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Original article

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Relationship between Caries status (caries & caries free group), Salivary flow rate, Buffering capacity, Salivary Mutans Streptococcus count and Sugar intake among 3-5 year old preschool children

Umamaheswari N, M.D.S*, Jayanthi M, M.D.S**

Abstract

Objective: The predictive value of a single diagnostic test on an individual can be misleading in disease of a multifactorial nature such as dental caries. Hence this study was undertaken to seek the relationship of salivary microbiologic parameters. (Mutans streptococcus count) and salivary physiochemical parameters (flow rate, buffering capacity) and sucrose intake with the occurrence of dental decay on the primary dentition among 3-5 years old of preschool children.

Materials and Methods: The present study comprised of 100 healthy children in the age group of 3-5 years, divided into two categories on the basis of their caries experience

Group 1:50 children with no detectable caries & Group 2:50 children with caries.

Children in caries group are categorized into Grade 1: 1 – 3 decayed teeth, Grade 2: 3 – 5,

Grade 3: > 5. A questionnaire was specifically designed which sought to discover the frequency of sugar consumption rather than the total amount of sugar eaten. The Stimulated saliva was collected to determine Flow rate, buffering capacity and Mutans streptococci count.

Results: There was a highly significant relation between frequency of sugar consumption, microbial parameter and the caries experience ($P < 0.001$) and an inverse relation between salivary parameters (salivary flow rate, buffering capacity) and the caries experience. ($P < 0.001$).

Conclusion: In conclusion**,** it is observed that there was a significant relation between caries experience and salivary flow rate, buffering capacity, salivary streptococcus mutans count, and sugar intake. This multifactorial approach of identifying high caries risk group children and implementation of preventive strategies represents an improvement over an approach that relied solely on single parameter.

Key words: Salivary flow; Buffering capacity; Dental caries; Streptococci mutans.

Introduction

In a period marked by brilliant achievements in the prevention and treatment of disease, dental caries still remains one of the most widespread afflictions in modern man. Dental caries is a common, complex, chronic disease that results from an imbalance between multiple potential etiological [risk] factors and multiple protective factors overtime. Ultimately this disease process can cause loss of tooth structure through demineralization or frank cavitations [cavities**].** The disease progression can be stopped if the factors responsible are nullified in the initial stage. It is thus important to identify high caries risk markers as well as individuals to implement preventive and interceptive procedures. With regard to its multifactorial nature, in evaluating the caries risk of a patient a number of factors must be taken into consideration.

In the year 1912 *Miller* [1] recorded that the flow of saliva plays an important role in the pathogenesis of dental caries.He proved the fact that the individuals with the diminished flow of saliva developed severe, rapid

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spreading caries lesion. The relationship of flow rate to caries is further compounded where one considers the matter of buffering capacity of saliva. The salivary buffer capacity is an important host factor to maintain a suitable pH with its bicarbonate content in saliva. The micro flora involved in the dental caries activity is streptococcus mutans. It has a unique feature of producing extra cellular polysaccharides eg.dextran or glucan which increases the tenacity of plaque as well as limits the diffusion of acids which increases the acidity to bring about demineralization of tooth enamel. It has been accepted for many years, and almost without question since the Vipeholm study, that sugar consumption is a major risk factor for dental caries. [2]In developing countries an increase in the consumption of sugary foods or changes in eating habits have been associated with the dental caries.

Based on the above facts, it clearly indicates that, the predictive value of a single diagnostic test on an individual can be misleading in disease of a multifactorial nature such as dental caries. Hence this study was undertaken to seek the relationship of salivary microbiologic parameters. (Mutans streptococcus count) and salivary physiochemical parameters (flow rate, buffering capacity) and sucrose intake with the occurrence of dental decay on the primary dentition among 3-5 years old of preschool children. These parameters were taken as assays that could be used as risk indicators of dental caries.The 3-5 yrs age groups presented with their primary dentition could be of interest because controlling the level of s.mutans in the early age could be beneficial, so that the upcoming dentition would not be challenged by cariogenic ability of these organisms.

Materials and methods

The present study comprised of 100 healthy children in the age group of 3-5 years from local nursery schools in Chennai. All children were in the primary dentition stage. A proforma was prepared to record the data. The children with the history of antibiotic consumption within last 3 months or were receiving any other antimicrobial agents concurrent with this study period, fluoride use or living in fluoridated area, any prior dental treatment were not included in the study. This was possible to study the natural occurrence of dental decay that was unclouded by the effects of treatment and preventive measures.

Dental examination was carried out on a chair, under natural lighting conditions. The teeth were wiped with a 2x2 gauze piece. The diagnosis of dental caries was predominantly by the visual methods and this was augmented by the gentle use of explorer or Ash's number 54 probe to remove dental plaque and confirm the softness of caries lesions and the caries experienced was assessed in the entire mouth with the dft index. (Grubbel 1944). This value gave the caries status of the individual. Children were divided into two categories on the basis of their caries experience.

Group 1:50 children with no detectable caries.

Group 2:50 children with caries.

Children in caries group are categorized in to three grades depending on the number of decayed tooth. Grade 1: 1 – 3 decayed teeth, Grade 2: 3 – 5, Grade 3: > 5

Dietary Questionnaire

Parents were asked to attend with their child in the school and at that time they were questioned closely about the child's dietary habits. A questionnaire was specifically designed which sought to discover the frequency of sugar consumption rather than the total amount of sugar eaten.

Parents were asked what the child ate at meal times and between meals on weekdays and at weekends. From the completed questionnaire, it was possible to calculate the number of occasions that sugar was consumed with meals, snacks, sweets and drinks, To this figure, calculated for 5 week days, was added

the number of occasions sugar was similarly consumed at week ends and the total for 1 week termed as "sugar index" for the child was determined. [3]

Collection of Salivary sample

The salivary samples were collected from the subjects on second visits. The tests were carried out using mid-morning (9 am-11 am) saliva samples. The investigations of *Weinberger et al (1990)* [4] showed that any food ingestion can alter the salivary physiochemical properties as well as microbial load. Therefore the salivary samples were collected at least 1.5 hrs-2hrs after the breakfast.

Salivary flow rate

The secretion of whole mixed saliva was measured after stimulation. Prior to stimulation the subjects were asked to eliminate any existing saliva in the mouth. Each child was given a sugarless chewing gum and was instructed to chew on both sides. Stimulated secretion was collected in sterile saliva collecting cups (Fig 1). Collection was tried for a period of 5 minutes. Since the composition of saliva depends on the duration of stimulation, the saliva collected during the first minute has a different composition from saliva collected after 5 minutes of constant stimulation.Then salivary flow rate was measured and was calculated per minute.[5]

Stimulated salivary flow rate expressed in ml/min			
	Hypo salivation	Low	Normal
Stimulated saliva	Grade 1 = < 0.7	Grade 2 = 0.7-1	Grade 3 = >1

Salivary buffering capacity (pH)

The estimation was carried out using a pH indicator paper that had been impregnated with acid. A small volume of saliva was taken with the pipette from the salivary samples and added to the strips. After 5 minutes the colour of the strips were compared with the colour coded chart which had numerical value. The colours had been chosen to indicate low, medium or good buffering capacity. [6]

pH	Inference
Grade 1 = =4	Low
Grade 2 = 4.5-5.5	Medium
Grade 3 = =6	High

Salivary microbiological tests

The collected samples were inoculated on Mitis salivarius bacitracin agar medium (MSB agar), which is a highly selective medium for S.mutans, for counting colony-forming units (C.F.U). The isolated plates of Mitis salivarius bacitracin agar was incubated at 37 ^{o}C in a candle jar environment for 48 hours. After 2 days the number of s.mutans were counted and recorded semi quantitatively as Grade 0 = '0' (no detectable cfu), Grade 1 = 1-9 cfu (Low), Grade 2 = 10-100 cfu (Medium) and Grade 3 = > 100 cfu (High) and the results were tabulated.The confirmation of s.mutans was done by smear examination (Fig 2) and biochemical tests.

Results

The analysis was done using chi-square test and the results from Table 1 indicated that 73.5% of the children who were caries free had < 32 frequency of sugar consumption. 62.5% of children with Grade 3 dft had > 32 frequency of sugar consumption. The children with increased frequency of sugar intake (>32) showed a rise in dft and children with decreased frequency of sugar intake (<32) were caries free (Graph-1) . There was a statistically significant relationship between frequency of sugar consumption and caries experience in the children corresponding to the p-value of 0.001 .The results from Table 2 showed 100% of children in Grade 3 dft had hyposalivation, 63% of children in Grade 3 dft had low flow rate, 70% of children who were caries free had normal flow rate. 63% of children in Grade 3 dft had medium buffering capacity and 68.5% of children who were caries free had high buffering capacity. The children with decreased flow rate and buffering capacity showed a rise in dft and the children who were caries free had normal flow rate and high buffering capacity (Graph-

2A,2B). Thus the relationship between salivary parameters and caries experience were statistically highly significant ($p < 0.001$). The results (Table 3) showed 100% of children who were caries free had no detectable mutans count, 69.6% of children in Grade 3 dft had highest mutans count (Grade 3). This suggested a direct relationship between mutans streptococci level in saliva and dft, with increase levels of mutans streptococci associated with increased dft and no mutans in caries free group ($p < 0.001$) (Graph-3).

Table 1: Relationship between Caries status and Sugar Index

Sugar Index in Grades	dft in Grades								Chi-Square Value	P-Value
	0		1		2		3			
	No.	%	No.	%	No.	%	No.	%		
1	50	73.5	15	22.1	3	4.4	0	0	88.97	<0.001***
2	0	0	0	0	12	37.5	20	62.5		

NS = Not significant

* = P < 0.05 significant at 5%

** = P < 0.01 significant at 1%

*** = P < 0.001 significant at 0.01%

Graph 1: Relationship between Caries status (Grade 0, 1, 2, 3) and Sugar Index (Grade 1,2)

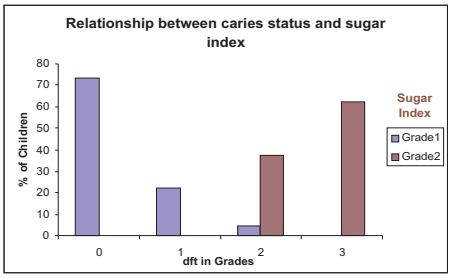


Table 2: Relationship between Caries status and Salivary Parameters

Variables in Grade		dft in Grades								Chi-Square Value	P-Value
		0		1		2		3			
		No.	%	No.	%	No.	%	No.	%		
Salivary Flow Rate	1	0	0	0	0	0	0	3	100.0	72.47	<0.001***
	2	1	3.7	2	7.4	7	25.9	17	63.0		
	3	49	70.0	13	18.6	8	11.4	0	0		
Salivary Buffering Capacity	1	0	0	0	0	0	0	0	0	59.33	<0.001***
	2	0	0	2	7.4	8	29.6	17	63.0		
	3	50	68.5	13	17.8	7	9.6	3	4.1		

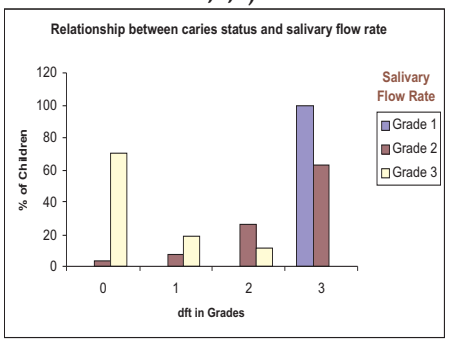
NS = Not significant

* = P < 0.05 significant at 5%

** = P < 0.01 significant at 1%

*** = P < 0.001 significant at 0.01%

Graph 2A: Relationship between Caries status (Grade 0,1,2,3) and Salivary Flow Rate (Grade 1,2,3)



Graph 2B: Relationship between Caries status (Grade 0,1,2,3) and Salivary Buffering Capacity (Grade 1,2,3)

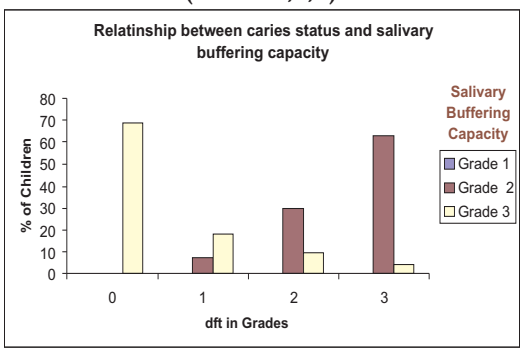


Table 3: Relationship between Caries status and Salivary Mutans Streptococcus Count

Salivary mutans Streptococcus counts in Grade	dft in Grades								Chi-Square Value	P-Value
	0		1		2		3			
	No.	%	No.	%	No.	%	No.	%		
0	16	100.0	0	0	0	0	0	0	112.88	<0.001***
1	34	82.9	7	17.1	0	0	0	0		
2	0	0	8	40.0	8	40.0	4	20.0		
3	0	0	0	0	7	30.4	16	69.6		

NS = Not significant

* = P < 0.05 significant at 5%

** = P < 0.01 significant at 1%

*** = P < 0.001 significant at 0.01%

Graph 3: Relationship between Caries status (Grade 0,1,2,3) and Salivary Mutans Streptococcus Count (Grade 0,1,2,3)

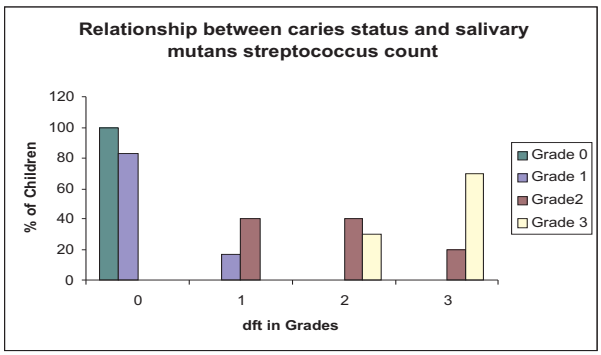


Fig 1: Determination of Salivary flow rate & buffering capacity

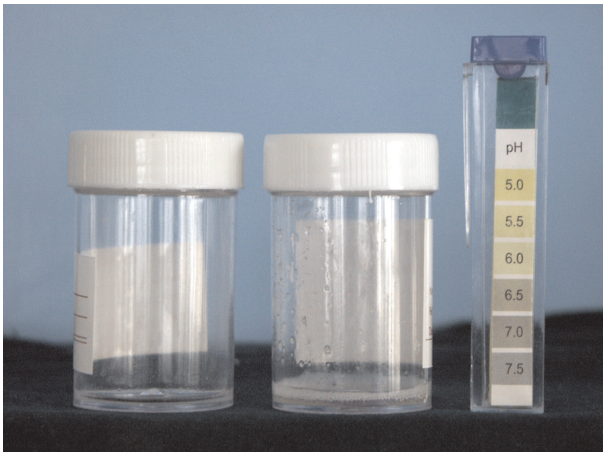
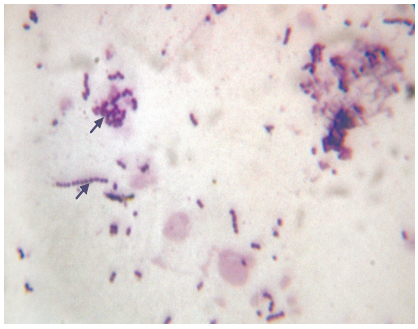


Fig 2: Microscopic view of mutans streptococcus



Discussion

The earlier model to represent the key factors involved in dental caries was put forth by *Fitzgerald and Keyes*. Recently, the concept of the caries balance was first published by Featherstone in 1999 [7] in an attempt to simplify the key factors involved in dental caries progression or reversal and make them readily applicable in clinical practice and easily understandable for the patient. The three pathological factors are cariogenic bacteria, fermentable carbohydrates and saliva dysfunction and the protective factors are saliva components and salivary flow, fluoride and antibacterial therapy. As per the concept of Featherstone, the caries experience tend to be related to microbial, non-microbial salivary parameters [5] and frequency of sugar intake .The current study focused on the relation of these variables with the caries experience among 3 – 5 year old preschool children. As this age group presented with their primary dentition could be of interest, so as to control the level of cariogenic organisms at this early age, so that the upcoming dentition would not be challenged by the cariogenic ability of these organisms.

