apex, Apexit, and Apexit Plus is related to the release of hydroxyl ions. These sealers may also help in the formation of root-end hard tissue. Despite their advantages, calcium hydroxide-based sealers exhibit some disadvantages such as limited antibacterial activity, poor cohesive strength, greater solubility, and marginal leakage.<sup>1,21</sup>

#### 4.3. In Weeping Canal

Weeping canal is a canal from which constant clear or reddish exudation is appeared. This exudate is associated with a large apical radiolucency. The tooth is difficult to treat as when opened, exudate stops but it again reappears in next appointment. Signs and symptoms are varies from symptomless to tenderness to percussion and palpation. Obturation of canals with exudates is contraindicated.

Table 1. Requirements and characteristics for root canal sealer—Grossman (1982).

- 1) It should be tacky when mixed to provide good adhesion between it and the Canal wall when set.
- 2) It should make a hermetic seal.

3) It should be radiopaque so that it can be visualized on the radiograph.

4) The particles of powder should be very fine so that they can mix easily with liquid.

5) It should not shrink upon setting.

6) It should not discolour tooth structure.

7) It should be bacteriostatic or at least not encourage bacterial growth.

8) It should set slowly.

9) It should be insoluble in tissue fluids.

10) It should be well tolerated by the periapical tissue.

11) It should be soluble in common solvents if it is necessary to remove the root canal filling.<sup>20</sup>

For such teeth, application of calcium hydroxide in the canal after drying with sterile absorbent paper points is helpful. This is because of its high alkalinity, which changes the acidic pH of periapical tissues to a more basic environment.<sup>2,5</sup>

#### 4.4. Perforation Management

One of procedural errors that can happen during root canal treatment is root or furcation perforation. This error can cause failure of the treatment and subsequent tooth loss. Calcium hydroxide was one of the most preferred materials that have been used to seal and manage perforations. It has many advantages in this treatment modality such as stimulation of hard tissue formation, easy preparation, rapid resorption when extruded into the periodontium and healing enhancement of damaged periodontal tissue.<sup>4</sup> In case of crestal and furcation perforations, calcium hydroxide is not the suitable material for the seal as a pocket is formed due initial inflammatory response to these materials and subsequent breakdown of the supporting tissues. Although calcium hydroxide possesses disadvantages—as mentioned previously, calcium hydroxide has been recommended as a traditional agent to manage perforations, and its usage still indicated to control infection, stop bleeding and as a temporary solution when inadequate time is available to perform a permanent repair. However, mineral trioxide aggregate (MTA) now is the material of choice for the permanent repair of perforations from both a conventional and surgical approach.<sup>4,21</sup>

#### 4.5. Role in Root Resorption

Root resorption can be classified into internal, external or root-ended resorption based on the site of origin, and can affect the cementum and/or dentine of the root. Since calcium hydroxide has alkaline pH, it actively influences the local environment around a resorptive area by reducing osteoclast activity and stimulating repair. The alkaline calcium hydroxide neutralizes the acidic Environment which exists in the region of resorption, reversing

the reaction and thus stimulating hard tissue formation. The diffusion of hydroxyl ions released by calcium hydroxide through the dentinal tubules that directly communicate with periodontal space would increase the PH of periodontal space from 6.0 to 7.

4.21 To treat an internal resorption, the canal and resorption lacuna are filled with calcium hydroxide paste. In this way calcium hydroxide will induce the necrotization process of the remaining tissue in the lacuna, and then by irrigation with sodium hypochlorite the necrotic residuals are removed.<sup>4</sup> In case of lateral resorption, pulp extirpation, debridement of root canal and application of calcium hydroxide are the preferred therapy. The resorptive defect should be filled with calcium hydroxide at 3-month intervals until it reveals hard tissue formation, confirmed by both direct examination through the access cavity and radiograph.<sup>11, 4</sup> After establishment of physical barrier, the defect can be compacted with Gutta-percha.<sup>3</sup> Recently, MTA is an alternative for calcium hydroxide in the management of internal root resorption. It has been reported that MTA used successfully in surgical and non-surgical treatment of internal resorption.<sup>4</sup>

#### **4.6. Calcium hydroxide in Apexification:**

In apexification technique canal is cleaned and disinfected, when tooth is free of signs and symptoms of infection, the canal is dried and filled with stiff mix of calcium hydroxide and CMCP. Commercial calcium hydroxide paste (eg. Calasept, Pulpdent, Hypocal, Calyx1) may be used to fill the canals. Histological the formation of osteodentin after placement of calcium hydroxide paste immediately on conclusion of a vital pulpectomy has been reported. There appears to be a differentiation of adjacent connective tissue cells; there is also deposition of calcified tissue adjacent to the filling material. The calcified material is continuous with lateral root surfaces, the closure of apex may be partial or complete but consistently has minute communications with the periapical tissue.<sup>32</sup>

#### **5. CYTOTOXICITY AND BIOCOMPATIBILITY OF CALCIUM HYDROXIDE.**

The primary function of the pulp is dentin formation which started when the peripheral mesenchymal cells differentiated into odontoblast and the collagen matrix begins to deposit, in a sequence of deposition/mineralization that will lead to complete tooth formation. Dentin is produced by the pulp continuously due to the tooth aging, even after the initial formation. Physical and/or chemical injuries may also produce reparative dentin.<sup>22</sup> Dentin-pulp complex can be protected by applying one or more layers of

some specific materials between the restorative material and dental tissues. Protection of the dentin-pulp complex leads also to pulp vitality recovery. Calcium hydroxide based products are the materials that can be used for this purpose.<sup>23</sup> Cytotoxicity and biocompatibility of these materials have been widely studied in different cell cultures.<sup>22</sup>

#### **6. REMOVAL OF CALCIUM HYDROXIDE FROM THE CANALS.**

Calcium hydroxide is the most commonly used intracanal medicament.<sup>24</sup> However, incomplete removal of the material from the canal may adversely affect sealer performance and subsequent long-term prognosis.<sup>25, 26</sup> Thorough cleaning of root canal system can be achieved by delivering effective irrigation, solution activation as well as direct contact with all canal walls especially in the apical third. Several methods have been described to remove calcium hydroxide from the canal. The most commonly used method is using a master apical file to the working length in conjunction with EDTA and sodium hypochlorite.<sup>27</sup> Using rotary files, sonic and ultra-sonic activated tips with irrigation have also been recommended. However, all of the mentioned methods are not able to remove calcium hydroxide from the canals especially in the apical third.<sup>28,29, 30</sup> It has been reported that continuous irrigations with vibrating motion may have positive effects on cleaning process, particularly in the apical third of the canal which is the most difficult part to clean.<sup>31</sup>

#### **CONCLUSION.**

Calcium hydroxide has been used for different purpose in endodontics and available in different forms. Despite its wide range of antimicrobial activity, calcium hydroxide is less effective against some species. Its cytotoxicity appears to be milder than other groups of sealers. The biocompatibility of calcium hydroxide based sealers is controversial and because of their solubility, they do not fulfill all the criteria of an ideal sealer. It is difficult to remove calcium hydroxide completely from the root canals. Further studies are recommended to evaluate the Effectiveness of calcium hydroxide and its applications in the field of endodontics

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**ENDODONTIC-PERIODONTIC LESIONS AND ITS MANAGEMENT – A REVIEW**

*Manish Sukhija, Sanjeev Kumar Salaria, Suruchi Juneja, Amit Khunger, Sanjeev Kamboj, Satwant Kaur*

**ABSTRACT:** The periodontium and the pulp are closely related and they have embryonic, anatomic and functional inter-relationships. Anatomically, there is a communication between the pulp and periodontium, via apical foramina, dentinal tubules and lateral or accessory canals. Pulpal and periodontal problems are responsible for more than 50% of tooth mortality today, so recently emphasis has been placed on the inter-relationship in which one of these diseases may progress to the second tissue resulting in a distinct and more complex pulpo-periodontal lesion. Combined periodontal-endodontic lesions require both root canal therapy and periodontal treatment to save the tooth involved. However, it is important to correlate these two entities, as confusion exists with regard to etiology, diagnosis and therapy. Hence the purpose of this article is to evaluate the ideal method of diagnosis, treatment protocol of endo-perio lesions and to achieve the best treatment outcome from the articles cited in literature from 1964 onwards.

**Keywords:** Dentinal tubules, endo-perio lesions, lateral canals, pulpal-periodontal disease

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**INTRODUCTION:** The tooth and its supporting structures must be viewed as a biological unit. The inter-relationship among these structures influences each other during health, function and disease. The periodontium and the pulp are closely related. They have embryonic, anatomic and functional inter-relationships. Anatomically, there is a communication between the pulp and the periodontium, via the apical foramina, dentinal tubules and lateral or accessory canals. In 1919, Turner and Drew<sup>2</sup> first described the effect of periodontal disease on the pulp. The relationship between periodontal and pulpal disease was first described by Simring and Goldberg<sup>3</sup> in 1964.

Since then, the term 'perio-endo lesion' has been used to describe lesions due to inflammatory products found in varying degrees in both periodontium and pulpal tissues in the same tooth. This makes it difficult to diagnose because a single lesion may present signs of both endodontic and periodontal involvement. Therefore, in treating pulpo-periodontal disease, it is important to determine if the lesion is from pulpal or periodontal infection and to determine the duration of the disease. After then adequate endodontic therapy combined with an ongoing periodontal care can overcome the endodontic-periodontal problems.<sup>4</sup>

**PATHWAYS OF COMMUNICATION BETWEEN PULP AND PERIODONTIUM<sup>5</sup>**

Pathways of communication between pulp and periodontium can be classified as:

- I. Developmental
- II. Pathological
- III. Iatrogenic

Extension of infection and inflammation from pulp to periodontium or vice versa can occur through any of these pathways of communication.

**I. DEVELOPMENTAL ORIGIN**

- a. Apical foramen
- b. Accessory canals and lateral canals
- c. Dentinal tubules
- d. Permeability of cementum
- e. Congenital absence of cementum exposing the dentinal tubules at the cervical region of teeth.
- f. Developmental grooves
- g. Enamel projection and enamel pearls at the cervical area.

**II. PATHOLOGICAL ORIGIN**

- a. Empty spaces on the root created by destruction of Sharpey's fibers.
- b. Vertical fibers.
- c. Idiopathic resorption – internal and external.
- d. Loss of cementum due to external irritants.

**III. IATROGENIC ORIGIN**

- a. Exposure of dentinal tubules following root planning.
- b. Accidental lateral perforation during endodontic procedure.
- c. Root fracture due to endodontic procedure.

**MICROBIOLOGY**

Among the pathological agents encountered in a diseased pulp and periapical tissues are: bacteria, fungi and viruses. These pathogens and their byproducts may affect the periodontium in a variety of ways and need to be eliminated during root canal treatment.<sup>6</sup>

**BACTERIA:** Actinobacillus actinomycetemcomitans, Bacteroides forsythus, Eikenella corrodens, Fusobacterium nucleatum, Porphyromonas gingivalis, Prevotella intermedia and Treponema denticola are present in both endodontic sample as well as in teeth with chronic apical periodontitis and chronic adult periodontitis.<sup>7</sup>

**FUNGI:** Various fungal species especially Candida albicans are prevalent both in endodontic infections as well as in subgingivally in many cases of adult periodontitis.<sup>7</sup>



**VIRUSES:** Recent data suggests that a number of common types of viruses such as Cytomegalo virus, Epstein-Barr virus, Herpes virus may be involved in pathogenesis of periodontal and endodontic disease ranging from an increase in periodontal pathogens in periodontal pockets to involvement in pulpal and periapical pathologies.<sup>2</sup>

## ETIOPATHOGENESIS OF ENDO-PERIO LESIONS

### 1. EFFECTS OF PERIODONTAL LESIONS ON THE PULP

The etiologic factors involved in the evolution of perio-endo lesions can be of a varied nature. However, it is widely accepted that microbial agents are the main cause (Figure 1). The formation of bacterial plaque on denuded root surfaces, following periodontal disease, has the potential to induce pathologic changes in the pulp through lateral or accessory canals. These changes could be atrophic, inflammatory or resorptive in nature. This process, the reverse of the effects of a necrotic pulp on the periodontal ligament, has been referred to as retrograde pulpitis.<sup>3</sup>

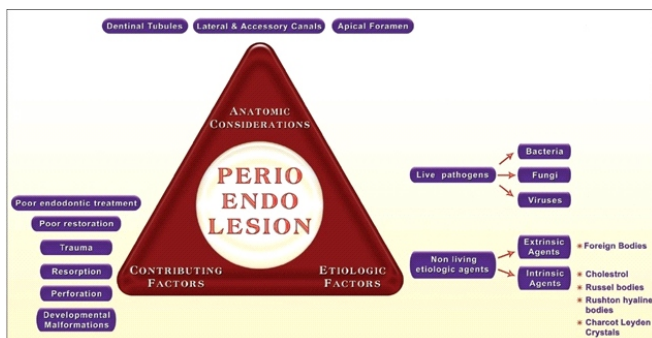


Figure.1:Diagrammatic representation of the etiopathogenesis of endoperio lesions.<sup>6</sup>

### 2. EFFECTS OF PERIODONTAL TREATMENT PROCEDURES ON THE DENTAL PULP

a) Scaling and root planning-This procedure removes the bacterial deposits. However, improper root planning procedures can also remove cementum and the superficial parts of dentin, thereby exposing the dentinal tubules to the oral environment. Subsequent microbial colonization of the root dentin may result in bacterial invasion of the dentinal tubules.<sup>6</sup> As a consequence, inflammatory lesions may develop in the pulp.

b) Acid etching-Root conditioning using citric acid during periodontal regenerative therapy helps to remove bacterial endotoxin and anaerobic bacteria and to expose collagen bundles to serve as a matrix for new connective tissue attachment to cementum.<sup>8</sup> Cotton and Siegel reported that citric acid, when applied to freshly cut dentine, has a toxic effect on the human dental pulp.

### 3. EFFECTS OF PERIAPICAL DISEASE AND CONDITIONS ON THE PERIODONTIUM

a) Impact of Disease Condition in the Vital Pulp- Inflammatory alterations in the vital pulp seldom cause lesions in the periodontal tissues that can be detected by clinical means. It is important to understand that as long as the pulp is vital, although inflamed, it is not likely that pronounced destruction of periodontal tissue is caused by this condition.<sup>9</sup>

b) Impact of the Pulpal Necrosis (asymptomatic apical periodontitis)- Contrary to the disease condition in the vital pulp, pulpal necrosis is frequently associated with inflammatory involvement of the periodontal tissue. The location of these lesions is most often at the apex of the tooth. They may also occur at any site where lateral and furcal canals exit into the periodontium .Involvement of the periodontal tissue is frequently a result of bacterial infection of a necrotic pulp causing abscess and sinus formation.

c) Lateral Lesions-Inflammatory process in the periodontium occurring as a result of root canal infection may not only be localized at the tooth apex but may also appear along the lateral aspect of the root and in furcation areas of 2 and 3 rooted teeth.<sup>10</sup>The clinical significance of accessory canals is spreading infectious products from necrotic pulp to the periodontium is not clear and no scientific documentation is yet available concerning the prevalence of endodontically derived lesions in the marginal periodontium.

### CLASSIFICATION OF ENDO-PERIO LESIONS

Various classifications were proposed for endo-perio lesions but the most acceptable classification was proposed by Simon, Glick and Frank in 1972.<sup>11</sup>

- Class I: Primary endodontic lesion
- Class II: Primary periodontal lesion.
- Class III: Primary endodontic disease with secondary periodontal involvement.
- Class IV: Primary periodontal disease with secondary endodontic involvement.
- Class V: True combined lesion.

Class VI: Concomitant pulpal and periodontal lesions

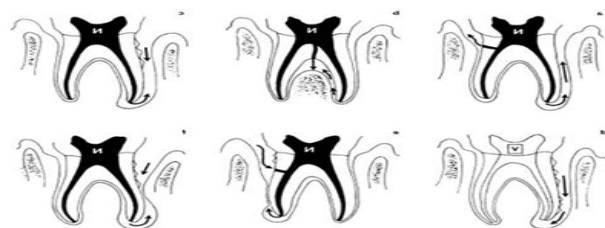


Figure 211:(a) Endodontic Lesions. The pathway of fistulation is

evident through the periodontal ligament from the apex or a lateral canal, (b) Fistulation may cause bifurcation involvement, (c) Primary Endodontic Lesion with Secondary Periodontic Involvement showing periodontitis with calculus formation beginning at the cervical area in existing pathway, (d) Periodontic Lesions. With progression of periodontitis to apical involvement (vital pulp), (e) Primary Periodontic Lesion with Secondary Endodontic Involvement. Periodontic involvement at the cervical margin and the resultant pulpal necrosis once the lateral canal is exposed to the oral environment, (f) "True" Combined Lesions. Two separate lesions are heading to a coalescence.

Recently Khalid S. Al-Fouzan (2014)<sup>12</sup> proposed another classification of endo-perio lesions, based on the primary disease with its secondary effect

1. Retrograde periodontal disease:
  - a. Primary endodontic lesion with drainage through the periodontal ligament,
  - b. Primary endodontic lesion with secondary periodontal involvement;
2. Primary periodontal lesion;
3. Primary periodontal lesion with secondary endodontic involvement;
4. Combined endodontic-periodontal lesion
5. Iatrogenic periodontal lesions.
  - a. Root perforations
  - b. Coronal leakage
  - c. Dental injuries or trauma
  - d. Chemicals used in dentistry
  - e. Vertical root fractures

#### DIAGNOSIS OF ENDO-PERIO LESIONS<sup>6</sup>

It is incumbent to gather all relevant information via history and examination. So, appropriate diagnostic procedures are needed to correlate this information to determine the condition which might be consistent with the findings. It also helps to differentiate between various conditions and to arrive at the correct diagnosis.<sup>13</sup>

#### VISUAL EXAMINATION

Soft Tissues, Inflammation, Ulcerations, Sinus tracts, Teeth Caries, Defective restorations, Abrasions, Cracks, Fractures, Discolorations

#### PALPATION

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

#### PERCUSSION

Peri-radicular inflammation  
 Compare with control teeth

#### MOBILITY

Loss of periodontal support  
 Fractured roots  
 Recent trauma,  
 Peri-radicular abscess

#### RADIOGRAPHS

Peri-radicular 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 radio-opaque material (guttapercha)

#### CRACKED TOOTH TESTING

Transillumination, Wedging, Staining

#### DIFFERENTIAL DIAGNOSIS OF ENDO-PERIO LESIONS

When pulp infection is the primary cause of a deep pocket in pulp-periodontal disease, not complicated by chronicity and when periodontal infection is the primary cause of a pocket not complicated by pulp disease, the following criteria are generally valid in differentiating these lesions.<sup>13</sup>

	PULPAL	PERIODONTAL
ETIOLOGY	Pulp infection	Periodontal infection.
PULP TEST	Non-vital	Vital.
MICROBIAL	Few organisms.	Complex microbial plaque.
TRAUMA (OCCLUSION)	May be primary or secondary	May be primary cause of a wide Periodontal space or secondary cause in pocket formation.
INFLAMMATION	Acute.	Chronic.
PH	Usually acid.	Usually alkaline.
ROOT SURFACE	No calculus	Calculus.
POCKET	Narrow, one surface, often facial.	Wide coronally, narrow apically Usually interproximal and part of a generalized disease.
BONE LOSS	One surface, often facial, wider apically, narrow coronally.	Multiple surfaces, usually interproximal wider coronally, often intrabony.
RADIOGRAPHIC FINDINGS	Funnel shaped, wider at apex but often superimposed over the root in facial pocket.	Generalized bone loss coronally not involving the periapical regions
RESTORATIVE	Deep restorations.	Caries or deep restorations not related.

Table 1. Differential diagnosis of endo-perio lesions

## HISTOPATHOLOGY

EPITHELIUM	No down growth.	Proliferation and down growth
CONNECTIVE TISSUE	Fibre residue on root surface, minimal granulation tissue in pocket.	No fibres except apical portion, large quantity of granulation tissue in pocket.
GINGIVAL RECESSION	Little or no recession	Gingival recession in chronic disease.
THERAPY	Pocket closure with Endodontic treatment or with simple additional periodontal procedures.	Regeneration possible only with advanced periodontal treatment, except in pockets of recent origin from acute inflammation.