Culturing plaque samples from discrete sites, such as occlusal fissures or proximal area, is an ideal method for the purpose of detecting and quantitating the mutans streptococcus that have colonized on teeth. However, it is often not practical to sample a large number of dental sites, hence the use of salivary sample to provide a workable alternative to assaying mutans streptococcus. The stimulated salivary samples were collected to determine the flow rate, buffering capacity and mutans count. The caries process occurs during and immediately following ingestion of cariogenic foods. It is precisely during this period, that the saliva is stimulated. This would suggest that stimulated rather than resting saliva should be studied. [8]

The children with increased frequency of sugar intake (>32) showed a rise in dft and children with decreased frequency of sugar intake (<32) were caries free. As mentioned in the other studies by Holbrook et al 1989 [3], Akapta et al

1992 [9], Mazengo et al 1996 [10], there was a statistically significant relationship between frequency of sugar consumption and caries experience ($p < 0.001$). The etiologic role of diet, particularly that of fermentable carbohydrates, in dental caries is well accepted, Perhaps the most conclusive proof was provided by the now classical Vipeholm Study (1946 – 1950). The frequencies with which cariogenic foods are eaten are more important. The more frequently, the more cariogenic they become.

The children with decreased flow rate and buffering capacity showed a rise in dft and the children who were caries free had normal flow rate and high buffering capacity. The results of the present study correlated with the other studies that have examined the relationship of salivary parameters on caries experience and the inverse relation between salivary parameters and caries experience. (Dan Ericsson et al 198[11], Purohit et al 1996 [12]). The saliva has a number of various functions; obviously the most important one is the clearance of oral micro-organisms and food components from the mouth to the gut. This balance can be disturbed either by extensive growth of bacteria as a consequence of for example, poor oral hygiene, abundant use of fermentable carbohydrates or some systemic diseases or by reduced salivary flow rate which in turn results in increase caries attack. The flow of the whole saliva is of clinical relevance for the susceptibility and activity of dental caries. [5]

The relationship between mutans streptococci and caries experience had been reported for several population of preschool children. Typically, the mean dft and dfs have been shown to increase with the increasing levels of mutans streptococci. (Chosack et al 1988 [13], Holbrook et al 1989 [3], Alalussua et al 1989 [14], Weinberger et al 1989 [4]). The amount of mutans streptococci in saliva is related to number of colonized surfaces on the teeth. The highest mutans streptococci levels may predict high-risk children at an early age. Alaluusua and Renken 1982 [14], Kohler and

colleagues 1988 [15], Fujiwara et al 1991 [16], Roeters et al 1995 [17], clearly demonstrated that early infection with mutans streptococci is a significant risk factor for future development of dental caries.

So from this study it is observed that there was a significant relation between caries experience and salivary flow rate, buffering capacity, salivary streptococcus mutans count, and sugar intake. This multifactorial approach of identifying high caries risk group children and implementation of preventive strategies represents an improvement over an approach that relied solely on single parameter.

Conclusion

The following conclusions were drawn from the study:

1. There was a highly significant relation between frequency of sugar consumption and caries experience. ($P < 0.001$)
2. There was an inverse relation between salivary parameters (salivary flow rate, buffering capacity) and the caries experience. ($P < 0.001$)
3. There was a direct relation between microbial parameter (salivary mutans streptococcus count) and the caries experience. ($P < 0.001$)

The present study demonstrated the importance of considering sugar intake, microbial and non microbial salivary parameters when assessing the caries activity in children. Although strong evidence exists that these parameters affect the caries process, on an individual or population basis they offer only little predictive value. Therefore future research should focus on exploring combinations, or clusters of various parameters which are typical for caries active and inactive individuals.Hence future research should focus on the other reliable parameters that can be incorporated to predict the caries status of the individual.

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Original article

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Occurrence of Candida Albicans in Oral Leukoplakia; A Clinical & Histological Evaluation

Anupama Sahay

Abstract

Background: Leukoplakia is most common premalignant lesion of the oral cavity. Candida albicans is the most common fungal species isolated from oral leukoplakia. Malignant transformation of Leukoplakia has been linked to several factors like habits, duration of lesion, location, clinical appearance and presence of Candida albicans.

This study was done on 50 healthy individuals with oral leukoplakia to determine the prevalence of Candida in leukoplakia and to examine the relationship between presence & absence of Candida with the histological feature and to determine the possible role of Candida in its malignant transformation.

Method: The presence of Candida was determined by microscopic examination of gram stain section & by culture. Biopsy material was obtained from all lesions for histological grading.

Result: Association between occurrence of Candida & type of leukoplakic lesion clinically & histologically were observed. 82% of non-homogeneous leukoplakic lesions yielded Candida & 89% histologically grade 3 lesions were found to be associated with presence of Candida in smear.

Conclusion: Findings implicates possible role of Candida albicans in transformation of untreated leukoplakia into malignancy.

Key words: Candida albicans; Oral leukoplakic lesions; Malignant transformation.

Introduction

Oral leukoplakia occurs in 3% to 4% of the adult population and if untreated, 5% to 10% of the cases will develop into carcinoma.

Recent years have brought several reports of an associated Candida albicans infection in patients with oral leukoplakia. Some reports consider that it just acts as a secondary invader in already established lesions. At the same time it has been suggested that some clinical forms of leukoplakia are the results of invasion by hyphae of C.albicans as well as the possible role of yeasts as a factor in the malignant transformation of leukoplakia. It is well known that Candida species are keratophilic and they tend to colonize thick layers of keratin and adhesion to epithelial cells is the initial step in the process by which Candida albicans adhere to oral mucosa.

Candida possesses enzymes with the ability to destroy the protein substrates on which they reside and these include candida aspartyl proteinases, phospholipase A and lysophospholipase which are secreted extracellularly. These are complemented by a variety of intra cellular proteinases and peptidases which are released into the environment on cell death. Furthermore the hyphal extensions of Candida serve as an ideal appendages abetting colonization and invasion and they help in adherence and anchoring organisms to host surface.

This present study is an attempt to find out if Candida albicans have any role in bringing any histopathological changes in leukoplakia.

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The aims and objectives of this study were

1. To determine the prevalence of Candida albicans in leukoplakia.
2. To compare the number of colonies obtained from the swab culture of lesion with that from apparently normal mucosa.
3. To correlate the clinical features of leukoplakia with the presence or absence of Candida albicans at that site.
4. To correlate the histological features of leukoplakia with the presence or absence of Candida albicans at that site.
5. To evaluate the role of Candida albicans in malignant transformation of leukoplakia.

Materials and Methods

Fifty healthy individuals with oral leukoplakic lesions were recruited. Individuals with dentures or with antibiotic or steroid therapy over the past 3 months, or with a history of candidosis, anemia, diabetes and any other condition or treatment known to promote oral candidosis or candidal carrier state were excluded. Any pathological condition in the oral mucosa caused exclusion from the healthy group. Patients who received or had received any treatment with antifungal agents within the latest 3 months, or had been hospitalized were also excluded.

Clinical investigation

Clinical investigation started with the examination of cases Clinical staging was done according to stages given by McCarthy,[1] as follows :

Stage-I

Represented the initial reaction of the mucous membrane to irritation, and clinically the lesion is red, granular area that gradually become slightly grey.

Stage-II

Lesions are bluish-white patches or plaques, sharply outlined and without any palpable induration.

Stage-III

Lesions are indurated plaques, white, possibly wrinkled, and sharply outlined.

Stage-IV

Lesions are indurated, leathery plaques with fissures, erosions and occasional warty proliferation of the surface.

The lesion was also classified as homogeneous and non-homogeneous according to Axell T et al in 1984.[2,3]

Homogeneous leukoplakia has been defined as a predominantly white lesion of uniform flat, thin appearance that may exhibit shallow cracks and has a smooth, wrinkled or corrugated surface with a constant texture throughout.

Non-homogeneous leukoplakia has been defined as a predominantly white or white-and-red lesions ("erythroleukoplakia") that may be irregularly flat, nodular or exophytic.

Cytological investigation

Smears were obtained from the lesional side and then heat fixed and stained by the Gram's stain. It was then evaluated for the presence or absence of Candida.

Mycological investigation

Sample from the lesional side was taken with the help of curette and from the apparently normal mucosa with a sterile cotton swab.

Both the samples were inoculated on two plates of sabouraud's Dextrose Agar (SDA). Both plates were incubated at 37^{o}C. It was observed everyday, for a week, for the appearance of growth.

Growth of the yeasts was registered as negative or positive along with quantitation of the colonies.

The tests used for species identification were germ tube test and morphology on corn meal agar.

The assimilation potential of isolated strains was studied by Modified Wickerham Medium (Tube Method).

Histological investigation

Incisional biopsy was obtained from leukoplakic side. It was fixed in 10% neutral formalin and embedded in paraffin wax. Three 5 μm sections were cut, one section was stained with haematoxylin – eosin and evaluated for histological changes and was graded histologically according to Mc Carthy et.al. [1],as follows :

Grade I - Simple hyperkeratosis

The width of the stratum corneum of the mucosal stratified squamous epithelium is increased. They may appear either as hyperkeratosis or parakeratosis. With hyperkeratosis the stratum granulosum may be accentuated. Acanthosis and some extension of rete pegs may be apparent, particularly in lesions of the alveolar mucosa and tongue. Chronic inflammatory infiltration into the underlying connective tissue is minimal or absent. This type of lesion represents a simple keratotic response to some mild irritant or stimulant.

Grade II - Hyperkeratosis and Inflammation

In this reaction there is hyperkeratosis and often notable inflammatory infiltration into the underlying connective tissue. Dilated capillaries are often in evidence. There may be extension of rete pegs, and some hydropic degeneration may be seen in the stratum spinosum. The degree of keratinization varies. It may be thick or thicker than the rest of the epithelium.

Grade III - Hyperkeratosis and Dysplasia (Dyskeratosis)

In addition to hyperkeratosis there is evidence of dysplasia or an abnormal orientation of the epithelium with cellular atypism. The chronic inflammatory cells are found in the connective tissue stroma and there is not the usual separation between epithelium and connective tissue at the basement membrane zone. The epithelium and connective tissue appear to blend into each other. However, there is no obvious invasion of the epithelium into connective tissue.

This histological findings were correlated with the Candida culture as well as the Candida found in the smear.

And finally clinical stage, histological grade and Candida's presence were correlated.

Now the other 2 sections were stained by PAS method and were evaluated for the presence of Candida, based on negative or positive finding of hyphae or pseudohyphae.

Results & Observations

A chi-square test and students't' test were used to analyse the results. Chi-square test was done to determine the extent of variations in the proportions of positive test results in following situations.

1. To examine difference in presence of Candida in smear between homogeneous and non-homogeneous subgroups (Table-VI). The result of statistical analysis shows that non-homogeneous type yielded more Candida than homogeneous type - 82% versus 7%. This difference is statistically highly significant ($p<0.001$).

2. To examine differences in candidal growth in culture between pathological mucosa and normal mucosa subgroups (Table-VII).

The results of statistical analysis showed that differences in positive test results were not statistically significant ($p<0.05$).

3. To examine differences in presence of Candida in smear between grade-I, grade-II and grade-III subgroups (Table-XII).

Results showed that grade-III leukoplakia yielded more Candida than grade-II – 89% versus 40%. No cases in grade-I showed Candida in smear. This difference is statistically highly significant ($p<0.001$).

Students't' test was done to determine the significance in difference of mean colony count between pathological and normal mucosa subgroups (Table-VIII).

Result showed that mean colony count were higher in pathological mucosa subgroup than normal mucosa – 22 versus 9.5. This difference is statistically significant ($p<0.001$).