Table 2. Histopathological differential diagnosis of endo-perio lesions

## TREATMENT OF ENDO-PERO LESION

### I. TREATING PRIMARY ENDODONTIC LESIONS

Endodontic treatment must be completed first and may result in partial closure of the pocket if the periodontal irritants have not invaded all the way to the apex. Root canals should be filled with calcium hydroxide paste. As it is bactericidal, anti-inflammatory and proteolytic, it inhibits resorption and favors repair. It also inhibits periodontal contamination from instrumented canal via patent channels connecting the pulp and periodontium before periodontal treatment removes the contaminants. The canals are eventually filled with a conventional obturation when there is clinical evidence of improvement. These lesions will not completely resolve with endodontic treatment alone and periodontal therapy should follow the endodontic treatment to ensure removal of plaque, calculus and infected cementum that has developed on the root surface within the pocket. The prognosis for primary endodontic lesions is good but worsen in the advanced stages of secondary periodontal involvement.<sup>16,17,18</sup>

### II. TREATING PRIMARY PERIODONTAL LESIONS

Determining the prognosis depends upon the stage of periodontal disease and the efficacy of periodontal treatment. Primary periodontal lesions are treated by hygiene phase therapy in the first instance. Subsequently, poor restorations and developmental grooves that are involved in the lesion are removed as these are difficult areas to treat successfully. Periodontal surgery is performed after the completion of hygiene phase therapy if deemed necessary. Periodontal treatment removes the noxious stimuli and secondary mineralization of dentinal tubules allows the resolution of pulpal hypersensitivity. If pulpal inflammation is irreversible root/re-root treatment is carried out followed by periodontal treatment; in some cases surgical intervention is advantageous. The prognosis of periodontal lesions is poorer than that of endodontic lesions and is dependent on the apical extension

of the lesion. As the lesion advances, the prognosis approaches that of a true-combined lesion.<sup>6,14</sup>

### III. TREATING TRUE COMBINED LESIONS

Primary endodontic lesions with secondary periodontal involvement may also occur as a result of root perforation during root canal treatment, or where pins or posts have been misplaced during coronal restoration. Symptoms may be acute, with periodontal abscess formation associated with pain, swelling, pus exudate, pocket formation, and tooth mobility. A more chronic response may sometimes occur without pain, and involves the sudden appearance of a pocket with bleeding on probing or exudation of pus. True-combined lesions are treated initially as primary endodontic lesions with secondary periodontal involvement. The prognosis of a true-combined perio-endo lesion is often poor or even hopeless, especially when periodontal lesions are chronic with extensive loss of attachment.<sup>19</sup> Root amputation, hemisection or separation may allow the root configuration to be changed sufficiently for part of the root structure to be saved. The prognosis of an affected tooth can also be improved by increasing bony support which can be achieved by bone grafting<sup>20</sup> and guided tissue regeneration.<sup>21</sup>

### IV. TREATING IATROGENIC LESIONS

Although the first priority is to close the iatrogenic communication, the aim is to produce a seal. The outcome of the treatment of root perforations depends on the size, location, time of diagnosis and treatment, degree of periodontal damage as well as the sealing ability and biocompatibility of the sealer. It has been recognized that the success of the treatment depends mainly on immediate sealing of the perforation and appropriate infection control. Several materials such as MTA (Mineral Tri-oxide Aggregate), Super EBA (Reinforced zinc-oxide cement with 32% eugenol & 685 Ethoxy Benzoic Acid), Cavit (Temporary restorative Material containing Zinc-oxide & Calcium Sulphate), IRM (Intermediate Restorative Material containing Zinc oxide & Eugenol), glass ionomer cements, composites, and amalgam have been recommended to seal root perforations.<sup>22</sup> Palatal perforations are difficult to manage, even surgically, and frequently lead to extraction. The successful treatment of root perforations depends principally on early detection and sealing. Lesions attributable to over-filling of root canals and intra-canal medicaments can usually be resolved by periradicular surgery, probably accompanied by a retrograde root filling. Teeth with lesions caused by vertical root fractures have a hopeless prognosis and should be extracted.

## PROGNOSIS

Prognosis of primarily endodontic and primarily periodontal disease is very straight forward. However, prognosis of combined forms of the lesions is more difficult to predict. Endodontic therapy is more predictable and completion of this therapy before periodontal procedures has a positive effect on periodontal healing. The most guarded prognosis is given for true combined lesions. In general, assuming that endodontic therapy is adequate, what is of endodontic origin will heal.<sup>6</sup> However, in cases of combined disease, the prognosis of combined diseases rests with the severity and extent of the periodontal lesion and the efficacy of periodontal therapy. The complete treatment of both aspects of perio-endo lesions is essential for successful long-term results.<sup>23</sup>

## CONCLUSION

It is essential to understand that in perio-endo lesions, the endodontic treatment is the more predictable of the two. However the success of endodontic therapy is dependent on the completion of periodontal therapy.

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**SIGNIFICANCE AND CLINICAL RELEVANCE OF BIOLOGIC WIDTH IN PERIODONTAL AND RESTORATIVE DENTISTRY: GENERAL REVIEW**

*Amit Khunger, Sanjeev Kumar Salaria, SatwantKaur, Navjot Kaur, Isha Sharma, Vishal Jindal*

**ABSTRACT**

The dimension of the space that the healthy gingival tissues occupy above the alveolar bone is defined as biologic width. It can be identified for each individual patient by probing to the bone level and subtracting the sulcus depth from the resultant measurement. There are many ways to compromise the biologic width. Infringement of the biologic width by placement of a restoration within its zone may result in gingival inflammation, pocket formation, abscess formation and alveolar bone loss. An adequate understanding of relationship between periodontal tissue and restorative dentistry is vital to ensure adequate form, function esthetic and comfort of the dentition. An attempt has been made in this article to discuss the concept of biologic width, its importance in maintaining a long term dental restoration, implication and methods to correct the biologic width violation.

**Keywords:** Alveolar bone loss, biologic width violation, restoration

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**INTRODUCTION**

Natural teeth are surrounded by soft tissues (unique structure is composed of junctional epithelium and soft connective tissue attachment) that provide a biologic seal between the oral cavity and periodontium known as biological width.

The biological width dimension represent anatomical and physiologic tissue where the host respond to physical (e.g. restorative margin, abutments and micro-gaps) and environmental (bacteria and chemicals) challenges through the initiation of inflammation and under the pathological conditions, tissue change. Restorative dentist need to take into account that these are responsive biologic tissue and that are impinging on them has consequences.

Maintenance of biologic width is essential to preserve the periodontal health and to remove any irritation that may damage the periodontium. The relationship between periodontal health and restoration of teeth is intimate and inseparable. Maintenance of gingival health constitutes one of the keys for tooth and dental restoration longevity. Encroachment of biologic width becomes of particular concern when considering the restoration of tooth that has fractured or been caries near the alveolar crest. Also, aesthetic demands often require “burying” of restorative margins subgingivally, which can lead to violation of this space.<sup>1</sup>

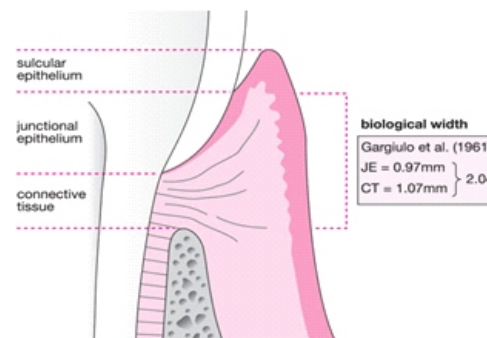
The aim of this paper is to assess the violation of biologic width and use of best surgical and non-surgical treatment modalities for

the management of violation of biologic width.

**BIOLOGIC WIDTH ANATOMY**

Biologic width is defined as dimension of soft tissue, which is attached to the portion of the tooth coronal to crest of alveolar bone. The concept of biologic width was initiated by Gargiulo et al in 1961, who reported certain uniformity in the dimension of some components of periodontium which forms the biologic width.<sup>2</sup> The term biologic width were coined by D Walter Cohen. It was described by Ingber (1977)<sup>3</sup>.

Vacek JS et al (1994)<sup>4</sup> histologically determined the Biologic width in 171 adult human cadaver jaws obtained mean measurements of 1.34 mm for sulcus depth,  $1.14 \pm 0.49$  mm for epithelial attachment,  $0.77 \pm 0.32$  mm for connective tissue attachment, 2.17 mm for Biologic width.



There is a definite proportion between the sulcus depth, the epithelial attachment, the connective tissue attachment, and the alveolar crest. The sulcular depth is 0.69 mm, junctional epithelium is 0.97 mm and mean supra alveolar connective tissue attachment is 1.07 mm. The total width of junctional epithelium and supra alveolar connective tissue attachment which form the biologic width is  $0.97 + 1.07 = 2.04$  mm.<sup>5</sup>

The dimension of biologic width is not constant, it depends on the location of tooth in the alveolus, varies from tooth to tooth, also from the aspect of the tooth. The significance of biologic width is that, it acts as a barrier and prevents penetration of microorganism into the periodontium.<sup>6</sup>

**EVALUATION OF BIOLOGICAL WIDTH**

**1. CLINICAL METHODS**

If a patient experiences tissue discomfort when the restoration margin levels are being assessed with a periodontal probe, it is a good indication that the margin extends into the attachment and that a biologic width violation has occurred.

Sign of biological width violation

- Ø Chronic progressive gingival inflammation around the restoration

- Ø Bleeding on probing
- Ø Localized gingival hyperplasia with minimal bone loss
- Ø Gingival recession
- Ø Pocket formation
- Ø Clinical attachment loss
- Ø Alveolar bone loss

## 2. BONE SOUNDING<sup>5</sup>

The biologic width can be identified by probing under local anesthesia to the bone level (referred to as "sounding to bone") and subtracting the sulcus depth from the resulting measurement. If this distance is less than 2 mm at one or more locations, a diagnosis of biologic width violation can be confirmed. This measurement must be performed on teeth with healthy gingival tissues and should be repeated on more than one tooth to ensure accurate assessment, and reduce individual and site variations.

## 3. RADIOGRAPHIC METHOD<sup>5</sup>

Radiographic interpretation can identify interproximal violation of biologic width

Sushama and Gouri (2011)<sup>7</sup> have described a new innovative parallel profile radiographic (PPR) technique to measure the dimension of dentogingival unit. PPR technique could be used to measure both length and thickness of dentogingival unit with accuracy, as it was simple, concise, non-invasive, and reproducible method

## MARGIN PLACEMENT GUIDELINES TO PREVENT BIOLOGIC WIDTH VIOLATION

### TYPES OF RESTORATIVE MARGIN<sup>8</sup>

A clinician is presented with three options for margin placement

**Supragingival:** It is least irritating to periodontium and is easy to prepare. The final fit and finish of the margins and removal of excess cement are also the easiest to achieve. Though this type of margin has the least impact to the periodontium, it is unesthetic and preferred only in non-esthetic area

**Equigingival margin:** Equigingival margin can easily be blended with the tooth and can be finished easily to provide a smooth and polished margin. But such margins are not desirable as they are thought to favour more plaque accumulation and therefore result in greater gingival inflammation.

**Subgingival margin:** Though it is esthetic, it is detrimental to periodontal health as it acts as permanent irritant to the periodontium. Many studies have demonstrated qualitative and quantitative changes in subgingival microbes, increased plaque index, gingival recession and pocket depth.

The first step in using sulcus depth as a guide in margins placement is to manage gingival health, the following three rules

can be used to place intracrevicular margins.<sup>9</sup>

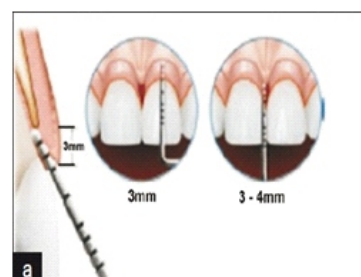
1. If the sulcus probes 1.5mm or less, place the restoration margin 0.5mm below the gingival tissue crest. This is especially important on the facial aspect and it prevents a biologic width violation in patient who is at high risk in that regard.
2. If the sulcus probes more than 1.5mm, place the margin one half the depth of sulcus below the tissue crest. This places the margin far enough below tissue so that it still is covered if the patient is at high risk of recession.
3. If sulcus greater than 2mm is found, especially on the facial aspect of tooth, then evaluate to see whether gingivectomy could be performed to lengthen the teeth and create a 1.5mm sulcus. Then patient can be treated using rule<sup>1</sup>

Kois (2000) proposed three categories of biologic width based on the total dimension of attachment and the sulcus depth following bone sounding measurements, namely: Normal Crest, High Crest and Low Crest.<sup>10</sup>

### (A) NORMAL CREST PATIENT

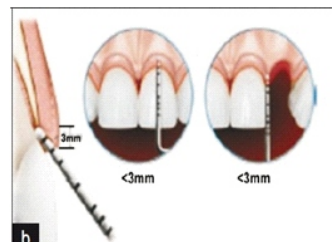
The mid-facial measurement is 3.0 mm and the proximal measurement is a range from 3.0 mm to 4.5 mm.

Normal Crest occurs approximately 85% of time. In these cases, the gingival tissue tends to be stable for a long term. Therefore, a crown margin which is placed 0.5 mm subgingivally tends to be well-tolerated by the gingiva, and is stable long term in the Normal Crest patient.



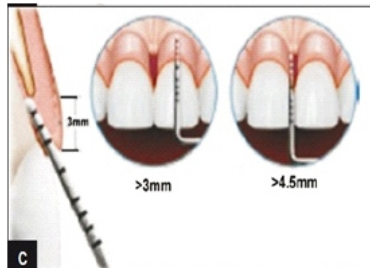
### (B) HIGH CREST PATIENT

The mid-facial measurement and proximal measurement is less than 3.0 mm. It occurs approximately 2% of the time. In this situation, it is commonly not possible to place an intracrevicular margin because the margin will be too close to the alveolar bone, resulting in a biologic width impingement and chronic inflammation.



### (C) LOW CREST PATIENT

The mid-facial measurement is greater than 3.0 mm and the proximal measurement is greater than 4.5 mm. Low Crest occurs approximately 13% of the time. The Low Crest patient has been described as more susceptible to recession secondary to the placement of an intracrevicular crown margin.



#### Importance of determining the crest category

When preparing anterior teeth for indirect restorations, it is essential that the dentist should know about the Crest category. This allows the operator to determine the optimal position of margin placement, as well as inform the patient of the probable long-term effects of the crown.

#### RESTORATIVE MARGIN LOCATION<sup>11</sup>

The location of restorative margins is determined by many factors, including esthetics, retentive factor, degree of gingival recession, susceptibility to root caries. Undoubtedly it is preferable if margin can remain coronal to free gingival margin.

Waerhaug (1978)<sup>12</sup> stated that subgingival restorations are plaque retentive area that is inaccessible to scaling instrument. These retentive area are continue to accumulate plaque even in the presence of adequate supragingival plaque control.

Orkin et al (1987)<sup>13</sup> demonstrated that subgingival restoration had a greater chance of bleeding and exhibiting gingival recession than supragingival restoration.

Stetler & Bissada (1987)<sup>14</sup> evaluated the effect of width of keratinized gingiva and subgingival restoration on periodontal health. Teeth with subgingival restoration and narrow zone of keratinized gingiva showed significantly higher gingival index score than teeth with submarginal restoration with wide zone of keratinized gingiva. Thus, clinician should consider gingival augmentation for teeth with minimal keratinized gingiva before placing the subgingival restorations.

It is also important for clinician and patients to understand that although crown margin may be placed subgingivally, it is highly likely that overtime the margins will eventually be located supragingivally. Although individual variation exists in the soft tissue attachment around teeth, there is general agreement that a minimum of 3mm should exist from restorative margin to alveolar bone, allowing for 2mm of biologic width space and 1mm for

sulcus depth.

#### RESTORATION OVERHANGS<sup>11</sup>

Overhanging dental restoration has long been viewed as contributing factor to gingivitis and possible periodontal attachment loss. They contribute to gingival inflammation due to their retentive capacity for bacterial plaque.

Jeffcoat and Howell (1980)<sup>15</sup> demonstrated a link to severity of overhang and amount of periodontal destruction. Based on radiographic evaluation of 100 teeth with overhangs 100 without overhang, they reported greater bone loss around teeth with large overhangs. The severity of bone loss is directly proportional to the severity of overhang.

Lang et al (1983)<sup>16</sup> investigated the specific aspect of the local bacterial accumulation associated with overhang restorations. The placement of subgingival overhangs resulted in changes in associated micro flora to that of one resembling the flora observed in adult chronic periodontitis. Increase proportion of gram negative anaerobic rods, in particular black pigmented bacteroides, were observed.

Thus overhangs not only increase the plaque mass but also increase the specific periodontal pathogen in the plaque. Most overhang restorations can be recontoured without replacing the restoration, and this should be considered a standard component of non surgical treatment.

According to spinks et al (1986)<sup>17</sup> motor driven diamond tip is faster for removing overhangs and led to smooth restoration compared to sonic scalers and curettes, respectively.

#### ARTIFICIAL CROWN CONTOUR<sup>11</sup>

Regarding crown contour, conflicting reports exist regarding the proper contour necessary for maintaining gingival health. Some reports that artificial crown should follow the original anatomy of tooth contour to permit functional stimulation and maintain gingival health. Other advise that crown should be under contoured for better periodontal health

Youdelis et al (1973)<sup>18</sup> stated that greater the amount of facial and lingual bulge of an artificial crown, the more the plaque retained at the cervical margin.

Becker & kaldahl (1981)<sup>19</sup> opined that buccal and lingual crown contour should be “flat”, not “fat” usually <0.5mm wider than CEJ, that furcation area should be “fluted” or “barreled out” to accommodate oral hygiene in these areas.

#### ROOT RESHAPING: AN INTEGRAL COMPONENT OF PERIODONTAL SURGERY<sup>20</sup>

Traditional crown-lengthening procedures have resulted in a significant amount of iatrogenic bone loss. Root reshaping alone



or the addition of this technique to minimal resective therapy can greatly reduce the overall quantity of bone removal traditionally seen in crown-lengthening or osseous-resective surgical procedures. It has long been established that creating a biologically acceptable root surface will enhance the outcome of both surgical and nonsurgical treatment of periodontitis. After the final finishing bur has been used and all old restorative margins eliminated, the clinician will be able to appreciate a final tooth contour with grooves and furcations eliminated or substantially decreased and subgingival calculus completely removed.

Keratinized tissue is an important component in the overall health and development of the periodontal-restorative relationship. Once the surgical therapy is complete and an adequate healing period has been observed, the restorative dentist must relay the importance of maintaining the new morphology of the dentition in the final prosthesis. Root reshaping will allow an improved embrasure that permits favorable oral hygiene and development of normal gingival form.

This procedure accomplishes several goals:

- (1) Minimum supporting bone is removed.
- (2) Deleterious root surface anatomy, such as grooves, concavities, and cemento-enamel projections, is diminished.
- (3) A smooth root surface that is more biologically acceptable to soft tissue is created.
- (4) Class I and II furcation lesions may be decreased or eliminated.
- (5) Improved gingival contours and space for restorative materials can be created in situations in which close root proximity is present.

#### **METHODS TO CORRECT BIOLOGICAL WIDTH VIOLATION**

There are various methods available in literature to correct the biologic width violation.

1. Surgical extrusion
2. Periotome extrusion
3. Orthodontic extrusion
4. Intentional replantation
5. Gingivectomy/osteoplasty

The mode of treatment is chosen based on the width of attached gingiva present, biologic width measurements as obtained from bone sounding, and esthetic requirements.<sup>6</sup>

#### **GINGIVECTOMY**

- >3mm of bone sounding
- Adequate amount of keratinized tissue

#### **APICALLY REPOSITIONED FLAP WITHOUT OSTECTOMY**

- >3mm of bone sounding of multiple teeth

- No Adequate amount of keratinized tissue

#### **APICALLY REPOSITIONED FLAP WITH OSTECTOMY**

- <3mm of bone sounding of multiple teeth
- No Adequate amount of keratinized tissue

#### **FORCED RUPTION**

- Done when surgical procedure can lead to a negative architecture

#### **CONCLUSION**

The health of periodontal tissue is dependent on the properly designed restorations. Incorrectly placed restoration margin, unadapted restoration and overhanging restoration violates the biologic width. Conceptually restorative margin can remain coronal to free gingival margin. Subgingival margin placement should be avoided. If restorative margin need to be placed apically repositioned flap with ostectomy, gingivectomy, periotome extrusion or orthodontic extrusion should be considered to provide the adequate tooth structure above the alveolar crest. Although individual variations exist in the soft tissue attachment around the teeth there is general agreement that a minimum of 3 mm should exist from restorative margin alveolar bone, allowing 2 mm of biologic width space and 1 mm for sulcus depth.

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**ABSTRACT**

Pulp vitality is extremely important for the tooth viability, since it provides nutrition and acts as biosensor to detect pathogenic stimuli. Treatment of the young permanent tooth with a necrotic root canal system and an incompletely developed root is very difficult. Few acceptable results have been achieved through apexification, but use of long-term calcium hydroxide might alter the mechanical properties of dentin. Regenerative endodontic procedures aim at the regeneration of pulp and dentin of the injured teeth. The present article reviews the recent approach of pulp revascularization and provides an overview of its methods with possible future potential of regenerating pulp as a routine dental procedure.