Table I: Distribution of examined individuals by age and sex

Age Range in years	Number of Individuals (n)	Female	Male
15 – 25	11	0	11
26 – 35	21	3	18
36 – 45	10	1	9
46 – 55	3	0	3
56 – 65	3	2	1
66 – 75	2	0	2
Total	**50**	**6 (12%)**	**44 (88%)**

Table II : Distribution by Habits

Sr. No.	Habits	No. of Individuals	Percentage
1	Tobacco with lime only	43	86.00
2	Bidi only	3	6.00
3	Tobacco with lime & Arecanut	1	2.00
4	Tobacco with lime & Gutkha	1	2.00
5	Pan with lime only	1	2.00
Total		**50**	**100.00**

Table III: Topographic Distribution of Lesions

Sr. No.	Site	No. of Individuals	Percentage
1	Buccal Mucosa	34	68.00
2	Lower vestibule	8	16.00
3	Gingiva	5	10.00
4	Labial mucosa	3	6.00
Total		**50**	**100.00**

Table IV: Types of Leukoplakic Lesion

	Number of Individuals	Percentage
Homogeneous	28	56.00
Non-homogeneous	22	44.00
Total	**50**	**100.00**

Table V: Distribution of Cases According To Clinical Staging of Lesion

Clinical stage	Number of Individuals (n)	Homogeneous	Non-homogeneous
Stage-I	10 (20%)	10 (100%)	0
Stage-II	27 (54%)	18 (66%)	9 (33%)
Stage-III	13 (26%)	0	13 (100%)
Stage-IV	0	0	0

Table VI: Candida Albicans Observed in Smear from the Leukoplakic Lesion

	No. of patients showing Candida	χ^2	Significance
Leukoplakic lesions (n=50)	20 (40%)		
Homogeneous (n = 28)	2 (7%)		
Non-homogeneous (n = 22)	18 (82%)	28.6	p<0.001 (HS)

Table VII: Growth of Candida – Isolated and Demonstrated In Culture from Pathological and Clinically Normal Mucosa in Patients with Leukoplakic Lesions

	No. of cases showing Candida	χ^2	Significance
Pathological Mucosa (n=50)	30 (60%)	0.36	p > 0.05 (NS)
Normal Mucosa (n=50)	27 (54%)		

Table VIII: Mean Colony Count of Isolated Candida in Culture from Pathological and Clinically Normal Mucosa in Patients with Leukoplakic Lesions

	Mean Colony count	't'	Significance
Pathological Mucosa (n=30)	22 (Min = 10; Max.=34)	4.9	p<0.001 (HS)
Normal Mucosa (n=27)	9.5 (Min = 4; Max.=20)		

Table IX: Histopathological Grading of Leukoplakic Lesions

	Grade-I	Grade-II	Grade-III
Homogeneous lesion (n=28)	11 (39%)	16 (57%)	1 (3%)
Non-Homogeneous lesion (n=22)	0	14 (64%)	8 (36%)
Total	11 (22%)	30 (60%)	9 (18%)

Table X: Presence of Candida in Smear and Dysplasia in the Leukoplakic Lesions

	No. of cases showing presence of Candida	No. of cases showing Epithelial dysplasia
Leukoplakic lesion (n=50)	20 (40%)	9 (18%)
Homogeneous (n=28)	2 (7%)	1 (3%)
Non-homogeneous (n=22)	18 (82%)	8 (36%)

Table XI: Co-Relation between Presence of Candida in Smear and Histological Grading of Lesion

Total No. of patients showing presence of Candida in smear	Grade-I	Grade-II	Grade-III
20	00	12 (60%)	8 (40%)

Table XII: Co-Relation between Histological Grade of Lesion and Presence of Candida in Smear

Histological grade	Total No. of patients	No. of patients showing presence of Candida in Smear	χ^2	Significance
I	11	0	16.3	p<0.001 (HS)
II	30	12 (40%)		
III	9	8 (89%)		

Discussion

The importance of the protocol established for this study was based on the idea that Candida albicans is associated with malignant changes at the site of leukoplakia.

In this study, out of 50 patients there were 44 (88%) males and 6 (12%) females with an average age of 35 years. The maximum number of patients was in the age group of 26-35 years (Table I). In a similar study by Pindborg et al (1980) [4] all patients were males with an average age of 45 years. Krogh et al (1987) [5] reported 84% males and 18% females with an average age of 57.5%.

In this study 43 (86%) patients were smokeless tobacco users in the form of tobacco with lime. 3 (6%) had the habit of bidi smoking (Table-II). Silverman and Richard (1968) [6]reported that 95% of men in their study used tobacco in various forms; 63% were cigarette smokers. 75% of the women smoked cigarette and in addition, three female patients used snuff. The duration of the habit ranged from 1 year to 25 years. Maximum of 34 (68%) cases had duration of habit for 5 years.

In the present study, the location of the lesion was prevalently buccal mucosa (68%) followed by lower vestibule (16%) and gingiva

(10%) respectively (Table-III). Nagai et al (1992) [7] reported, among 18 cases 9 were from the tongue, 5 from the buccal mucosa, 5 from the gingiva, 1 from the palatal mucosa, 1 from the floor of the mouth and 1 from the labial mucosa. Silverman and Richard (1968) [6] showed that most common oral site was buccal mucosa, followed by floor of the mouth, tongue, alveolar mucosa, labial mucosa and gingiva.

On the basis of clinical appearance lesions were grouped into homogeneous and non-homogeneous type. In this study 28 (56%) cases had homogeneous leukoplakia and 22 (44%) had non-homogeneous leukoplakia (Table-IV). In a study of Rindum et al (1994) [8] out of 32 cases, 11 (34%) cases had homogeneous leukoplakia and 21 (65%) cases had non-homogeneous leukoplakia.

Clinical staging of the lesion on the basis of clinical findings were also done which was proposed by McCarthy.[1] 10 (20%) were in stage-I, 27 (54%) were in stage II and 13 (26%) were in stage-III. No cases were found in stage-IV. All lesions in clinical stage-I were of homogeneous type while all lesions in stage-III were of non-homogeneous type. Lesions in Stage-II exhibited both homogeneous and non-homogeneous type (Table-V).

Cytological Examination

Cawson and Lehner (1967) [9] demonstrated that the microscopic examination of PAS stained smears were the most helpful single investigation in candidal infection. They opined that hyphae in direct smears are of greater significance as it is in this phase that organisms actively invade the tissues. When a plaque is firmly scraped hyphae can often be seen embedded in detached fragments of epithelium. And they finally concluded that the most helpful single investigation is the direct smear, the discovery of hyphae which would raise strong suspicion that Candida albicans is the cause of the lesion. However, the diagnosis must be confirmed by biopsy.

In the present study 20 (40%) patients demonstrated candidal hyphae in the smear, in which 12 (60%) cases in histological grade-II and 8 (40%) cases were in grade-III, while no case in grade-I demonstrated candidal hyphae in smear (Table-VI, XI). In homogeneous leukoplakia subgroup 2 (7%) cases showed hyphae in smear whereas 18 (82%) cases showed hyphae in smear in non-homogeneous leukoplakia subgroup (Table-VI). Rindum et al (1994) [8] reported the presence of hyphae in 63% of cases. Cawson and Lenher (1967) [9] regarded hyphal form as a reliable indicator of active infection whereas Rindum et al (1994) [8] demonstrated that 4-47% of smears contained hyphae or pseudohyphae like structures in case of healthy dentate individuals with the same frequency in women as in men and most commonly from the tongue. According to them these structures are not an unequivocal sign of candidal infection.

As results indicate, non-homogeneous leukoplakia yielded Candida more frequently than homogeneous type – 82% versus 7%. These results are in accordance with those of Rindum et al(1994) [8] where 81% of non-homogeneous leukoplakia yielded candida. Krogh P et al (1987) [5,10] suggested that malignant development of oral precancer may be elicited by particular biotypes of C.albicans. It is also evident from the result that in cases with histological grade-III lesions, 8 (89%) cases has demonstrated presence of Candida in smear, in cases of histological grade-II lesions 12 (40%) cases has demonstrated presence of Candida in smear, while no case with histological grade-I lesion has demonstrated Candida in smear. It indicates that cases with histological grade-III lesions yielded Candida more frequently than grade-II lesions (Table-XII). As non-homogeneous leukoplakic lesions and histological grade-III lesions yielded Candida more frequently, presence of Candida can be associated with leukoplakias which has the potential to undergo malignant changes. Banoczy and Sugar (1972) [11] also found a 61% incidence of Candida in their cases of speckled leukoplakia undergoing malignant transformation.

Mycological Examination

In the present study, candidal colony was found in culture of 60% of samples taken from lesional mucosa and in 54% of samples taken from apparently normal mucosa (Table-VII). Rindum et al (1994) [8] reported candidal colony in culture of 95% of samples taken from lesional mucosa and in 89% of samples taken from apparently normal mucosa.

The colony count varied from 10 to 34 (Mean 22) in the culture from the lesional side and 4 to 20 (Mean 9.5) in the culture from apparently normal mucosa. Increased colony count in lesional side may be due to keratophilic nature of the Candida.

Histological Examination

In this study 11 (22%) cases were in grade-I, 30 (60%) cases were in grade-II and 9 (18%) cases were in grade-III (Table IX). None of the cases showed hyphae in PAS stained section. The reason might be as described by Cawson (1966) [12] that non-invasive hyphae and yeasts may be detected in smears or grown in culture but lost during histological processing, producing a negative result on staining the section with PAS. Again Roed Peterson (1970) [13] revealed that fungal infection as assessed by PAS staining are lower than those obtained by culture, and using the PAS stain there is 13% chance of missing fungal infection particularly if hyphae are scarce or only one section is analyzed. Negative results in PAS may also be due to scraping of the mucosa for isolation of Candida in smear and culture. Scraping may lead to removal of hyphae from the superficial keratinized portion of the lesion.

Histopathological changes as studied in H & E stained section were correlated with the Candida found in smear and culture. No case with histological grade-I has shown the presence of Candida in the smear, 12 (40%) cases of histological grade-II have shown presence of Candida in smear, whereas 8 (89%) cases with histological grade-III have shown presence of Candida (Table-XII).

Presence of Candida in almost all cases of histological grade-III but one implicates its possible role in transformation of untreated leukoplakia into malignancy, whether the Candida are causally involved in the development of leukoplakia and in the transformation of leukoplakia into carcinoma are matters still being debated.

Krogh et al (1990) [10] postulated possible mycological etiology of oral mucosal cancers. They found that certain strains of Candida albicans and other yeasts may play a causal role in the development of oral cancer by means of endogeneous nitrosamine production. This findings were supported by Rindum et al(1994) [8] also.

Birman, Kignel, Silveriar, Paula (1997) [14] added that the patients should be drinkers and smokers since these agents as well as yeast like Candida albicans, are prone to favour the production of nitrosamines, which could be an adjuvant of neoplasia development.

Barrett et al (1998) [15] demonstrated that Candida species have been identified in as many as 31% of biopsied leukoplakias, but it was not clear which changes are due to candidal infection and which are due to other factors in studies using human material.

In the present study absence of Candida from one histological grade III case, from few grade-II and from all grade-I cases were observed. It may be due to the salivation which has a constant flushing action which keeps the mucosa moist but may probably remove the unattached or loosely attached Candida from the oral cavity.

In order to establish an infective process Candida must adhere to the host surface and subsequently proliferate and penetrate the host defense that is, the mucosal barrier. One more reason which can be suggested for absence of Candida in the mucosa in most of the cases might be that the proteins within the keratinized mucosal cells may act as antifungal and retard candidal invasion. If the integrity of the epithelium is breached, for example in the presence of prosthesis causing maceration of the oral mucosa or epithelial atrophy due to any reason may result in microscopic breaches of the epithelium and invasion of Candida may occur. This probably explains the presence of candidal hyphae in non-homogeneous leukoplakia where the epithelium has undergone alterations which may affect the efficacy of the barrier mechanisms of the mucosa.

In homogeneous leukoplakia the superficial layers consists of a thick band of keratinized squames which could be either para or orthokeratinized. Probably the invasion of candidal hyphae is prevented as keratin acts as an endogeneous barrier.

As the surface keratin is formed, which is made up of the filaggrin and loricrin, there is dehydration of the cells and cells become packed with filaments surrounded by filaggrin facilitating their dense packing. Thus the cells of the keratinized layers become dehydrated and extremely flattened which become more resistant to mechanical damage and chemical solvents, hence maintaining the cell viability. In non-homogeneous leukoplakia the surface keratinized layers are not always uniform, this which facilitate candidal invasion.

For the colonization of the candidal organisms not only the mucosal changes but also other factors play an important role. As mentioned in various studies iron, folate and vitamin deficiencies may increase the individual susceptibility via systemic pathway and facilitate epithelial invasion.

Tobacco consumption may be a predisposing factor for candidal infection. When compared with the frequency and years of tobacco habit, patients who had the habit for more than 6 years and who chewed tobacco continuously were found to have dysplastic changes.

The other local factor may play a direct role on candidal colonization. For example, the flushing action of the salivary flow, the secretary IgA component of the saliva, the antifungal factors such as lysozyme, lactoperoxidase, lactoferrin, histidine rich polypeptides all of which may keep the oral candidal population at bay. The salivary pH and dietary carbohydrate content may influence the candidal growth.

Summary & Conclusion

1. Leukoplakia was more prevalent in 26-35 years of age range (42%).

2. Leukoplakia was found to be more prevalent in males.

3. In 86% of cases leukoplakia was associated with smokeless tobacco and lime consumption habit.

4. The most common site of lesion found was buccal mucosa (68%).

5. Presence of Candia in smear was noted in 40% of cases.

6. Non-homogeneous leukoplakia yielded more Candida than homogeneous leukoplakia- 82% versus 7% which is statistically highly significant ($p<0.001$).

7. In culture growth, Candida was noted in almost equal number of samples from pathological and normal mucosa whereas the mean colony counts from pathological mucosa were significantly higher than those from normal mucosa.

8. Most of the homogeneous leukoplakia histologically were in grade-I (39%) and grade-II (57%), only 3% were in grade-III. In non-homogeneous type 64% were in grade-II and 36% were in grade-III, none were in grade-I.

9. Overall 9 (18%) cases showed epithelial dysplasia in which 8 (89%) were found to be associated with presence of Candida in smear and were of non-homogeneous type.

Presence of Candida in almost all cases of histological grade-III lesions implicates its possible role in transformation of untreated leukoplakia into malignancy. Growth of Candida in almost equal number of cultures from normal and pathological mucosa implicates possible role of some other predisposing factor for malignant transformation and supports the view that tobacco consumption may be a predisposing factor for candidal infection and premalignant changes.

The exact role of Candida as etiological factor in malignant transformation of leukoplakia still remains a question. Hence, further studies are required to find the cause and effect relationship of Candida in malignant transformation of leukoplakic lesion.

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Effect of Various Root Canal Irrigants on Removal of Smear Layer and Debris an in Vitro study: A Scanning Electron Microscopic (SEM) Study

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Abstract

Objective: To compare the effectiveness of different Root Canal irrigants. To evaluate comparative efficacy of different root canal irrigants when used singly or in combination for the removal of smear layer and debris.

Methods: One hundred fifty freshly extracted premolars, for orthodontic purposes were selected. Access cavities were prepared and working lengths were established. The teeth were divided into 6 groups of 25 teeth each. Six groups of teeth were irrigated with Saline, Sodium Hypochlorite (NaOCl) 5.2%, Chlorhexidine Gluconate (CHX) 0.2%, Hydrogen Peroxide (H_2O_2) 3%, Ethyldiamine Tetra Acetic Acid (EDTA) 17% and Sodium hypochlorite and EthylDiamine Tetra Acetic Acid respectively.
The teeth were sectioned longitudinally and examined under Scanning Electron Microscope for removal of smear layer and debris at different levels of root canal system.

Results: The best smear layer and debris removal was obtained with 5.2% Sodium Hypochlorite and 17% Ethyldiamine Tetra Acetic Acid combination followed by Ethyldiamine Tetra acetic Acid 17% when used alone.

Conclusion: The intracanal irrigation was found to be most effective with a combination of irrigation rather than when used alone.

Key words: Root Canal Irrigants; Efficacy; Smear Layer; Scanning Electron Microscope.

Introduction

In pediatric patients, Pulpectomy (root canal treatment) is the treatment of choice for maintaining structural integrity of grossly carious tooth. To ensure good long serving pulp treatment, the skill of dentist, chemo mechanical preparation of root canal and removal of smear layer and debris followed by obturation play a combined role[1]. The ideal properties of various root canal irrigants must be the removal of complete smear layer and debris. The aim of endodontic treatment is the disinfection and then obturation of root canal system in three dimensions to prevention reinfections.[2] Canal system, irrigation and disinfection and then obturation of root canal system in three dimensions to prevention reinfections.[3,11] Irrigation of root canal is probably the most underrated procedure in endodontic therapy[4]. The exact composition and clinical implication of smear layer is not completely understood. It plugs the orifices of dentinal tubules reducing the permeability of dentin thereby preventing bacterial penetration into the dentinal tubules[5]. However, on the other hand smear layer acts as a reservoir for potential irritants.[6, 26] Proponents state that removal of the smear layer allows for intimate contact of irrigants and medicaments with potentially infected dentinal tubules. They also state that the smear layer removal increases the bond strength of resin sealers which results in better apical seal whereas opponents of smear layer removal have found that the smear layer acts as a barrier, inhibiting bacterial colonization of the

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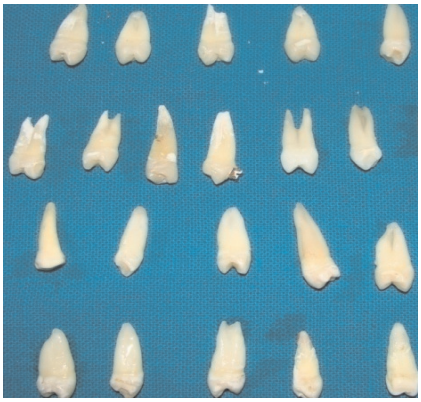
dentinal tubules.[7] Obturation in the presence of smear layer is considered as a weak union between canal walls and obturating material because smear layer can break away from underlying matrix resulting in microleakage.[8,24] So in view of this background, the current study was undertaken with the aim to assess and compare the efficacy of Sodium Hypochlorite (NaOCl) 5.2%, Hydrogen Peroxide (H_2O_2) 3%, Normal saline, Ethylenediamine Tetra Acetic Acid (EDTA) 17%, Chlorhexidine Gluconate (CHX) 0.2%, alone and in combination of Sodium Hypochlorite (NaOCl) 5.2% and Ethylenediamine Tetra Acetic Acid (EDTA) 17% in removal of the smear layer and debris from the root canal walls.

Materials and Methods

Total of 150 premolars were collected for the study from the Department of Pedodontics and Preventive Dentistry, Santosh Dental College and Hospital, Ghaziabad. Inclusion

Fig 1: Picture of Some Samples used in the study



Criteria for the selection of each tooth were : dried with paper points.

Then all teeth were decoronated with diamond disc (Dentaurum) mounted on a low-speed handpiece (NSK). (Fig 2). Then longitudinal and transverse grooves, which did not penetrate into the canal, were prepared along the buccal and lingual surfaces of each root. Then the roots were carefully sectioned with the help of surgical chisel and mallet (API), thereby providing two sections from each root (Fig 3). The two halves were dehydrated in alcohol, coated with gold palladium and viewed with a Scanning Electron Microscope (Fig 4). The apical, middle and cervical portion of root was scanned and representative areas

Fig 2: Decoronation of crown

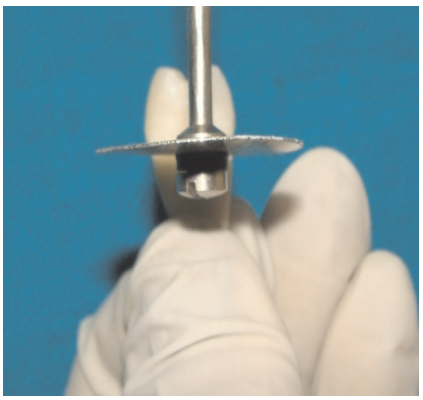
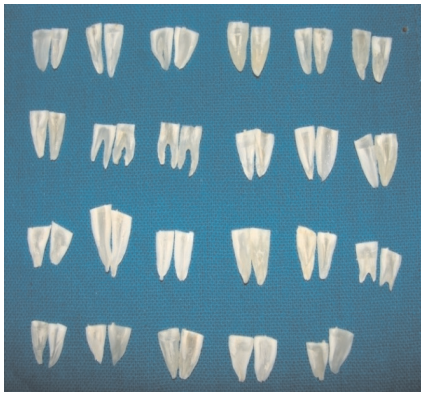


Fig 3: Longitudinally Sectioned Samples



0–Heavy smear layer seen with indistinguishable tubular outline.

were photographed at x2000 - x5000 magnification, for assessing the presence of debris, soft tissue or smear layer.

Criteria for evaluation of smear layer removal as by Rome et al [3] –3

No smear layer seen with all the dentinal tubules opened. (100% distinguishable tubular outline free of debris). 2- Little smear layer seen with more than 50% distinguishable tubular outline. 1– Moderate smear layer seen with less than 50% distinguishable tubular outline or with more than 50% indistinguishable tubular outline.In group 2,

moderate smear layer was seen in 65 % of samples with 50% distinguishable tubular outline (mean score 2) and only mild amount of smear layer (mean score 1) was removed in 30% of samples. In group 3, in about 80% of samples mild amount of smear layer was removed with more than 50% indistinguishable tubular outline (mean score 1) and 20% of samples showed moderate smear layer removal (mean score 2) In group 4, about 88% of samples little amount of smear layer was removed with more than 50% indistinguishable tubular outline (mean score 1) and 12% of samplese moderate amount of smear layer was removed (mean score 2). In Group 5, about 68% showed little smear layer with more than 50% distinguishable tubular outline (mean score 2) and in 32% of samples no smear layer was seen with all the dentinal tubules opened. (100% distinguishable tubular outline free of debris) (Mean score 3).In Group 6, about 92% of samples no smear layer was seen with all the dentinal tubules opened. (100% distinguishable tubular outline free of debris) (Mean score 3) and 8% of samples showed little smear layer with more than 50% distinguishable tubular outline (mean score 2). The observed scores, total sum and mean of smear layer and debris removal are presented in (Table 1)**.** The percentage of smear layer and debris removal is presented in (Table 2)**.** The graphic bar **(**Graph 1**)** represents mean grading for smear layer removal. The irrigants which showed maximum mean grading was efficient in removing the smear layer whereas irrigants with minimum mean grading failed to remove the smear layer completely. The graphic bar **(**Graph 2**)** represents percentage value for complete removal of smear layer.

To achieve this objective, root canals are cleaned thoroughly before the root filling using mechanical instrumentation, supplemented with irrigants and intracanal medications. Instrumentation leads to formation of an amorphous, irregular layer known as the smear layer on root canal walls. The smear layer contains remnants of ground dentine, pulp tissue, odontoblastic processes and bacteria Success of root canal therapy depends on the accurate diagnosis, quality of instrumentation, cleaning and shaping of 1.Freshly extracted premolars for the purpose of orthodontic treatment. (Fig 1)

All intact teethExclusion Criteria for teeth were

1. Fractured Premolar

2. Previously root canal treated teeth The teeth were divided into 6 groups of 25 teeth each on the basis of respective irrigating solutions being used.

First group-Normal Saline- control group Second group-Sodium Hypochlorite – 5.2% (NOVO)

Third group - Hydrogen Peroxide – 3% (Sandika pharmaceutical)

Fourth group Chlorhexidine Gluconate – 0.2%

Fifth group EDTA-17% (Dentsply).

Sixth group EDTA 17% and NaOCl 5.2%

Method

Conventional access cavities were prepared on the occlusal surfaces of the teeth. Pulp was extirpated and working length determined 1mm short of the apex using 10 size K- file. A No.-10 K file (DENTSPLY) was inserted into each canal until tip of the file was visible at the apical foramen.1mm length was subtracted from this length in order to establish the working length for each root canal. Biomechanical preparation was done by crown-down technique. For each experimental group, a new ensemble of files was used.During the procedure all specimen were kept moist by holding them in moist gauze. All the teeth were stored in normal saline throughout the study. After each instrumentation canals were irrigated with 2ml of respective group irrigating solution. The apical foramen of each canal was sealed using sticky wax in order to prevent the escape of irrigating solution beyond the apical foramen. Final flush using distilled water was done in all the groups in order to remove any reaction of irrigants with root canal wall. After final irrigation, the root canals were Fig 2. Decoronation of crown Fig 3. Longitudinally

Sectioned Samples. 0 – Heavy smear layer seen with indistinguishable tubular outline.

Results

About 70% of samples were unable to remove the smear layer (mean score 0) and 20% of samples were able to remove mild amount of smear layer removal (mean score 1).Heavy smear layer with indistinguishable tubular outline was noted in all specimens Group 1. Samples irrigated with control group showed very little smear layer removal. (Fig 5). Group 1. Samples irrigated with EDTA 17% showed moderate smear layer removal. (Fig 7). Group 5.Samples irrigated with 5% NaOCl, 0.2% CHX and 3% H2O2 showed the presence of high amounts of smear layer but were well debrided. (Fig 6). Group 2, 3, 4. Samples irrigated with NaOCl-EDTA (Group 6) combination, the smear layer was removed very effectively when compared with other groups (Fig 8). The NaOCl and EDTA combination showed the ability to demineralize inorganic component of smear

Fig 4: Scanning Electron Microscope (SEM)

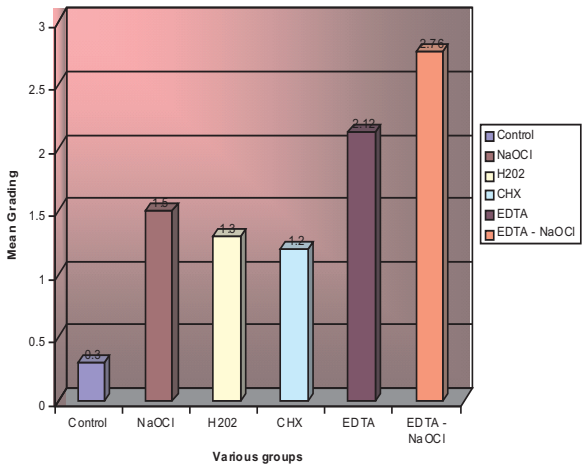
Table 1: Observed Scores, Total Sum and Mean of Smear Layer removal by various groups

S.No	Control Group	NaOCl	H_2O_2	CHX	EDTA	NaOCl-EDTA
1.	0	1	1	1	2	3
2.	0	1	1	1	2	3
3.	0	1.5	1.5	1.5	1.5	3
4.	1	1	1	1	2	2.5
5.	0	2	2	2	2	3
6.	0	2	1	1	2	3
7.	1	1.5	1.5	1.5	2.5	2.5
8.	1	1.5	1.5	1	2.5	2.5
9.	0	2	1	1	2	3
10.	0	2	1	1	2	3
11.	0.5	1	1	1.5	2	3
12.	0	1	1	1	2.5	2.5
13.	0	1	1	1.5	2	2.5
14.	1	1.5	1.5	1.5	2	3
15.	1.5	1.5	1.5	1	1.5	3
16.	0	2	1	1	2	2
17.	0	2	2	1	2.5	2.5
18.	0.5	1.5	1.5	1.5	2.5	2.5
19.	1	1	1	1	2.5	3
20.	0	1.5	1.5	1.5	2	3
21.	0.5	1.5	1.5	1	2	3
22.	0	2	2	1	2	2.5
23.	0	1	1	1	1.5	3
24.	0	2	1	1	3	3
25.	0	1.5	1.5	1.5	2.5	2
Total sum	9	37.5	32.5	30	53	69
Mean	0.3	1.50	1.30	1.20	2.12	2.76

Table 2: Overall mean grading and percentage of smear and debris removal of various groups

Groups	Irrigants	Mean Grading Value	% of Smear Removal
1st	Control group	0.3	10.6%
2nd	NaOCl	1.50	50%
3rd	H_2O_2	1.30	43.3%
4th	CHX	1.20	40%
5th	EDTA	2.12	70.6%
6th	NaOCl-EDTA	2.76	92%

Graph 1: Overall mean grading of smear layer removal in various groups



Graph 2: Overall percentage of smear layer removal by various groups

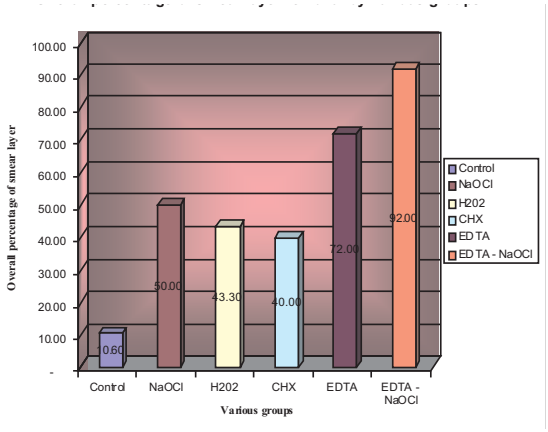
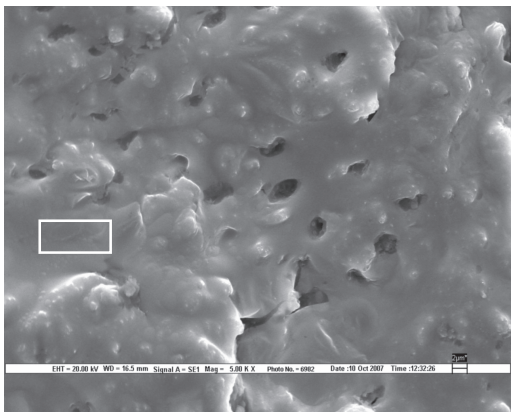
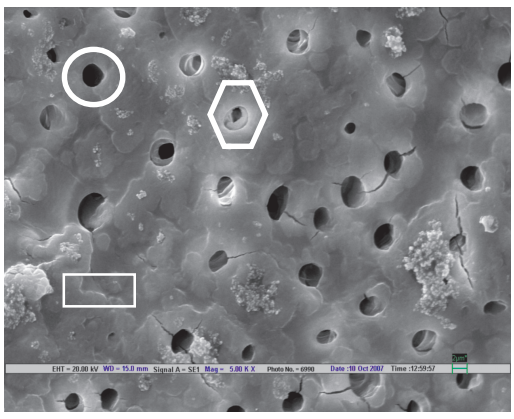