**Key words:** Guided tissue regeneration, necrosed pulp, root canal treatment, tissue engineering

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**INTRODUCTION**

Regenerative endodontics (revascularization/pulpal regeneration) is one of the most exciting new developments in endodontics. The current (2012) American Association of Endodontist defines regenerative endodontics as "biologically-based procedures designed to physiologically replace damaged tooth structures, including dentin and root structures, as well as cells of the pulp-dentin complex."<sup>1</sup>

The origin of biologically compatible regenerative endodontic procedures that allow revival of damaged dentin and root structures, including the cells of pulp-dentin complex dates back to around 1952, when Hermann first reported the application of calcium hydroxide Ca(OH)<sub>2</sub> in vital pulp amputation.<sup>2</sup> Until date, its application has been limited to the patients between the age group of 8 and 16 years<sup>3</sup> and in teeth with minimal periapical pathology. However, the scope of this procedure is changing with the growing evidence of persistence of self-maintained mesenchymal stem cells (MSCs) in adults<sup>4</sup> and the advent of superior scaffolds like platelet-rich plasma and platelet-rich fibrin that delivers enhanced concoction of growth factors. In addition, the presence of inflamed periapical progenitor cells,<sup>5</sup> infection survived stem cells from the apical papilla (SCAP)<sup>6</sup> in teeth with large periapical pathology, may further widen its horizon.

Pulpal necrosis in an immature tooth with an open apex can have devastating consequences for patients and presents a distinctive challenge for the dentist. Though root canal revascularization through blood clotting has become a new norm in regenerative

endodontic practice with successful clinical results reported, conventional techniques such as partial pulpotomy, apexification, and apexogenesis are not yet obsolete, and clinicians have to rely on these traditional procedures or the use of apical barriers to treat immature teeth with pulpal necrosis.<sup>3</sup> Apexification with Ca(OH)<sub>2</sub> has several disadvantages. It requires multiple visits during a long period of time (6-24 months; average, 1 year-7 months), it depends on the parents commitment to ensure the child's dental visits are kept, the barrier formed is often porous and not continuous or compact and also it undermines the mechanical strength of dentin because of a prolonged exposure to Ca(OH)<sub>2</sub>.<sup>7</sup> These drawbacks led to the use of mineral trioxide aggregate (MTA) by Torabinejad and Chivian, an alternative to Ca(OH)<sub>2</sub> apexification, where they suggested of cleaning the root canal and sealing the open apex with MTA in 1 or 2 visits could minimize the risk of root canal overfilling and promote apical repair.<sup>8</sup> However, clinical experience on the outcome of apexified teeth with thin and weak roots after successful treatment showed that they are highly susceptible to fracture.<sup>9</sup> Therefore, alternative approaches that allow the increase of root thickness and length should be pursued. In recent times, a novel concept of revascularization of immature nonvital, infected teeth was introduced. The idea is to create and deliver new tissues to replace the necrotic pulp.<sup>10</sup>

**THE CONCEPT**

Currently, there are two major concepts in the regenerative endodontics: Guided tissue regeneration and tissue engineering.

**GUIDED TISSUE REGENERATION****(REVASCULARIZATION :**

The guided tissue regeneration has now become widely known as the "revascularization" or "revitalization" approach. The concept of revascularization, per se was introduced by Ostby in 1960.<sup>11</sup> In 1971, Nygaard-Ostby and Hjortdal performed studies that can be considered the forerunner of pulpal regeneration. The studies were aimed at determining how periodontal tissue would react, if the entire pulp was removed from the main canal and the apical part subsequently allowed to be filled with blood. It was further demonstrated that in a traumatic avulsion, blood vessels slowly grow from the apex toward the pulp horn by replacing the necrosed pulp left behind after the avulsion injury.<sup>12</sup>

The development of normal, sterile granulation tissue within the root canal is thought to aid in revascularization and stimulation of cementoblasts or the undifferentiated mesenchymal cells at the peri-apex, leading to the deposition of a calcific material at the apex as well as on the lateral dentinal walls.

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## TISSUE ENGINEERING

The second concept in the regenerative endodontics is tissue engineering where synthetic biodegradable materials were introduced as scaffolds for cell expansion. Currently, at least five different types of MSCs have been isolated from the dental tissues, including dental pulp stem cells (DPSC), stem cells of human exfoliated deciduous teeth (SHED), SCAP, dental follicle progenitor cells, and stem cells from periodontal ligament.<sup>13</sup> Among these, DPSC, SHED, and SCAP show stronger potential for pulp regeneration. However, its further use in regenerative endodontics was halted due to the lack of isolation of specific dental stem cells.

## CASE SELECTION

Case selection is important. It has been reported that pulp revascularization can occur most predictably in teeth with open apices.<sup>14</sup> An apical diameter of at least 1 mm (mesiodistally) radiographically is necessary to allow ingrowth of vital tissue. The presence of a periradicular radiolucency or a negative vitality test are not determining factors in case selection as vital pulp tissue or apical papilla may be present in the canal and at the apex.<sup>15</sup>

## CLINICAL PROCEDURES FOR REVASCULARIZATION THROUGH BLOOD CLOTTING

It is important to understand the biological feature permitting revascularization in young avulsed tooth/necrotic tooth before it is clinically applied. These teeth have an open apex, short root and intact, but necrotic pulp tissue. Revascularization of the pulp space in infected immature teeth with apical periodontitis is impossible unless the canals are disinfected.

The blood clot revascularization method involves the following steps:

1. During the first visit, minimal instrumentation and irrigation with 2.5% sodium hypochlorite for over 20 min after excavation of the coronal pulp.
2. Disinfection with copious irrigation, and with the use of the "3 mix-MP" triple antibiotic paste, consisting of equal quantities of ciprofloxacin, metronidazole, and minocycline (concentration = 20 mg/ml) in propylene glycol or macrogol ointment (as a carrier), for a period of 3 weeks.
3. In the second visit, mechanical irritation of the apex is performed with the use of a sterile K-file to initiate bleeding into the root canal to the level of cemento-enamel junction. A blood clot was produced to the level of the cemento-enamel junction to provide a scaffold for the in-growth of new tissue followed by a double seal of mineral trioxide aggregate in the cervical area and a bonded resin coronal restoration to prevent coronal bacterial

ingress.<sup>16</sup>

Maintaining the viability of the remaining survived pulp tissue and the SCAP are considered critical for revascularization to succeed. Therefore, it is essential to follow a protocol of no canal instrumentation throughout the revascularization procedure in order to preserve these essential enduring stem cells.<sup>16-18</sup> If this approach fails to regenerate new tissue, apexification is needed to achieve apex closure in order to perform conventional root canal therapy.

## FOLLOW-UP:

Clinical and radiographic exam:

\*No pain or soft tissue swelling (often observed between first and second appointments) \*Resolution of apical radiolucency (often observed<sup>6-12</sup> months after treatment)

\*Increased width of root walls (this is generally observed before apparent increase in root length and often occurs 12-24 months after treatment)

\*Increased root length

\*Apical closure.

## MECHANISM OF REVASCULARIZATION:

It is possible that a few vital pulp cells remain at the apical end of the root canal, which might proliferate into the newly formed matrix and differentiate into odontoblasts under the organizing influence of cells of Hertwig's epithelial root sheath, which are quite resistant to destruction, even in the presence of inflammation.<sup>19</sup>

\* Another possible mechanism of continued root development could be due to multipotent DPSC<sup>20</sup> which are present in permanent immature teeth in abundance. These cells from the apical end might be seeded onto the existing dentinal walls and might differentiate into odontoblast and deposit tertiary or atubular dentin.

\*The third possible mechanism could be attributed to the presence of stem cells in the periodontal ligament<sup>21,22</sup> which can proliferate, grow into the apical end and within the root canal, and deposit hard tissue both at the apical end and on the lateral root walls.

\*The fourth possible mechanism of root development could be attributed to SCAP or the bone marrow. Instrumentation beyond the confines of the root canal to induce bleeding can also transplant MSCs from the bone into the canal lumen. These cells have extensive proliferating capacity.<sup>23,24</sup>

\*Another possible mechanism could be that the blood clot itself, being a rich source of growth factors, could play an important role

in regeneration, which include platelet-derived growth factor, vascular endothelial growth factor, platelet-derived epithelial growth factor, and tissue growth factor and could stimulate differentiation, growth, and maturation of fibroblasts, odontoblast, cementoblasts etc., from the immature, undifferentiated mesenchymal cells in the newly formed tissue matrix.

#### **MERITS OF REVASCULARIZATION**

Root canal revascularization through blood clotting is a relatively simple and practical approach, which can be accomplished with presently available instruments and materials. Moreover, the possibility of immune rejection and contamination can be averted since the root canal system is filled with patient's own blood cells.<sup>10</sup> Case reports have revealed progressive thickening of dentinal walls, continued root development, and positive response to thermal pulp testing.<sup>25</sup>

#### **LIMITATIONS<sup>26</sup>**

- \* Difficult to achieve it in fully formed permanent teeth.
- \* Potential clinical and biological complications such as crown discoloration, development of resistant bacterial strains (due to long-term use of antimicrobial agents), and allergic reaction to intracanal medicament.
- \* Potential risk of necrosis, if tissue is reinfected.
- \* The concentration and composition of the progenitor/ stem cells entrapped in the fibrin clot is unpredictable, particularly in older patients and may lead to the disparity in the result.
- \* Lack of long-term follow-up studies makes revascularization procedure a supplement but not a substitute to the already existing treatment protocols such as apexogenesis, apexification, or partial pulpotomy.<sup>3</sup>

#### **CONCLUSION**

The success of revascularization points out the potential future fate of apexification procedures. Such procedures may no longer be the preferred first option to treat immature permanent teeth with non vital pulps. Based on the present studies, it is reasonable to conclude that revascularization is a reparative process rather than regenerative process. As the exact nature of the tissue formed inside the pulp canal in humans is not completely understood, it is better to consider revascularization therapy only when other conventional modalities of treatment like apexification, apexogenesis, and partial pulpotomy fail. The future research should focus on the issues that must be addressed to develop a safe, effective, and consistent method for regenerating a functional pulp-dentin complex.