Fig 5: SEM photograph of sample treated with Saline



Smear layer

Fig 6: SEM photograph of sample treated with NaOCl



Completely Opened dentinal tubules

Partially opened dentinal tubules

Smear layer

Fig 7: SEM photograph of sample treated with EDTA

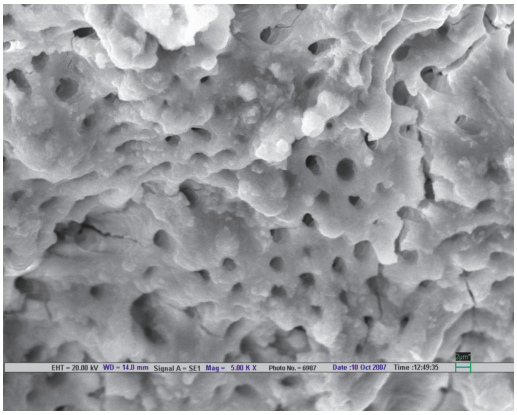
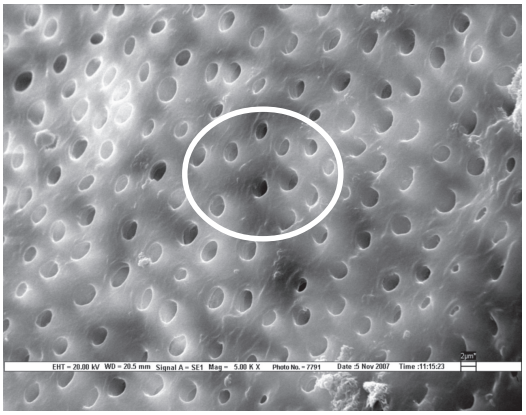


Fig 8: SEM photograph of sample treated with NaOCl & EDTA combination



layer and dissolve organic component of the smear layer. The solution also has the capability of preventing the smear layer from becoming packed into the dentinal tubules.

Discussion

When root canals are instrumented during endodontic therapy, a layer of material composed of dentin, remnants of pulp tissue and odontoblastic processes and sometimes bacteria is also formed on the canal walls. This layer is called as the Smear Layer.[8,9,10,11] The exact composition of the endodontic smear layer has not been determined but SEM examination has revealed that it contains both organic and inorganic materials. The inorganic materials in the smear layer are made up of tooth structure. According to Mader et al (1984) the organic component may consist of heated coagulated proteins, necrotic or viable pulp tissue and odontoblastic processes plus saliva, blood cells and micro-organisms.[12] Smear layer has been the topic of concern for all the clinicians over the years and a lot of research has been done by various investigators. Controversy still remains about its clinical significance and influence on success of the treatment.[13].Under clinical conditions, especially during the treatment of infected teeth, viable bacteria andtheir products can be incorporated onto the smearlayer, forming a deposit of irritants.[14]EDTA is an inorganic solvent & demineralizes dentin and removes inorganic component of smear layer.[19, 20] It removes the

Completely Opened dentinal tubules free of debris

calcium ions from the dentin and hence increases the diameter of exposed dentinal tubules. Sodium Hypochlorite is an organic solvent. Since smear layer contains both organic and inorganic components, addition of Sodium Hypochlorite solution with EDTA will remove organic component of the smear layer. The disodium salt of EDTA at 17% concentration and neutral pH is widely preferred to enlarge the root canal, removes the smear layer and prepares the dentinal walls for better adhesion of obturating materials [21, 22, 23].

Conclusion

This present in-vitro study was carried out to evaluate the effects of various root canal irrigants on removal of smear layer and debris by Scanning Electron Microscope.The best cleaning of the root canal walls was observed with Sodium Hypochlorite-5.2% and Ethylenediamine Tetra Acetic Acid-17% combination (Group 6). The use of EDTA -17% alone was capable of removing inorganic component of smear layer. Sodium Hypochlorite 5.2%, Hydrogen Peroxide 3% alone did not produce satisfactory results. The worst cleaning was observed in the groups in which Normal Saline (control Group) and CHX solution 0.2% were used as irrigants.

Therefore, its complete elimination would allow the most effective removal of the irritants from root canals, besides promoting an increase in the dentine permeability and increase in the ability of filling materials to penetrate into the dentinal tubules which contribute greatly to the success of endodontic therapy.[15] So the present study was therefore done with the purpose of evaluating the effects of various root canal irrigants on smear layer and debris removal.Greater discussions on the subject and various studies have been done to overcome this confusion. All of us, while doing SEM evaluation of various root canal irrigants for removal of smear layer and debris, would question the reliability and validity of the irrigants. A perusal of the literature reveals that there are various irrigant solutions for removing the smear layer and debris efficiently. Thorough research has documented that the NaOCl 5.2%-EDTA 17% combination has proven its superior effectiveness [16, 17, 18]. Therefore the combination of NaOCl 5.2%-EDTA 17% is the most reliable root canal irrigants for the removal of smear layer efficiently.

What this study adds

This study emphasizes the need to use root canal irrigants while doing biomechanical preparation in endodontic therapy from root canal walls. ·

This study highlights the combination of Sodium Hypochlorite 5.2% and Ethyl Diamine Tetra Acetic Acid 17% as the best irrigating solution.

Why this paper is important to pediatric dentists

Despite modern advances in the prevention of dental caries and an increased understanding of the importance of maintaining the natural dentition, many teeth are still lost prematurely. Maintaining the integrity and oral health is the primary objectives of the endodontic therapy. ·

In order to achieve successful root canal treatment, apart from the skills of dentist, chemo mechanical preparation of root canal, complete removal of smear layer and debris by an ideal irrigants play an important role.

Acknowledgement

I wish to say thanks to whole staff of Department of Pedodontics and Preventive Dentistry of Santosh Dental College & Hospitals Ghaziabad and my family for their valuable time, guidance and support throughout.

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Original article

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Knowledge and attitude on infant oral health among graduating medical students in Bangalore city, India

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Abstract

Primary care providers' involvement in infant oral health is an essential public health priority and initiatives should begin in early childhood. This study was aimed to evaluate the knowledge and attitude of graduating Medical students towards infant oral health and to propose ways to improve oral health education in the Medical curriculum. A cross- sectional survey was conducted among 359 graduating Medical students belonging to 8 (all) Medical colleges in Bangalore city, India. A self-administered questionnaire consisting of 21 questions divided into four domains assessing Infant Dental Anatomy, Early childhood caries, Fluorides, and Preventive strategies were distributed among participants included in the study. The data analysis was done using SPSS version 12 and data was subjected to student –t test . The average knowledge percentage score was 56.7% and average attitude percentage score was 42.9%. 66.66% of students were aware that First tooth erupts at 6 and half months after birth. Only 60.7% knew that problems with deciduous teeth will affect permanent teeth and 65.2% knew that first dental visit should be from 6 months to 1 year. This study has identified several factors that need consideration in the future exploration and development of knowledge and attitude on infant oral health care among graduating Medical students.

Key words: Knowledge and attitude; Infant oral health; Graduating medical students.

Introduction

Infant oral health is the foundation upon which Dental health must be built. Since 1986, the American Academy of Pediatric Dentistry (AAPD) has recommended that the first dental visit should occur within six months of the eruption of the first tooth and no later than twelve months of age. [1]In contrast, the American Academy of Pediatrics (AAP) previously recommended that first dental visit by age three , but changed the guideline in 2003 to establishing a Dental home by age one for children with caries risk.[2]

Physicians are the first health professionals to come in contact with the expectant parents, and parents of infants.[3] Optimally a Physician sees a child 8 times in first year and around 12 times by age of 3.Overall Children < 5 years are seen more by a Physician than a Dentist.[1] They need more knowledge and skills in addressing childrens' oral health because of the prevalence of Dental disease, racial and socioeconomic disparities in disease burden, and the limited access to dental care for many children.[3,4] Hence, integrating oral health diseases prevention and promotion strategies into these health care professionals practice becomes essential.

It is unclear up to what degree these healthcare professionals are knowledgeable about preventive Dental counseling as a part of well child visits.

Currently a limited amount of oral health subject matter is included in the Medical education but numerous opportunities and models exist that can prepare Medical professionals to become competent providers of oral health care and to do so adequate knowledge of the disease process ,risk factors,

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signs, symptoms, prevention, and intervention strategies are required.[5,6,7]

The strategy of utilizing primary care(Medical) providers to promote oral health is particularly necessary in rural regions where there are few dentists and even few Pediatric Dentists which compound the problem of obtaining access to dental care.

Thereby, examining the baseline knowledge and opinions of Medical students during their formative healthcare professional education is worthwhile. Thus the article begins with an examination of the current oral health related educational requirements and presents the knowledge and attitude of graduating medical students on infant oral health and proposes ways to improve and increase oral health education in the Medical health education process.

Materials and methods

A cross-sectional survey was conducted among 359 graduating Medical students from all the Medical colleges affiliated to Rajiv Gandhi University of Health Sciences, located in Bangalore, Karnataka (India). A self-administered questionnaire consisting of 21 Questions divided into 4 domains assessing-I) Infant Dental Anatomy,II)Early childhood caries,III) Fluorides and IV) Preventive strategies, was distributed among participants included in the study on a specific day & time scheduled in convenience with the respective colleges. Each participant was given 10 minutes to complete the questionnaire. After the participants had filled the questionnaire their doubts were cleared and they were explained the importance of infant oral health and their role in Preventive and Pediatric Dentistry. The data analysis was done using SPSS version 12 and data was subjected to student –t test.

Results

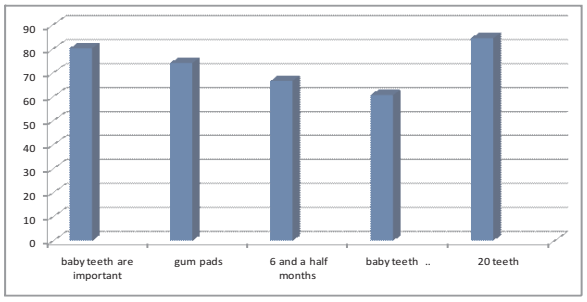
A total of 359 graduating Medical students participated in the study. The average knowledge percentage obtained was 56.7% and average attitude percentage score was 42.9%. About 80.2% respondents felt that "baby teeth" are important**.** Only 74.1% knew that dental arches of new born are called gum pads. First tooth erupts at the age of 6 and a half months was a fact known by 66.66% of participants.

Only 60.7% knew that problems of deciduous teeth will affect permanent teeth. About 84.4% gave an appropriate answer that eventually 20 "baby teeth" are present in a child. 61.8% replied that oral cavity of a newborn is not free of bacteria.

The responses regarding early childhood caries showed a lack of knowledge among the participants (Table 1).

About 62.1% knew that fluorides decreases dental caries and only 48.7% knew that fluoridated tooth paste should not be used in toddlers(1 to 2 years of age) .However 82.7% knew that excess fluoride intake will cause irreversible tooth discoloration. Respondents' knowledge on Primary preventive strategies was adequate (Table 2).

Graph 1: Infant Dental Anatomy [Percentage of Respondents with Right Answers]



Graph 2: Fluorides [Knowledge of Respondents on Fluorides]

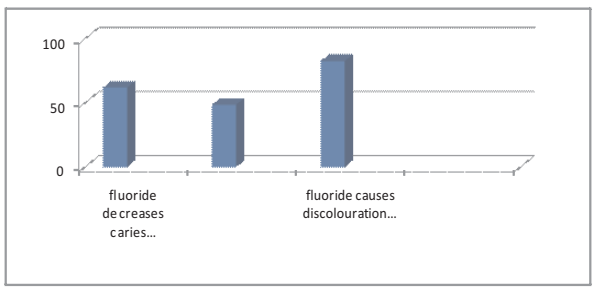


Table 1: Knowledge and Attitude on Early Childhood Caries

Questions	Responses	Frequency	Percentage
Oral cavity of newborn is free of bacteria	a)yes	101	28.1
	b)no	**222**	**61.8**
	c)don't know	36	10.0
Is dental caries infectious and transmissible from mother	**a)yes**	**70**	**19.5**
	b)no	241	67.1
	c)don't know	48	13.4
Cessation of demand feeding should be stopped after the first tooth has erupted in the oral cavity	**a)true**	**66**	**18.4**
	b)false	291	81.1
Which micro-organism causes ECC	**a)lactobacillus**	**111**	**30.9**
	b)streptococcus-mutans	174	48.5
	c)actinobacillus	74	20.6
Which teeth are first affected by ECC	**a)maxillary incisors**	**136**	**37.9**
	b)mandibular incisors	131	36.5
	c)all teeth are equal affected	92	25.6
Counseling on feeding and weaning to prevent ECC in infants in antenatal period is	**a)required**	**252**	**70.2**
	b)not required	80	22.3
	c)don't know	27	7.2
Is it ok to let the baby nurse in bed with mother all night	a)yes	96	26.7
	b)no	**224**	**62.4**
	c)don't know	39	10.9
Putting a baby to bed with a bottle of fruit juice/milk	a)correct	24	6.7
	b) not correct	**329**	**91.6**
	c)don't know	6	1.7

Note: The Correct Responses Are Marked In Bold

Table 2: Knowledge and Attitude on Primary Preventive Strategies

Questions	Responses	Frequency	Percentage
Should gum pads be cleaned	**a)yes**	**285**	**79.4**
	b)no	53	14.8
	c)don't know	21	5.8
When is the correct time to start cleaning the teeth	a)1 year after eruption of 1st tooth	164	41.7
	b)immediately after eruption of first tooth	**138**	**38.4**
	c) 3 years after eruption of of first tooth	57	15.9
First dental visit	**a)6 months to 1 year i.e by first birthday**	**234**	**65.2**
	b)2 years after first birthday	78	21.7
	c)3 years after birthday	47	13.1

Note: The Correct Responses are Marked in Bold

Discussion

In the present study the majority of Medical students believed that "baby teeth" are important however 60.7% students were aware that decay of deciduous teeth will affect permanent teeth. This was comparable with the value of 59.6% in the study by Robert Schroth et al. in 2007,[8] and 74% by Shivaprakash et al. in 2009.[6] About 19.5% of the Medical students agreed that dental caries is infectious and transmissible from mother to child as compared to 23.7 % pediatricians and 24.9% of family physicians as reported by Preeti Prakash et al. in 2006.[5]Most of the respondents (48.5 %) opined that the causative organism for Early Childhood Caries (ECC)is Streptococcus mutans as compared to 10% published by Retna Kumari et al. In 2006. [4]

In Dentistry, there is quasiconcensus that breastfeeding on demand especially at night and if prolonged produces caries. [9, 11, 12, 13, 14] Likewise in pediatrics, there are publications that share the same opinion. In our study 18.4% of Medical students agreed that there should be cessation of demand feeding when the first tooth erupts, compared to 49.4% by Mina Chung et al. in 2006 .[7] Majority of (70%) respondents felt the need of ante natal counseling on feeding and weaning habits in infants as compared to 60% of respondents by Shivaprakash et al. in 2009.[6] Prenatal education becomes the key to the dental care of the infant because the mothers should serve as models for their children to provide a successful environment for good oral health. Most of the respondents (91.6%) knew that putting a baby to bed with a bottle of fruit juice or milk is harmful as compared to (63.5%) by Retna Kumari et al. in 2006[4] and 72.6%

by Shivaprakash et al. in 2009. [6] Giving the baby a sweetened pacifier is harmful was agreed by 68.2 % of respondents, compared to (90%) by Retna Kumari et al. in 2006 [4] and (68 %) by Shivaprakash et al.in 2009.[6]This is also supported by the study of Wyne AH et al. in 2002[10], stating that children with feeding characteristics such as breast-feeding before/during sleep, nocturnal/nap-time bottle-feeding, excessive consumption of fruit juices/soft drinks from a container and a high frequency of sweet intake were prone for Early Childhood Caries.