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## Case Report

### ACCIDENTAL EXTRUSION OF SODIUM HYPOCHLORITE BEYOND ROOT APEX – A CASE REPORT

Ramachandra Reddy GV, Karthikeyan Ramalingam, Sunil Tejaswi

#### ABSTRACT:

Endodontic treatment is a routinely performed clinical procedure in dental practice. Irrigation with sodium hypochlorite plays an important role in the debridement and disinfection of the root canal system. We present a case of inadvertent injection of sodium hypochlorite into the periapical tissues, causing tissue destruction, extraoral swelling, and ecchymosis. Clinical symptoms and management of the condition are discussed.

**Key words:** Complications, emphysema, hemorrhage, root canal irrigant, sodium hypochlorite

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#### INTRODUCTION:

Use of chemical irrigants such as sodium hypochlorite and hydrogen peroxide as an adjunct to mechanical debridement of pulp canals is a common practice in endodontics. Sodium hypochlorite has been effective against a broad spectrum of bacteria and to dissolve vital as well as necrotic tissue. This and its lubricating property make it an excellent choice for intracanal irrigation. However, it has been shown that sodium hypochlorite has toxic effects when it comes in contact with vital tissues, resulting in hemolysis, skin and mucosal ulcerations, necrosis, and swelling.<sup>1,2</sup>

In dental literature, several cases have been reported with varying tissue damage due to inadvertent injection of root canal irrigants. The following case report describes one such complication caused due to extravasation of Sodium hypochlorite into the periapical tissues.

#### CASE REPORT:

A 37-year-old female patient reported to the Oral medicine department with a complaint of pain and swelling on the right side of her face.

History revealed that she was undergoing root canal therapy on her maxillary right second premolar. The procedure was started by her general dentist the previous day under local anesthesia, access cavity was prepared and the canal was debrided with a chemical agent and closed dressing was given. Later in the evening patient started developing pain and swelling in the region & discoloration of the skin on the affected area. The swelling gradually increased in size. Her medical history was insignificant.

Physical examination revealed that she was anxious and under

stress. Vital signs were normal.

There was a diffuse swelling on the right side of the face extending from infraorbital margin to the lower border of the mandible, mediolaterally from the ala of the nose to 2cm anterior to the tragus of the ear. Ecchymosis was present on the overlying skin extending from the right corner of the lip (Figure 1).



Figure 1: Clinical picture showing extra oral swelling with ecchymosis.

Intraoral examination revealed an extensive irregular ulcer extending from the right buccal sulcus in the region of first and second premolars to the buccal mucosa with irregular margins. The surface was covered with slough (Figure 2).



Figure 2: Clinical picture showing intra-oral ulcer covered with necrotic slough.

A tentative diagnosis of tissue necrosis secondary to chemical root canal irrigant was made. Later it was confirmed that Sodium hypochlorite was used as an irrigant.

The patient was given Amoxicillin 500mg three times a day and Ibuprofen 200mg thrice a day. The closed dressing was removed and the root canal was left open. She was advised chlorhexidine mouth rinse three times a day and cold pack over the skin followed by warm application. A follow-up appointment the next day showed a marked reduction in signs and symptoms. Over a period of one week, the swelling and facial lesion showed resolution (Figure 3) and the intra-oral ulcer had also healed considerably (Figure 4). Later root canal treatment was completed successfully using saline as an irrigant.



Figure 3: Clinical picture showing the healing of facial lesion after a week.



Figure 4: Intra oral picture showing Healing ulcer.

#### **DISCUSSION:**

Sodium hypochlorite is often used as an irrigant during routine endodontic treatment. Although a number of different solutions are available, Sodium hypochlorite in various concentrations is the most frequently used irrigant for sterilization and debridement of canals. It is well recognized to be effective against a broad range of pathogens, gram positive and gram-negative bacteria, fungi, spores, and virus including human immunodeficiency virus.<sup>3, 4</sup>

Hydrogen peroxide also has been widely used for irrigation of the root canal system, although it is less effective in killing microorganisms.<sup>5,6</sup>

The literature contains several case reports of complications due to inadvertent injection of irrigant into the periapical tissues causing emphysema, ecchymosis, allergic reactions and necrosis of bone & the soft tissue<sup>7, 8,9,10,11</sup> These complications occur due to incorrect working length determination, widened apical foramina, forceful injection of irrigant into the periapical tissue due to wedging of the irrigating needle or lateral canals.<sup>12</sup> Precautions must be taken in these cases to prevent such accidents.

When Sodium hypochlorite is forced into the periapical tissue

inadvertently, the sequelae of injury is e.g. Excruciating severe pain for two or five minutes, Immediate swelling of the area with the spread of the tissue reaction to the surroundings through the loose connective tissue, Profuse hemorrhage either interstitially or manifesting intraorally. As the tissue destruction progresses, extreme constant discomfort replaces the initial severe pain. Once the initial bleeding stops interstitial oozing still continues because of lysis of cellular structures and surrounding vasculature. This results in significant ecchymosis.<sup>2</sup>

When such incidents occur, the dentist should remain calm and assist the patient by reassuring. The treatment should be carried at minimizing the swelling, controlling pain and preventing secondary infection. Use of cold packs externally is recommended initially, followed by warm compression and warm mouth rinse to stimulate microcirculation. Antibiotics are recommended depending on the severity of tissue injury and the presence of subcutaneous necrotic tissue and dead space which can promote secondary infection. In more severe cases immediate hospitalization and surgical intervention might be required. This is to provide decompression, to facilitate drainage, meticulous debridement and to promote healing.<sup>1,2</sup>

Most of the cases resolve after seven to ten days. When acute symptoms subside, endodontic treatment may be completed using mild irrigating solutions preferably saline. Some patients however left with complications like paresthesia and facial nerve weakness.<sup>5,7</sup>

Guivarch et al have performed a systematic review of 52 reported cases of sodium hypochlorite accident published between 1974 to 2015. They reported that sudden pain, profuse bleeding and almost immediate swelling constitute a triad of signs/symptoms pathognomonic of sodium hypochlorite extrusion. All or most of the signs and symptoms resolve within few weeks. Permanent sequelae include nerve lesions and scar tissues. They recommended that the future case reports should provide the irrigation method, immediate extrusion signs/symptoms, management and etiology of the accident, post-extrusion monitoring and prognosis.<sup>13</sup>

#### **CONCLUSION:**

Although Sodium hypochlorite is a very effective intracanal irrigant in endodontic practice, complications are bound to occur due to accidental injection into the periapical tissues as it is extremely cytotoxic. Care should be taken while irrigating teeth



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with wide open canals and perforated teeth. Canals should be irrigated with gentle pressure and movement. This will reduce the chances of causing accidental injection of irrigant into the periapical tissues, thereby preventing tissue injury and its complications.

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## Case Report

### AMELOBLASTIC CARCINOMA – A CASE REPORT

Vineeta Yadav, Shallu Bansal, Dinesh Kumar Verma

#### ABSTRACT

Ameloblastic carcinoma is a rare aggressive malignant lesion of odontogenic origin with characteristic histologic features that demands more aggressive surgical approach than that of an ameloblastoma primarily. It occurs primarily in the mandible in a wider range of age groups. The lesion comprises of about 1% of all cysts and tumours taking place in the jaws, making it the most ordinary, clinically considerable odontogenic tumour. The regional lymph node dissection should be considered and performed selectively under neck dissection and satisfactory time must be given prior to reconstruction of the post resection defect for the reason being possible tumour recurrence. In our case we have performed supraomohyoid neck dissection for one such case reported to our department followed by successful reconstruction of the mandible with the reconstruction plate.

**Keywords:** Malignant ameloblastoma, Odontogenic tumour, Reconstruction plate, Supraomohyoid neck dissection,.

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**Source of Support:** Nil **Conflict of Interest:** Nil

#### INTRODUCTION

Ameloblastoma is a benign but locally aggressive neoplasm which clinically presents as a gradually growing painless swelling of the jaw. Eighty percent get arises in the mandible.<sup>1</sup> It might present as a cystic lesion with benign clinical type or as a huge tissue mass with ulceration, considerable bone resorption along with tooth mobility.<sup>2</sup> The lesion comprises of about 1% of all cysts and tumours taking place in the jaws, making it the most ordinary, clinically considerable odontogenic tumour. This neoplasm is normally recognized as a locally invasive tumour demonstrating extensive propensity to recur, although seldom behaves aggressively or shows metastatic spreading.<sup>3</sup>

The matter of malignancy in ameloblastoma has been the focus of extensive discussion and debate for many years. There can be small dispute that an ameloblastoma that metastasizes is malignant, although the tumour shows benign histologic description. In other instances, on the basis of an aggressive clinical course ameloblastomas have been considered to be malignant in the absence of metastasis. These lesions time and again show unusual or atypical histologic character. Carcinomas originating from ameloblastomas have been preferred by numerous terms, such as malignant ameloblastoma, ameloblastic

carcinoma, metastatic ameloblastoma and primary intra-alveolar epidermoid carcinoma.

We present a rare case of mandibular ameloblastic carcinoma of left side ramus.

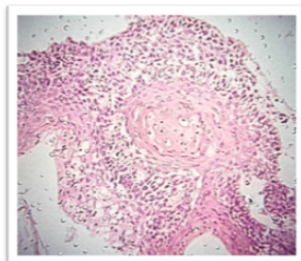
#### CASE REPORT

A 29 years old male reported to department of Oral and Maxillofacial Surgery of Surendera Dental College and Research Institute, Sri Ganganagar, Rajasthan complaining of a persistent swelling in his left posterior mandible with the intra oral suppuration associated since 4 years. Prior to this patient had undergone extensive dental review along with the FNAC of the same but patient is unknown of the report as well as has lost the same. Clinical examination extra-orally revealed a diffuse swelling on left side lower third of face extending antero-posteriorly from body of mandible up to the angle region and Superio-inferiorly from left lobule of ear up to the lower border of mandible. On palpation swelling was firm, non-tender, diffuse, non-reducible, non-compressible, non-fluctuant, non-pulsatile, afebrile surface temperature, overlying skin appeared normal. Regional lymph node examination revealed that of two submandibular lymph nodes being palpable, level Ib; having anterior one sized to approx. 1cm, mobile, soft, tender and posterior one sized to approx 1 cm, fixed, firm, non-tender.

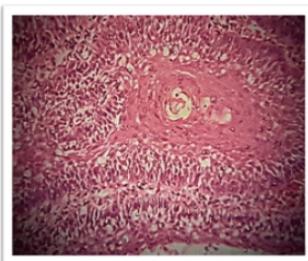
Clinical examination intra-orally revealed vestibular obliteration present from region of 37 to retromolar area, having whitish appearance with flattened borders, round ends and margins were non-indurated with palpatory findings to be firm, ill-defined, non-reducible, non-compressible, non-pulsatile, surface temperature afebrile.

Radiographic examination of head and neck revealed radiolucent lesion involving the body and ramus of mandible, with ill-defined margins, along with destruction of the cortical plate.

Histopathology report revealed islands and sheets of epithelium in an infiltrative pattern within a stroma of mature fibrous tissue, with the evidence of a single layer of peripheral columnar cells, few central cells resembling stellate reticulum that are condensed and hyper cellular along with squamous metaplasia within the islands, nuclear enlargement, hyperchromatism, mild pleomorphism, altered nuclear-cytoplasmic ratio and increased mitotic activity. The connective tissue shows mature collagen fibers with chronic inflammatory cells, areas of hemorrhage and degeneration suggestive of a malignancy of epithelial origin (Figure 1,2).



**Figure 1:** Islands and sheets of epithelium



**Figure 2:** Central cells resembling stellate reticulum within islands

In May 2017, the patient underwent surgical treatment as wide local excision with supraomohyoid neck dissection on left side followed by primary closure under general anesthesia for the same in the department (Figure 3 and 4).

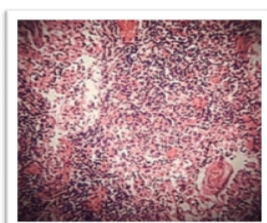


**Figure 3:** Supraomohyoid neck dissection

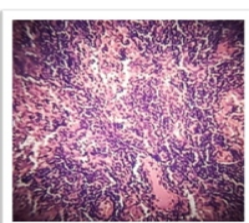


**Figure 4:** Closure with drain placed after surgery

On microscopic examination of the specimen revealed that the lymph nodes of level Ia, Ib, IIa, IIb and III; had evidence of increased vascularity and areas of hemorrhage with the areas of degeneration having altered lymphoid architecture. Also presence of few germinal centers within the lymphoid aggregates were found (Figure 5 and 6).



**Figure 5:** Increased vascularity and areas of hemorrhage



**Figure 6:** Areas of degeneration having altered lymphoid architecture

In August 2017, the patient underwent surgical reconstruction with the reconstruction plate under general anesthesia for the post resection defect of the left side of the mandible (Figure 7 & 8).



**Figure 7:** Reconstruction plate fixed



**Figure 8:** Closure done after reconstruction

## DISCUSSION

The measure of differentiation in epithelial neoplasms is usually considered to be significant in predicting biologic conduct of metastasis. The core variation linking Elzay's and Slootweg and Müller's schemes relates to the slight indication of histogenesis.<sup>4</sup> According to these authors, the name ameloblastic carcinoma should be worn to choose lesions that show signs of histologic type of both ameloblastoma and carcinoma. The tumour may perhaps metastasize and histologic characteristics of malignancy possibly bring into being in either the primary tumour, the metastases or both.<sup>5</sup> The prevalence of ameloblastic carcinoma is in excess of that of malignant ameloblastoma by a 2:1 ratio.<sup>4</sup>

The phrase ameloblastic carcinoma was introduced by Shafer et al. (1974)<sup>6</sup> to illustrate a tumor derived from the malignant conversion of the epithelial cells of an ameloblastoma. The difference between ameloblastic carcinoma and malignant ameloblastoma has been the subject of extensive consideration and variable classification in past years. Present severance of these 2 entities is based upon the metastatic yet well-differentiated, benign histology of malignant ameloblastomas in both primary and metastatic sites compared to the cytological atypia exhibited by ameloblastic carcinomas.

In 1982, Elzay<sup>7</sup> argued that the WHO classification does not make any stipulation for sorting out tumours that are histologically identical to classic ameloblastoma and metastasize from ameloblastoma-like lesions which are histologically malignant prior to metastasizing. He projected a modification of the classification wherein all primary intraosseous carcinomas which does not involve the salivary glands would be classified as PIOC. In 1971, the World Health Organization (WHO)<sup>8</sup> published its classification of odontogenic carcinomas recognizing the following subtypes:

- malignant ameloblastoma
- primary intraosseous carcinoma
- other carcinomas arising from odontogenic epithelium, including those arising from odontogenic cysts.

In this classification, "malignant ameloblastoma" refers to a neoplasm in which classic histologic character of ameloblastoma are seen in the primary tumour situated in the jaw with in any associated metastatic deposits. "Primary intraosseous carcinoma" (PIOC) refers to a primary carcinoma of the jaw not having characteristics of ameloblastoma and not arising from an odontogenic cyst. The "other carcinomas" group refers to carcinomas arising from odontogenic epithelium with those arising from odontogenic cysts.<sup>8</sup>

A consent histologic norm for ameloblastic carcinoma remains

obscure. Hall et al. (2007)<sup>9</sup> described parameters to support in the diagnosis, including the existence of sheets, islands, or trabeculae of epithelium and the nonexistence of stellate reticulum-like areas. Further description of malignancy included hyperchromatism, large or atypical nucleoli, an accentuated mitotic index, necrosis, calcification, and neural and vascular incursion.

Two types of classic ameloblastoma be required to also be well thought-out in the differential diagnosis of ameloblastic carcinoma. The acanthomatous ameloblastoma exhibits altering degrees of squamous metaplasia and even keratinization of the stellate reticulum fraction of the tumour islands; though, peripheral palisading is maintained and no cytological characteristics of malignancy are bring into being. The alleged kerato-ameloblastoma is a atypical alternative of ameloblastoma that contains major keratinizing cysts which may root some anxiety there by diverting the pathologist from the otherwise ameloblastomatous aspect.

Devoid of involvement, ameloblastic carcinoma (all types) runs an aggressive track amid widespread local destruction and metastatic extend. No treatment accord yet exists; on the other hand, wide local excision with satisfactory hard and soft tissue margins appears for the most part usually supported algorithm. Seeing that in our case, a conterminous neck dissection has to be undertaken for diagnostic staging and therapeutic purposes. Adjuvant radiotherapy for close or affirmative margins or in those with nodal metastases might be advantageous, but chemotherapy regimens have no facts of help. As these tumors are prone to reappear, a careful and prolonged follow-up with methodical review and periodic imaging, predominantly of the chest, is warranted.

### CONCLUSION

This case illustrates the malignancy of epithelial origin with stellate reticulum with squamous metaplasia within the islands. The patient underwent successful radical surgical resection proceeded with the reconstruction of the defect with reconstruction plate and is alive without disease at 5 months of follow-up, including 2 months of post-operative reconstruction within.

Ameloblastoma shows an array of histologic and biologic activities ranging from benign to explicit malignancy. Reconstruction of the post-resection defect may continue as normally expected subsequent any head or neck carcinoma resection. Satisfactory time must be given prior to reconstruction for the reason being possible tumour recurrence.

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## Case Report

### LINGUAL FRENECTOMY WITH ELECTROCAUTERY: A CASE REPORT

*Puneet Kumar, Kanika Gupta Verma, Suruchi Juneja Sukhija, Virinder Goyal*

#### ABSTRACT:

The frenum is a mucous membrane fold that attaches the lip and the cheek to the alveolar mucosa, the gingiva, and the underlying periosteum. Ankyloglossia or Tongue-tie results from a short or thick and fibrotic lingual frenum. Ankyloglossia leads to the restriction of tongue movements which ultimately may result in speech problems such as difficulty in pronunciation of some sounds, affects feeding, oral hygiene maintenance, malocclusion or gingival recession. Thus, depending upon patient's history of speech and mechanical difficulty, the surgeries for ankyloglossia can be taken into consideration. Procedure of lingual frenectomy involves removal of a band of tissue, the lingual frenulum which connects the floor of the mouth with tongue. This procedure could be "frenoplasty" or "frenotomy" which is partial removal of frenum or repositioning of the frenum, and complete removal of frenum which is termed as "frenectomy". Various techniques are there to perform frenectomy such as with the help of scalpel, electrocautery or with the help of lasers. The present case report presents a case of eight year old boy with ankyloglossia. The lingual frenectomy was done using electrocautery followed by speech therapy.

**Key Words:** Ankyloglossia, Lingual frenum, electrocautery, frenectomy, speech problems

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#### INTRODUCTION:

Tongue is an important organ, that helps a person in speech, articulation and various tongue movements including elevation of tongue tip, retraction, protrusion and grooving.<sup>1,2</sup> A frenum is an anatomic structure formed by a fold of mucous membrane and connective tissue and sometimes muscle fibers that attach the lip and cheeks to the alveolar mucosa and/or gingiva and the underlying periosteum. Proper positioning of the frenum enables the person to pronounce the alphabet properly and aids in phonetics.<sup>3</sup> The condition when frenum is short or encloses muscle fibers with it, making it thick and fibrotic, it can result in ankyloglossia or also known as tongue-tie.

The term ankyloglossia comes from the Greek word meaning amylose, i.e. crooked and glossa, i.e. tongue. In 1960s, Wallace defined tongue-tie as a condition in which the tip of the tongue cannot be protruded beyond the lower incisor teeth because of a short frenulum linguae.<sup>3,4</sup> Prevalence of ankyloglossia is around

4.2% to 10.7% with a male to female ratio of 3:1.5,<sup>6</sup> Various issues which are commonly associated with tongue-tie are problem in breast feeding, speech development, dental caries, gingivitis and halitosis and eating and digestion problems.<sup>1,4</sup>

Suggested classification of tongue-ties: (based on distance of the insertion of the lingual frenum to the tip of the tongue).<sup>2,7</sup>

Clinically acceptable, normal range of free tongue: greater than 16mm

Class I: Mild ankyloglossia: 12 to 16 mm

Class II: Moderate ankyloglossia: 8 to 11 mm

Class III: Severe ankyloglossia: 3 to 7 mm

Class IV: Complete ankyloglossia: less than 3 mm

For treating ankyloglossia, various surgical techniques such as frenotomy, frenectomy and frenuloplasty can be used. Conventionally these procedures were carried out by scalpel, but now electrocautery or diode lasers can be used for the same with added advantages over the conventional method.<sup>2</sup>

#### CASE REPORT:

An eight year old male patient reported to the Department of Paediatric and Preventive Dentistry, Surendera Dental College and Research Institute, Sriganganagar, Rajasthan, with the chief complaint of irregular alignment of teeth in both upper and lower arches. There was no history of pain, sensitivity and trauma. His medical and family history was not relevant but patient was having habit of tongue thrusting. A lisping pronunciation with lingua-palatal words such as 'r' and 'l' was present. On local functional examination, deglutition was infantile swallowing pattern. Intraoral examination revealed mixed type of dentition with anterior open bite (Figure 1) and moderate ankyloglossia (Class II) was present which was confirmed by heart-shaped tongue on protrusion (Figure 2). Molar relationship was Class I bilaterally. Orthopantomograph investigation was done (Figure 3) that revealed no significant finding. For the correction of anterior open bite, fixed orthodontic treatment was planned. Patient was referred to the Department of Orthodontics for the management of anterior open bite. The management of anterior open bite was initiated, but because of ankyloglossia, the tongue movements were uncontrolled. Thus, patient was referred back to the Department of Paediatric and Preventive Dentistry, for management of ankyloglossia. Bilateral nerve block was given, tip of tongue was held with the help of suture and then the lingual frenum was clamped using two mosquito hemostats. Care was taken with regard to position of the sublingual carbuncle. Two incisions were made, one at the superior aspect of the hemostat

and the second at inferior aspect of the hemostat with the help of electrocautery that resulted in a diamond shaped wound. The interrupted sutures were given using (3-0) black braided silk sutures (Figure 4). This allowed for the tissues to heal by primary intention thereby minimizing the scar tissue formation.