Regarding the awareness on fluorides 48.7% respondents believed that fluorides should not be used in toddlers whereas only 4% agreed in study conducted by Retna Kumari et al. 2006 [4] and 23.7% of family physicians and 37.1% pediatricians agreed in the study by Preeti Prakash et al. in 2006. [5] The Medical professionals should be well versed with AAPD policy statement and guidelines for judicious administration of fluoride.

Effective prevention strategies are integral to improve the oral health and quality of life for the very young.[15]The overall awareness on preventive strategies was comparatively good wherein 79.4% respondents agreed that gum pads should be cleaned however only 25 % of them agreed in a study by Shivaprakash et al. in 2009 [6] and 32% in study by Retna Kumari et al. in 2006[4].About 65.2% recommended 1st dental visit in 6 months to 1 year as compared to 40% by Retna Kumari et al. in 2006,[4]. 52.5 % by Shivaprakash et al.in 2009[6] and only 2.7% of pediatricians and family physicians agreed with it in the study of Preeti Prakash et al. in 2006.[5]

Although overall knowledge and attitude of Medical students towards infant oral health was adequate, the knowledge regarding Early Childhood Caries was lacking. They were not trained to identify the cases clinically nor was it included in their curriculum. They did not have postings in Dentistry as a part of their curriculum.

The AAPD has come up with the concept of Dental home, referring a child for an oral health examination by a dentist who provides care for infants and young children at 6 months after the first tooth erupts or by 12 months of age. It provides an opportunity to implement preventive dental health habits that meet each child's unique needs and keeps the child free from dental or oral health disease. This concept of Dental home should be introduced in the system of Medical education.

Conclusion

The knowledge of graduating Medical students (participants) was adequate regarding the importance of "baby teeth" however there was inadequate awareness regarding Early Childhood Caries, micro-organisms responsible, bottle feeding and fluoride usage in caries control. This study has identified that there is a need to increase the knowledge of medical students through effective strategies. Medical students require adequate training in infant oral health in Medical school, Residency, and in Continuing Medical Education courses. The Medical professionals should also be encouraged to actively participate in Continuing Dental Education programs and courses specifically related to infant oral health. Such courses should be made mandatory so that they can be useful to upgrade Dental awareness which in return can be imparted to the patients.

Suggested methods to increase the awareness of Infant Oral Health among Medical professionals

1) Inclusion of Infant Oral Health in Medical curriculum
2) Medical students posting in the Department of Preventive Dentistry
3) Joint continuing Medical – Dental Education Programmers.
4) Post Graduate Programme in Preventive Dentistry should include

Medical student interaction programme.

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Review article

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Early Intervention: Understanding the Need in Children

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Abstract

The traditional approach to dental caries manage-ment presumed caries was inevitable. Therefore, the philosophy was to treat the effects of the disease (caries and/or gum disease) then initiate a preventive program. Contemporary guidelines, however, recommend early professional intervention to provide examination, risk assessment, and anticipatory guidance for parents so that disease can be prevented. Therefore, traditional professional intervention aimed at oral health beginning at age 3 years is no longer appropriate. Contemporary management recommendations are that professional intervention begins at approximately 12 months of age or shortly after the primary teeth begin to erupt. This way, disease can be prevented and the effects will never have to be dealt.

Keywords: Infant; Anticipatory guidance; Oral health.

Introduction

Good oral health is an integral component of good health. Many children have inadequate oral and general health because of active and uncontrolled dental caries.[1]Dental caries is a complicated, multifactorial, transmissible, infectious disease and it often begins to develop during infancy. It is five times more common than asthma and seven times more common than hay fever in children. [2, 3]

The traditional approach to dental caries manage-ment presumed caries was inevitable. Therefore, the philosophy was to treat the effects of car-ies then initiate a preventive pro-gram. Contemporary guidelines, however, recommend early professional intervention to provide examination, risk assessment, and anticipatory guidance for parents so that disease can be prevented. Therefore, traditional professional intervention aimed at oral health begin-ning at age 3 years is no longer appropriate.[4]

The preventive process must begin early in infancy—during the infant's first year—to ensure a successful outcome. The goal is to provide infants and toddlers with a pleasant, non-threatening introduction to dentistry and to establish and reinforce the foundation of sound& healthydental habits.[5]

Goals of infant oral health care

- To break the cycle of early childhood caries (ECC)
- To disrupt the acquisition of harmful microflora
- To manage risk / benefits of habits
- To provide optimal fluoride protection
- Use anticipatory guidance to arm parents in therapeutic alliance

First Dental Visit

Very few infants younger than one year have oral prob-lems that require intervention, but almost all have an oral environment at risk for oral diseases. The goal of the first dental visit is to assess the risk for dental disease, initiate a preventive program, provide anticipatory guidance and decide on

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periodicity of subsequent visits.The first visit should be non-threatening, and requires minimal manipulation of the infant, but at the same time pro-vides sufficient time with the parents to gather histori-cal information and demonstrate appropriate home care procedures.

Bacteria colonize the mouth shortly after birth and increase in number as more teeth erupt. These are commensals that remain in homeostasis with the oral cavity. The window of infectivity, for mutans strep-tococci, the organism most closely associated with dental caries, is between 19 and 31 months of age. Therefore, early intervention needs to be initiated be-fore age 19 months to prevent colonization and to pro-vide appropriate recommendations to parents on con-trolling the bacteria. The American Acad-emy of Pediatric Dentistry recommends that in-fants and their parents seek their first professional evaluation by a dentist around 12 months of age.[4]

Examination of infant & toddler

Infant oral health intervention assumes that the child has no disease but may be prone to disease due to risk behaviors such as night-timefeeding/bottle use or lack of fluoride. Conceptually, these risk factors will eventually lead to disease if not addressed; con-versely, if the risk factors are eliminated, the child will be free of disease.[6]

At the infant oral evaluationvisit, the dentist should do the following:

a) A thorough medical and dental history, covering the prenatal, peri-natal and postnatal periods should be obtained.

b) A thorough oral examination is performed.

c) Assessment of the infant's risk of developing oral and dental disease is done, and the appropriate interval for periodic reevaluation based on the result theassessmentis determined.

d) Anticipatory guidance for the parent or other caregiver regarding dental and oral development, fluoride status, non-nutritive oral habits, injury prevention, oral hygiene and effects of diet on dentition is provided.[2]

Examination procedure

The examination procedures include direct obser-vation and digital palpation. The parents should be informed before the examina-tion that it will be necessary to gently restrain the child and that it is normal for the child to cry during the procedure. The infant is held on the lap of a parent, usually the mother. This direct involvement of the parent provides emotional support to the child and allows the parent to help restrain the child. The dentist's voice should remain unstrained and pleasant during the examination. The dentist's behavior should reassure the child and alleviate the parents' anxiety concerning this first dental procedure.[1]

One method of performing the examination is the dentist and the parent is seated face to face with their knees touching. Their upper legs form the "examination table" for the child. The child's legs straddle the parent's body, which allows the parent to restrain the child's legs and hands. The other method is the parent is at a right angle to the direction the dentist is facing. These positions are also convenient for demonstrating oral hygiene procedures to the parents

Anticipatory Guidance

Anticipatory guidance is defined as proactive counseling of parents and patients about developmental changes that will occur in the interval between health supervision visits that includes information about daily caretaking specific to that upcoming interval.

Anticipatory guidance is the complement to risk assessment; addressing protective factors is aimed at preventing oral health problems.[6]

General anticipatory guidance for the mother includes the following: [7]

- Oral hygiene: Tooth-brushing and flossing on a daily basis are important for the

parent to dislodge and re-duce bacterial load in dental plaque.

- Diet: Important components of dietary education for the parents include the caries potential of their diet, cariogenicity of certain foods and beverages, role of frequency of consumption of these substances.
- Fluoride: Using a fluoridated toothpaste and rinsing every night with a mouth rinse containing 0.05% sodium fluoride have been sug-gested to help reduce plaque levels and help enamel remineralization.
- Caries removal: Routine professional dental care for the parents can help keep their oral health in optimal condition. Removal of active caries and subsequent res-toration are important to minimize infecting the infant with the parents' oral flora.
- Delay of colonization: Education of the parents especially mothers, on sharing utensils (eg, shared spoons), foods and cups can help prevent early colonization of oral flora,by bacteriafrom parent mouth in their infants.
- Xylitol chewing gums: Recent evidence suggests that the use of Xylitol chewing gum (4 pieces per day by the mother) had a significant impact on child's caries rate.

General anticipatory guidance for the young patient (0 to 3 years of age) includes the following[7]

- Oral hygiene: Cleansing the infant's teeth as soon as they erupt with either a washcloth or soft brush will help reduce bacterial colonization. The use of dental floss when adjacent teeth are in contact is important to help reduce interproximal caries.
- Diet: After the eruption of the first primary teeth, ECC prevention is possible byrestricting bottle/breast-feeding to normal meal times and not allowing the infant to feed ad libitum or while sleeping. The parent understanding of the cariogenicity of certain foods can help the infant and child eliminate or reduce their caries levels.
- Fluoride: Optimal exposure to fluoride is important to all dentate infants and children. Caution is indicated in the use of all fluoride-containing products. Decisions concerning the administration of additional fluoride are based on the unique needs of each patient.

Recommendations

Based on accepted guidelines, the following recommendation is made: [8,9]

1. Infants should be breast-fed during the first year of life, although ad libitum nocturnal breast-feeding should be discouraged after the first primary tooth erupts.

2. Bottle-fed infants should not be put to sleep with the bottle.

3. Children should be weaned from the breast or the bottle by 12 to 14 months of age.

4. Infants older than 6 months and with exposure to less than 0.3 ppm fluoride in their drinking water need di-etary fluoride supplements of 0.25 mg fluoride per day.

5. Parents should be advised to reduce their child's sugar consumption frequency.

6. Infants should be allowed to consume only 0.11-0.17litres of fruit juice per day. They should not be given pow-dered beverages or soft drinks, as these drinks pose increased risk for dental caries.

7. Only iron-fortified infant cereals along with breast milk or infant formula should be given to infants who are older than 6 months of age.

8. Parents should be counseled on the potential of vari-ous foods that constitute a choking hazard to infants

Common conditions of infant oral cavity

Teething

The Latin term 'Dentiodifficilis' was coined due to the importance of teething as a diagnosis.[10]

Natal & Neonatal teeth

Natal teeth are present at birth and neonatal present within 30 days of birth. [6]

Early Childhood Caries / Nursing Caries

The American Academy of Pediatric Dentistry (AAPD) defines early childhood caries (ECC) as the presence of one or more decayed (non-cavitated or cavitated), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger. The Academy also specifies that, in children younger than 3 years of age, any sign of smooth surface caries is indicative of severe early childhood caries (ECC).[1]

Conclusion

Early examinations followed by regular recall examinations contribute to the youngsters' becoming excellent dental patients without fear at very young ages. These children's chance for enjoying excellent oral health throughout life is also enhanced.

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Review article

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Applications of Lasers in Dentistry

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Abstract

Introduction of Lasers into the field of clinical dentistry helped in overcoming some of the drawbacks posed by the conventional methods of dental procedures. Since its first use for dental application in the 1960s, it has evolved rapidly in the last couple of decades. At present, wide varieties of procedures are carried out using lasers. The purpose of this review is to describe laser use in dental procedures. Lasers are found to be effective in cavity preparation, caries removal, restoration removal, etching, and treatment of dentinal sensitivity, caries prevention and bleaching. Based on development in adhesive dentistry and the propagation of minimum intervention principles, lasers may revolutionize cavity design and preparation.

Key words: Laser; Dental tissue; Adhesive dentistry.

Introduction

The use of lasers in dentistry has increased over time. The first laser was introduced into the field of medicine and dentistry during the 1960s [1]. Since then,it has progressed rapidly. Because of their many advantages, lasers are indicated for a wide variety of procedures[2,3,4,5]. Conventional methods of cavity preparation with low- and high-speed handpieces involve noise, uncomfortable vibrations and stress for patients. Although pain may be managed by local anaesthesia, fear of the needle and of noise and vibration of mechanical preparation remains causes of discomfort. These disadvantages have led to a search for alternatives for dental hard tissue removal. The aim of this review is to describe the application of lasers in dental hard tissue procedures.

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Historical development

The first experiment with lasers in dentistry was reported in a study about the effects of a pulsed ruby laser on human caries[1]. The results of that study showed that the effects varied from small 2-mm deep holes to complete disappearance of the carious tissue, with some whitening of the surrounding rim of enamel, indicating extensive destruction of carious areas along with crater formation and melting of dentine. Further work in the 1970's focused on the effects of neodymium (Nd) and carbon dioxide (CO2) lasers on dental hard tissues. Early researches found that CO2 lasers produced cracking and disruption of enamel rods, incineration of dentinal tubule contents, excessive loss of tooth structure, carbonisation and fissuring and increased mineralization caused by the removal of organic contents[6]. It was also reported that the use of the CO2 laser was unfavourable because of the loss of the odontoblastic layer[7]. Hence, it was noted that, unless heat-related structural changes and damage to dentinal tissues could be reduced, laser technology could not replace the conventional dental drill. Further advances in laser technology however, have identified acceptable biologic interactions. For example, the Er: YAG laser was tested for its ability to ablate (or vapourise) dental hard tissues[6]. Enamel and dentine cavities were successfully

prepared using the Er: YAG laser. Since then, this laser has been used for caries removal and cavity preparation, soft tissue minor surgery and scaling[3].

Clinical applications

Cavity preparation

The Er: YAG laser was tried for preparing dental hard tissues for the first time in 1988. It was successfully used to prepare holes in enamel and dentine with low '*fluence*s' (energy (mJ)/unit area (cm2)). Even without water-cooling[8], the prepared cavities showed no cracks and low or no charring while the mean temperature rise of the pulp cavity was about 4.3°C [9]. In 1989, it was demonstrated that the Er: YAG laser produced cavities in enamel and dentine without major adverse side effects. The ablation efficiency was about one order of magnitude lower than for soft tissue. It was then concluded that dentine and enamel removal was very effective with no risk to the pulp[10,11] and the ablation rates in enamel were stated to be in the range of 20-50 ¼m/pulse, and in dentine they were reported to be as high at lower fluences.

Clinically, cavity preparation in enamel results in ablation craters with a white chalky appearance on the surface of the crater[12]. In dentine, cavity margins are sharp and dentinal tubules remain open without a smear layer. In a clinical study conducted to evaluate the efficiency and safety of the Er: YAG laser for caries removal and cavity preparation in dentine and enamel[13], Class I, II, III, IV and V cavities were prepared for amalgam and composite restorations. It was found that the Er: YAG laser was equivalent to the air rotor in its ability to make cavity preparations in enamel and dentine and remove caries. However, the floor of the preparation was not as smooth as that achieved with the high-speed drill.

Caries removal

Carious material contains a higher water content compared with surrounding healthy dental hard tissues. Consequently, the ablation efficiency of caries is greater than for healthy tissues. There is a possible selectivity in the removal of carious material using the Er: YAG laser because of the different energy requirement to ablate carious and sound tissues leaving those healthy tissues minimally affected. However, Rechmann found that selective ablation of carious dentine is difficult with the Er: YAG laser[9]. The ablation thresholds of healthy dentine and carious dentine are different. The ablation threshold of healthy dentine is two times higher than the corresponding threshold of carious dentine. Therefore, very small fluences (energy (Joules) / area (cm2)) of the Er: YAG laser energy are required to selectively ablate carious dentine.

This low fluence will result in low efficiency of the ablation process[14]. In another *in vitro* study investigating the effectiveness of caries removal by Er: YAG laser, it was found that the Er: YAG laser ablated carious dentine effectively with minimal thermal damage to the surrounding intact dentine[3]. The laser removed infected and softened carious dentine to the same degree as the bur treatment. In addition, a lower degree of vibration was noted with the Er: YAG laser treatment. However, the study did not address the issue of selective removal of carious tissue and further studies of caries removal using lasers are indicated.

Restoration removal

The Er: YAG laser is capable of removing cement, composite resin and glass ionomer [15]. The efficiency of ablation is comparable to that of enamel and dentine. Lasers should not be used to ablate amalgam restorations however, because of potential release of mercury vapour. The Er: YAG laser is incapable of removing gold crowns, cast restorations and ceramic materials because of the low absorption of these materials and reflection of the laser light[16]. These limitations highlight the need for adequate operator training in the use of lasers.

Etching

Laser etching has been evaluated as an alternative to acid etching of enamel and

dentine. The Er: YAG laser produces micro-explosions during hard tissue ablation that result in microscopic and macroscopic irregularities. These microirregularities make the enamel surface microretentive and may offer a mechanism of adhesion without acid-etching. However, it has been shown that adhesion to dental hard tissues after Er: YAG laser etching is inferior to that obtained after conventional acid etching[17]. These authors attributed the weaker bond strength of the composite to laser-etched enamel and dentine to the presence of subsurface fissuring after laser radiation. This fissuring is not seen in conventional etched surfaces. The subsurface fissuring contributed to the high prevalence of cohesive tooth fractures in bonding of both laser-etched enamel and dentine. A similar conclusion was drawn from a study that compared shear bond strength (SBS) of composite resin to dentine surfaces following different treatments[18]. These authors reported that acid etched specimens achieved the highest SBS values, while laser treatment showed the lowest SBS results.

Treatment of dentinal hypersensitivity

Dentinal hypersensitivity is one of the most common complaints in dental patients. Various treatment modalities such as the application of concentrated fluoride to seal the exposed dentinal tubules have been tested to treat the condition. However, the success rate can be greatly improved by the ongoing evaluation of lasers in hard tissue applications. A comparison of the desensitising effects of an Er: YAG laser with those of a conventional desensitising system on cervically exposed hypersensitive dentin[19] showed that desensitising of hypersensitive dentine with an Er: YAG laser is effective, and the maintenance of a positive result is more prolonged than with other agents.

Caries prevention

Several studies examined the possibility of using laser to prevent caries[20,21]. It is believed that laser irradiation of dental hard tissues modifies the calcium to phosphate ratio, reduces the carbonate to phosphorous ratio, and leads to the formation of more stable and less acid soluble compounds, reducing susceptibility to acid attack and caries.

Laboratory studies have indicated that enamel surfaces exposed to laser irradiation are more resistant to acids than non-laser treated surfaces[22].

The quantum of protection against caries progression provided by the one-time initial laser treatment was reported to be comparable to daily fluoride treatment by a fluoride dentifrice[23]. The threshold pH for enamel dissolution was reportedly lowered from 5.5 to 4.8 and the hard tooth structure was four times more resistance to acid dissolution.

However, the actual mechanism of acid resistance by laser irradiation is still unclear and studies, particularly *in vivo,* to test those claims are required.

Tooth Bleaching

The objective of laser bleaching is to achieve an effective power bleaching process using the most efficient energy source, while avoiding any adverse effects[24]. Power bleaching has its origin in the use of high-intensity light to raise the temperature of hydrogen peroxide, accelerating the chemical process of bleaching. The FDA approved standards for tooth whitening has cleared three dental laser wavelengths: argon, CO2 and the most recent 980-nm GaAIAs diode.

There are no reports at present about the use of the Er: YAG laser in bleaching techniques. The wavelength of the Er: YAG laser may be unsuitable for the procedures, but it is a further area that could be explored.

Conclusion

The Er: YAG laser has been found to have applications in areas such as cavity preparation, caries removal and restorations, and etching of enamel. However, the advantages as well as limitations of the Er: YAG laser treatment have not yet been fully documented. There are lots of opportunity for the Er: YAG laser in dental applications. Lasers may revolutionise cavity design and

preparation based on development in adhesive dentistry.

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Review article

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Breast Feeding v/s Bottle Feeding: Effects on Occlusion

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Abstract

Human breast milk is the healthiest form of milk for human babies. Breastfeeding promotes health, helps to prevent disease, and reduces health care and feeding costs. There is another compelling benefit to exclusive breastfeeding: positive effects on the development of an infant's oral cavity, including improved shaping of the hard palate resulting in proper alignment of teeth and the proper development of the swallowing action of the tongue. The purpose of this article is to stimulate further research as well as to propose the importance of breastfeeding to developing and maintaining the physiologic integrity of the oral cavity.

Key words: Breast feeding; Oral cavity; Cranio-facial development; Malocclusion; Bottle feeding.

Introduction

Human breast milk is the healthiest form of milk for human babies. There are few exceptions, such as when the mother is taking certain drugs or is infected with tuberculosis or HIV. Breastfeeding promotes health, helps to prevent disease, and reduces health care and feeding costs. Breast milk is made from nutrients in the mother's bloodstream and bodily stores. It has just the right amount of fat, sugar, water, and protein that is needed for a baby's growth and development. During breastfeeding antibodies pass to the baby. It contains several anti-infective factors such as bile salt stimulated lipase (protecting against amoebic infections), lactoferrin (which binds to iron and inhibits the growth of intestinal bacteria) and immunoglobulin A protecting against microorganisms.[1,2] Merits of human breast milk as compared to artificial feeds include ideal nutritional content, better absorption, fewer food-related allergies, more favorable psychological development, better immunologic defenses, and a substantial economic advantage. There is another compelling benefit to exclusive breastfeeding: positive effects on the development of an infant's oral cavity, including improved shaping of the hard palate resulting in proper alignment of teeth and the proper development of the swallowing action of the tongue.[3,4] The swallowing pattern developed during infancy extends into adulthood.

Growth of the craniofacial area naturally involves an increase in size as well as dramatic changes in proportion. At birth, the cranium is slightly more than 60% complete, whereas the face is only 40% complete. The mandible is underdeveloped at this time, exhibiting an obtuse shape of the facial profile.[5] Growth does not mean just an increase in size but also changes in shape and orientation. During growth, the bone undergoes a remodeling and displacement process. The rate of change is different in different areas. The control of the growth involves a complex interaction with local functions, responding to local signals, which must act in concert with other

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regions.[6] Growth is strongly influenced by genetic, functional and environmental factors.

Process of breast feeding

The key to successful breastfeeding is a proper "latch-on" and swallow by the infant as described by Woolridge, [7] Escott, [8] Weber, [9] and Bosma.[10] During effective latch-on, the infant draws both the nipple and some of the surrounding areolar tissue into the mouth as far back as the junction of hard and soft tissue palates [11]and extends the tongue over the lower gum pad. Infant feeding takes place by the rhythmic pumping action known as 'suckling'. In the first few days after birth, the lips are not readily poised, but a primitive rooting reflex exists and when the child is nursed, it turns its head naturally to the breast.[12] The lips form a seal and the mouth cavity is enlarged as the jaw moves. The whole of the lower jaw is raised and lowered alternately with a rocking motion. The tongue is protruded and remains in contact with the lower lip throughout. As the jaw is lowered, the body of the tongue moves downwards and forward. The nipple is considerably extended and taken well back into the mouth, and the squeezing action is completed by the contraction of the floor of the mouth. [12] The movement of the tongue is described as a peristaltic, rolling motion. [13] This produces a low or negative pressure in the oral cavity, which facilitates the passage of milk from the nipple, although the oxytocin-induced milk let –down reflex triggered by touch receptors in and around the nipple is sufficient to give a flow of milk. [14] The upward movement of the mandible with upward and backward movement of the body of the tongue increase pressure in the oral cavity and force the contents into the upper part of the pharynx, initiating relaxation and then contraction of the pharyngeal constrictors. The airway is maintained during suckling. [14,15,16]

Process of bottle feeding

The tongue action for bottle-fed babies was more piston-like or a squeezing motion. A proper swallowing action may not develop and a tongue-thrust may develop instead. Some of the time during bottle-feeding, the infant only needs to squeeze on the nipple to express formula from the bottle. At other times, the infant may have to suck excessively to remove formula from the bottle. Since the hole at the tip of the nipple is not regulated to a standard size, the size of the hole can be quite variable. A nipple with a large hole may gush out an excessive amount of formula that could possibly choke the infant. The infant has to place the tongue at the back of the throat in a protective posture so that too much formula does not go down the throat. This abnormal motor activity of the tongue is referred to as a tongue thrust or a deviate swallow.

If the hole is too small, the infant may have to suck on the nipple excessively to express the formula. As formula is removed, a vacuum can be created inside the bottle. More suction is then needed to remove the formula. The greater the sucking action needed within the mouth, the greater the potential for collapse of the oral cavity.

Since most bottle-nipples are firmer than the breast, the tongue gets drawn inside the mouth to protect the bottom side of the tongue from being traumatized by the gum pad.

Effects of Breast and Bottle Feeding on Oral Cavity Development

Active breastfeeding encourages mandibular development, with a strengthening of the jaw muscles. The tongue, lower lip, and mandible move in concert to draw the nipple into the mouth and to empty it rhythmically by a series of compressions in a front-to-back sequence. Weber[9]concluded that the "stripping" movement of the tongue in breastfeeding was more important than suction in obtaining milk. Picard[17] suggested that the undesirable effects of artificial nipples on infants were permanent, and that correction in later life would be extremely difficult because muscle development would be affected. The forceful breastfeeding motion encouraged mandibular development, while bottle feeding could actually hinder the formation of strong jaw muscles.

Drane[18] noted that during breastfeeding, the shape of the breast-nipple is dictated by the internal geometry of the infant's mouth. However, an artificial teat is already formed, with a specific shape, and is made from a material stiffer than breast tissue. The piston-like action used to obtain milk from the bottle is more explosive and more powerful than the action used in breastfeeding. Therefore, greater pressure is applied to the artificial teat than is applied to the breast-nipple. This pressure is produced predominantly by the oral musculature. Koenig[19] stated that during bottle-feeding, the infant produced oral suction with the oral musculature rather than with thoracic musculature. Woolridge[7] has also demonstrated that less suction is needed during breastfeeding than during bottle feeding. Forceful action causes the cheeks to draw in, putting pressure on the gums and teeth, affecting the position of teeth. This action can also cause an implosion of the oropharynx, and thereby affect the development of the oropharynx. During breastfeeding, the infant has to work the jaws and tongue in a natural physiological manner to aid in the compression of the lactiferous sinus. This action, plus normal swallowing motions, help to develop proper perioral (around the mouth and jaw) musculature. Not much muscle coordination is needed during most bottle-feeding, so perioral, facial, and TMJ musculature may not develop properly. It was also observed that breast fed infants have the lowest prevalence of digital habits. They found a positive association between bottle feeding and over jet. Breast-feeding also lowers the risk of the antero-posterior mal-relationships. However the breast-fed infants showed the least amount of relative change in maxillary arch length and palatal depth.

Cranio-Facial Development and the Etiology of Malocclusions

Shepard,[20] noted that the largest increments in craniofacial growth occurred within the first 4 years of life, and that craniofacial development is 90% completed by 12 years of age. The flexible and soft human breast nipple tissue is beneficial in shaping the hard palate because it flattens and broadens in response to the infant's tongue action. As the infant uses a peristaltic-like motion to "strip" milk from the mother's nipple/areolar area, the hard palate is gently shaped by the infant's tongue to a rounded U-shaped configuration. A physiologically and appropriately shaped palate aligns the teeth properly and reduces the incidence of malocclusions.

In the early stages of oral cavity development, the palate is almost as malleable as softened wax. Thus, when any object is pressed against the soft bones of the palate, these bones can be molded into a narrow, unnatural shape. This eventually leads to the poor alignment of teeth, and the "V-shaped" palate found in many people with malocclusions. This dynamics also explains how the upper back teeth are pulled inward to cause "cross-bite."