Antibiotics and analgesics were prescribed to prevent post-operative infection and pain. Patient was then recalled after 7 days for the removal of sutures and speech therapy. After the removal of sutures, better protrusion of tongue was found (Figure 5). Patient was guided for the pronunciation of lingua-palatal words and patient was guided for the adult swallowing pattern with the help of 4S exercises at follow-up visits.



Figure 1: Intraoral photograph showing anterior open bite.



Figure 2: Intraoral photograph showing heart-shaped notching of tongue and ankyloglossia.



Figure 3: Orthopantomograph



Figure 4: Frenectomy followed by suturing



Figure 5: Post-operative photographs showing removal of sutures after 7 days, and complete movement of tongue without notching.

**DISCUSSION:**

Ankyloglossia is a rare congenital anomaly characterized by the attachment of tongue to the floor of the mouth. It occurs due to failure in cellular degeneration leading to longer anchorage between tongue and floor of the mouth.<sup>7</sup> Ankyloglossia, Partial or Complete causes specific speech disorders in certain individuals. It does not prevent or delay the onset of speech, but interferes with articulation which is consistent with our case. A simple speech articulation test has been suggested in which if the elevation of the tongue tip is restricted, the articulation of 1 or more of the tongue sounds- such as “t”, “d”, “l”, “th” and “s” will not be accurate.<sup>1,2</sup>

Lalakea recommended measuring lingual mobility and tongue elevation to document and define the degree of restriction and ankyloglossia. Mobility is measured in millimeters the tip of the tongue extended the lower dentition, while elevation is measured by recording interincisal distance with the tongue tip maximally elevated and in contact with the upper teeth. If there is ankyloglossia the protrusion and elevation values of 15mm or less will be recorded and 20 to 2mm for normal individuals.<sup>8</sup>

A normal range of motion of the tongue is indicated by the following criteria: the tip of the tongue should be able to protrude outside the mouth without clefting, the tip of the tongue should be able to sweep the upper and lower lips easily without straining, the tongue when retracted should not blanch the tissues lingual to the anterior teeth and the lingual frenum should not create a diastema between the mandibular central incisors.<sup>8</sup> Frenectomy is defined as complete excision of the whole frenulum. These procedures are conventionally carried out with help of surgical scalpel, but it can be carried out with the help of electrocautery and laser. Electrocautery is effective in performing soft-tissue surgery with a positive result. Electrocautery has been used in dentistry since 1928 for the soft tissue procedures. Electrocautery was used in this case as it has many advantages such as it controls hemorrhage, provides bloodless area with clear view of the operative field, permits adequate contouring of tissues, less

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discomfort to patient, less scar formation, lesser collateral tissue damage and lesser chair time. It requires no safety glasses and can remove large amount of tissue and its speed of incision and excision, measured in seconds is faster than any other methods.<sup>9,10</sup>

**CONCLUSION:**

Tongue tie or ankyloglossia affects quite a number of infants and children. It causes improper chewing and swallowing of food which in turn increases the gastric distress and bloating, snoring and bed wetting at sleep. Dental caries can occur due to restricted tongue's sweeping action on the teeth and spreading of saliva. Malocclusion like open bite due to thrust created by tongue tie spreading of lower incisors and tooth mobility due to long term tongue thrust. Therefore it is important that accurate information and guidance should be given to the parents so that appropriate revision could be done for infants and children. Electrosurgery can be used as an alternative to conventional surgery. Successful result can be obtained with careful usage and having proper knowledge.

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- **DENTAL MECHANIC & DENTAL HYGIENIST COURSE**



## SURENDERA SCHOOL OF NURSING



- **GNM**
- **B.Sc. NURSING\***

## PROPOSED SURENDERA MEDICAL COLLEGE & HOSPITAL



- **MBBS\***

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# Instructions to Author for Manuscript Submission

## About the Journal

The journal of updates in dentistry is official publication of Surendra Dental College and Research Institute. This journal publishes research papers, clinical studies, reviews and case reports or series related to all the specialties in the field of dentistry. The journal will be published in the month of January and July.

## Editorial Process

The manuscript will be reviewed for possible publication with the understanding that it is being submitted to journal of updates in dentistry alone at that point in time and has not been published anywhere, simultaneously submitted or already accepted for publication elsewhere. The journal expects that authors would authorize one of them to correspond with the journal for all matters related to the manuscript. All manuscripts received are duly acknowledged.

Manuscripts accepted for publication are copy edited for grammar, punctuation, print style and format. Page proofs are sent to the corresponding author. The corresponding authors are expected to return the corrected proofs within two days. It may not be possible to incorporate corrections received after that period. The whole process of submission of the manuscript to final decision and sending and receiving proofs is completed through e-mail.

## Conflicts of Interest/Competing Interests

All authors of submitting manuscript to the journal must disclose any and all conflicts of interest they may have with publication of the manuscripts or an institution or product that is mentioned in the manuscripts and/or is important to the outcome of the study presented. The authors should also disclose conflict of interest with products that compete with those mentioned in their manuscript.

**Types of submission:** Original articles, review articles, clinical studies, case reports and short communications.

**Covering letter:** Principal author must sign covering letter indicating full responsibility for paper submitted with signatures of all authors. Articles must be accompanied by a declaration by all authors stating that the article has not been published in any journal/book. Author should mention complete designation and name of the department on the manuscript.

**Title page:** The first page should include:

1. The title of the article (descriptive but concise, including the study design)
2. The full names and professional/academic affiliations of all authors. All authors must have made substantive intellectual contribution to the study. For authorship of multicenter trials, the individuals directly responsible for the manuscript should be identified.
3. Contact details including phone, fax and e-mail address should be provided for the corresponding author.
4. If the paper was presented at an organized meeting, the name of the organization, location and date of the meeting should be included.
5. Disclaimers, if any.
6. Source(s) of support in the form of grants, equipment, drugs or all these.
7. Running head of no more than 40 characters (including spaces).
8. A word count for the text only (excluding abstract, acknowledgments, figure legends and references).
9. The number of figures and tables.

## Preparation of Manuscripts

The manuscript should be typed, double-spaced on standard-sized paper (8.5" × 11") with 1" margins on all sides. Times New Roman font 12 pt should be used. The fonts used in the text as well as graphics should be restricted to Times New Roman, Symbol.

**Abstract and Keywords:** Should be structured and limited to 250 words. A brief summary of the research should be given under the subheadings, introductions, methods, results and conclusion. Not more than six keywords are needed. It should not contain abbreviations, footnotes or references.

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

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

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

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

**Figures:** Illustrations must be numbered and cited in the text in order of appearance and submitted electronically (at least 300 DPI in .TIFF format). Each registration (including its corresponding legend) must be on a separate page. Illustrations, photographs and radiographs must be submitted electronically.

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

**Tables:** Tables should be numbered consecutively in Arabic numbers in the order of their appearance in the text. A brief descriptive title should be supplied for each. Explanation, including abbreviations, should be listed as footnotes, not in the heading. Every column should have a heading. Statistical measures of variations, such as standard deviation or standard error of the mean should be included as appropriate in the footnote. Do not use internal horizontal or vertical lines.

**References:** Readers should be provided with direct references to key original research sources, whenever possible. All references must be cited in the text, using the Vancouver style (numbered references). References should be marked in order of appearance with superscript numbers, and listed numerically in the reference list at the end of article.

**Journal Reference Style:**

1. West JD, Oates TW. Identification of stability changed for immediately placed dental implants. *Int J Oral Maxillofac Implants* 2007;22:623-30.

**Book Reference Style:**

1. Lee JS, Kim JK, Park YC, Vanarsdall RL. Applications of orthodontic mini implants. Chicago: Quintessence 2007.
2. Baumgartner JC. Pulpal infections including caries. In: Hargreaves KM, Goodis HE (Eds). *Seltzer and Bender's Dental Pulp*. Chicago: Quintessence 2002:281-307.

**Acknowledgments:** Those who have helped the authors carry out the study and/or prepared the manuscripts but have not made significant intellectual contribution to deserve authorship must be acknowledged. Mention all applicable grants and other funding that supports the work.

**Review articles:** It is expected that these articles would be written by individuals who have done substantial work on the subject or are considered experts in the field. A short summary of the work done by the contributor(s) in the field of review should accompany the manuscripts.

The prescribed word count is up to 3000 words excluding tables, references and abstracts. The manuscripts may have about 90 references. The manuscripts should have an unstructured abstract (250 words) representing an accurate summary of the article. The section titles would depend upon the topic reviewed. Authors submitting review article should include a section describing the methods used for locating, selecting, extracting and synthesizing data. These methods should also be summarized in the abstract.

The journal expects the contributors to give post-publication updates on the subject of review. The update should be brief, covering the advances in the field after the publication of the article and should be sent as a letter to editor, as and when major development occurs in the field.

**Case reports:** New, interesting and rare cases can be reported. They should be unique, describing a great diagnostic or therapeutic challenge and providing a learning point for the readers. Cases with clinical significance or implications will be given priority. These communications could be of up to 1000 words (excluding abstracts and references) and should have the following headings: Abstract (unstructured), keywords, introduction, case reports, discussion, reference and tables and legends in that order.

The manuscript could be of up to 1,000 words (excluding references and abstract) and could be supported with up to 10 references. Case reports could be authored by up to four authors.

For any queries and information, contact our editorial office.

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- **M.TECH** (COMPUTER, MECHANICAL ENGINEERING)
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