Other infant habits, unrelated to feeding, may contribute to malocclusions. Prolonged finger sucking caused an anterior open bite, proclination and protrusion of the maxillary incisors, a lengthening of the upper arch and the anterior displacement of the maxilla. In addition, studies by Bowden,[21] Melsen,[22] Paunio,[23] and Ogaard[24] found a positive association between the use of pacifiers and malocclusion. The forms of malocclusion described by these authors included cross bite, reduced arch width, and lower anterior facial height, rotation of mandibular plane angle, open bite, and tongue thrust swallow.

Another problem that occurs during early oral cavity development is that of infringement on the space of the nasal cavity. When the roof of the mouth is pushed up, the floor of the nasal cavity rises as well. Since the bridge of the nose does not rise accordingly, there is a decrease in the total nasal space. This can have a dramatic effect on the individual's breathing efficiency because the size of the nasal chamber is reduced. Kushida et al.[25] have shown that a high palate and narrow arch, as described here, are good predictors of snoring and obstructive sleep apnea. Individuals with good occlusion normally have a well-rounded and full "U-shaped" arch.

Summary

Preventing disease, in a natural way, far outweighs the alternative: treating the disease with our newest medical technologies, which can be costly and time consuming. Breastfeeding has been shown to be immunologically, emotionally and nutritionally advantageous; there are also the benefits of a reduced risk of Obstructive Sleep Apnea/Sleep Disordered Breathing. All health care providers need to understand the benefits of breast-feeding and need to encourage it as much as possible.

Breastfed babies have a better chance of dental health than artificially-fed infants because of the effects of breastfeeding on the development of the oral cavity and airway. With fewer malocclusions, these children may have a reduced need for orthodontic intervention. In addition, children with the proper development of a well-rounded, "U-shaped" dental arch, which is found more commonly in breastfed children, may have fewer problems with snoring and sleep apnea in later life. The purpose of this article is to stimulate further research as well as to propose the importance of breastfeeding to developing and maintaining the physiologic integrity of the oral cavity.

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Case report

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Complex Odontoma of Maxilla: A Case Report

L. Kayal*, S. Jayachandran, Khushboo Singh****

Abstract

Odontomes are most common type of odontogenic tumours & generally they are asymptomatic & discovered during routine radiography. This paper describes a case of complex odontoma associated with impacted permanent maxillary premolar with clinical, radiographic & microscopic findings. Surgical excision of the lesion was performed and follow up was done for 1 year. This paper also highlighted the significance of CT attenuation values as an adjunct to diagnosis.

Key Words: Complex odontoma; Impacted maxillary premolar; Computed tomography.

Introduction

Odontoma is the most common odontogenic tumour & comprises approximately 22% of odontogenic tumours of jaws [1]. These tumours are formed of enamel & dentin, but they can also have variable amount of cementum & pulp [2]. They are considered as hamartomatous malformations of both ectodermal and mesodermal cell origin [3]. According to WHO classification (2005), two types are: complex and compound odontoma. Compound odontomes are usually located in anterior maxilla and complex odontomes in posterior mandible. Hitchin suggested that odontomes are either inherited or an interference with genetic control of tooth development [4]. Trauma, infection or growth pressure may disturb biological mechanism that controls tooth development and may be regarded as source of odontoma [4]. It may be diagnosed at any age but usually detected during first two decades of life [5,6]. Majority of cases are asymptomatic and seldom causes swelling, pain, suppuration, bony expansion, and displacement of teeth [7,8]. It is a benign lesion, but often causes disturbance in eruption of associated tooth [9,10,11]. The canines, followed by upper central incisors and third molars are most frequent impacted teeth [12]. Radiographically, complex odontoma appears as irregular mass of calcified material surrounded by a thin radiolucent area with smooth periphery, and compound type shows calcified structures resembling teeth in the center of a well defined radiolucent lesion. Odontomes are treated by conservative surgical removal with little probability of recurrence [5,13].

Case Report

A 13 year old male child was referred to the department for swelling on palate in upper left back teeth region for the past 6 months which gradually increased to the present size. Medical history was insignificant. No history of trauma was present. Dental history included history of extraction. Extraoral examination revealed hard swelling present in left maxillary region having ill defined margins with normal overlying skin and non tender on palpation. Intraoral examination revealed permanent dentition except for the presence of retained left primary maxillary

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second molar. Examination also revealed well defined hard swelling present on left hard palate not crossing the midline and extending to alveolar region buccally with obliteration of buccal vestibule producing alveolar bulge, overlying mucosa was normal, swelling was non tender on palpation, and was also associated with grade I mobility of teeth 24, 65, 26 and 27 [Figure 1, 2]. Aspiration was not attempted because of intact bone cortex in the entire region, no fluctuant area was present. On vitality testing, 24, 65, 26, and 27 were found to be vital. Based on clinical features, provisional diagnosis was given as benign odontogenic tumor and differential diagnosis was given as fibro-osseous lesion particularly fibrous dysplsia. Maxillary occlusal radiograph showed ill defined radiopaque lesion in left maxillary posterior region [Figure 3]. Panoramic radiograph revealed radiopaque mass in left maxillary posterior region with radiolucent rim and also impacted 25 [Figure 4]. Other areas were normal in panoramic radiographic. CT scan including axial and coronal view revealed hyperdense lesion closely placed to left maxillary premolar and molar region [Figure 5,6] and coronal view also showed the presence of impacted 25. Hounsefield unit (HU) for the lesion ranged from 1344 to 1486. So seeing the HU value it was confirmed that the lesion is tooth like material because enamel and dentin have specific values which are >1500 H.U. and 1000-1500 H.U. respectively. CT attenuation levels have been reported to range from 34 to 513 Hounsfield (HU) depending on the fibrous tissue and bone content for fibrous dysplasia [14]. So based on CT features and HU value of the lesion, radiographic diagnosis was given as odontoma with impacted 25. Biochemical investigations were also done and serum calcium, serum phosphorus, alkaline phosphatase were within normal limits. The lesion was surgically removed under local anesthesia completely along with teeth 24, 65, 26, 27 as they were mobile and also impacted 25 as it was attached to the lesion [Figure 7]. The surgical specimen was submitted for histopathological evaluation. Post operative healing was satisfactory. Histopathological examination confirmed the diagnosis of odontoma. Clinical examination and panoramic radiograph after 1 year of follow up showed satisfactory healing and no evidence of the recurrence [Figure 8, 9].

Figure 1: Intraoral view showing alveolar bulge buccally

Figure 2: Intraoral view showing swelling on left palate not crossing midline

Figure 3: Maxillary occlusal radiograph showing ill defined radio-opaque lesion in left maxillary posterior region

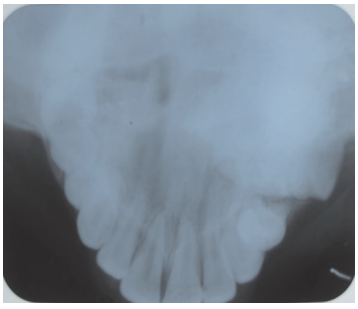

Figure 4: Panoramic radiograph showing ill defined radio-opaque lesion with radiolucent rim and impacted 25

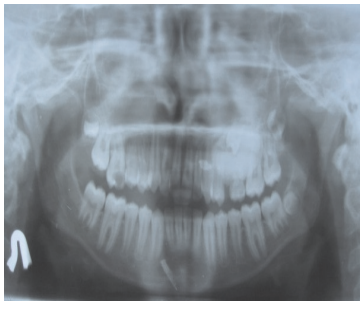

Figure 5: Axial section of CT scan showing hyperdense lesion in left maxillary premolar-Molar region

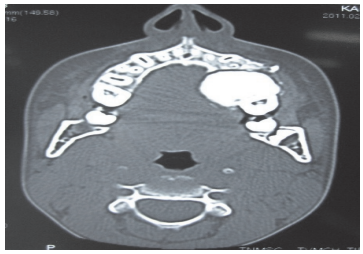

Figure 6: Coronal section of CT scan at the premolar area showing hyperdense lesion in left maxillary region with impacted 25

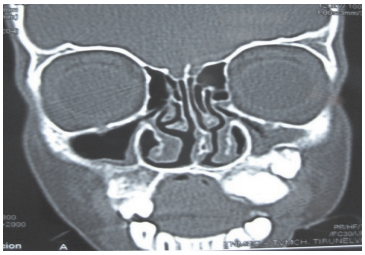

Figure 7: Photograph of the surgically excised specimen

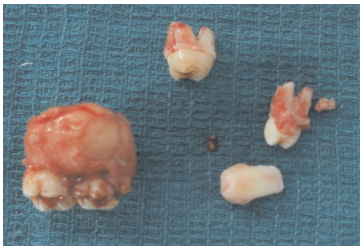

Figure 8: Clinical photograph after 1 year of follow up

Figure 9: Panoramic radiograph after 1 year of follow up

Discussion

Odontomes are generally asymptomatic and are rarely diagnosed before second of life. Clinicians often encounter the problem of tooth impaction, which is defined as a situation where a tooth fails to erupt into a normal functional position by the expected time. Tooth impaction is encountered more commonly in permanent dentition and rarely in primary dentition [15]. Various etiologies have been proposed for tooth impaction which include odontomes, odontogenic tumours, ankylosis, trauma, dentigerous cyst. Among these factors, odontoma is the most common etiological factor. These lesions are commonly small, seldom occur larger than a tooth. In this case report, lesion was larger than tooth. The treatment for odontoma is surgical removal, if they are excised early without disturbing underlying tooth, the eruption of the impacted teeth can be expected spontaneously or after orthodontic traction [7,16]. However, underlying impacted teeth are sometimes extracted in association with removal of odontomes [17]. In this case, lesion was surgically removed along with impacted 25 because it was attached to underlying mass. However every effort should be made to preseve impacted teeth. In general, if the root of impacted tooth is still developing, the tooth may erupt normally but once the root apex has closed, the tooth lose its potential to erupt [18]. Hisatomi et al. reported that the impacted tooth tend to erupt regardless of degree of root formation after removal of odontoma interfering with tooth eruption, although some teeth showed infraversion and/or crowding [19]. In conclusion, any pediatric patient who presents with delayed tooth eruption or tooth displacement with or without history of trauma, radiographic examination should be performed.

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Case report

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Volume 5 Number 3, July - September 2012

Mesiodens in the Primary Dentition: A Rare Occurrence

Prashanth Shetty*, Vivek P., Anita*****

Abstract

Supernumerary teeth occur frequently in the permanent dentition, but they are rare in the primary dentition. Mesiodens is a supernumerary tooth with a cone shaped crown and a short root. The etiology of supernumerary teeth is still unknown and not well understood. Incidence of mesiodens in children varies from 0.15 – 0.38%. Morphologically, mesiodens may be of three types: the most commonly seen is conical, while tuberculate and supplemental types are less common.

Keywords: Supernumerary teeth; Mesiodens; Primary dentition.

Introduction

The supernumerary tooth present in the midline of the maxilla between the two central incisors is referred to as 'mesiodens.' The occurrence of mesiodens in the primary dentition is very rare when compared to the permanent dentition. The incidence of mesiodens in permanent dentition ranges from 0.15 to 3.8%, whereas in primary dentition it ranges from 0 to 1.9%. [1, 2, 3] They are twice more common in boys, while no significant sex distribution is noted in primary supernumerary teeth.[4] Mesiodens may at times erupt normally or then stay impacted or follow an abnormal path of eruption.[3] Mesiodens or mesiodentes may produce a variety of complications, for example, crowding, delayed eruption, diastema, rotations, cystic lesions, and resorptions of adjacent teeth, etc., to the developing dentition/occlusion of a child. Supernumerary teeth may occur as a single isolated dental anomaly or in association with other developmental anomalies, or syndromes such as cleft palate and cleft lip, cleido-cranial dysostosis, Down's syndrome, and Gardner's Syndromes.[4]

Supernumerary teeth of the premaxillary region may appear in a variety of shapes though the most common type is conical or peg shaped (61%).[5] The other two commonly present are tuberculate and supplemental (adjacent tooth like).

Various theories have been put forward to explain the etiology of supernumerary teeth, which includes phylogenetic reversion (atavistic theory), split in tooth bud (dichotomy theory), locally conditioned hyperactivity of the dental lamina (dental lamina theory), and a combination of genetic and environmental factors (unified etiologic explanation).[6]

We are hereby presenting a case report of a 5year old boy with well maintained primary dentition who had come to our department as a part of the school dental health programme who on routine checkup was found to have a mesiodens.

Case Report

As a part of the school dental health programme that is conducted by our department of Pediatric and Preventive Children Dentistry, the Class I students of a

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nearby school were brought in for a normal routine checkup. No extraoral abnormality was detected (Fig 1) and his family and medical history were non contributory as we derived later from the parents.

Intra-oral examination revealed a complement of the primary dentition in a well-maintained oral health. A conical mesiodens was noted between the central incisors (Fig 2). Occlusal radiograph showed a completely formed mesiodens with a conical crown and a root (Fig 3).

It was decided to keep the mesiodens under observation rather than going in for extraction, a decision can be taken once the eruption of the permanent central incisors begins.

Fig. 1: Extra-Oral View Showing no Abnormality

Fig. 2: Conical Mesiodens

Fig. 3: Occlusal View Showing Mesiodens

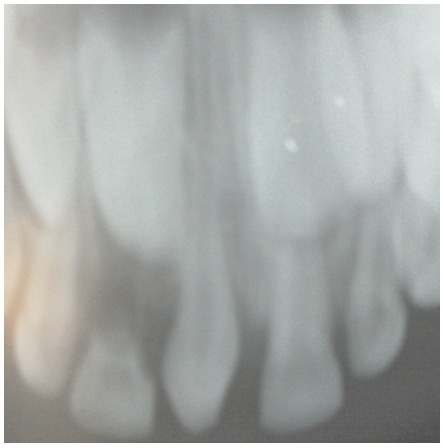

Fig. 4: Model Showing Mesiodens

Discussion

Mesiodens account for a 45-67% of all supernumerary teeth.[7] Balk defined mesiodens as the most common of supernumerary teeth located mesial to both centrals, appearing peg shaped in a normal position or inverted position.[8] Authors have also mentioned that the anterior midline of maxilla is the most common site of supernumerary tooth in which case the supernumerary tooth is known as mesiodens.[9] Very few supernumerary teeth have been reported for the primary dentition.[8] The present case is quite unusual as this reports a mesiodens in primary dentition which is rare.

Supernumerary teeth are classified according to their shape and size (morphology) and location. The present case, reports of a conical mesiodens.

Conical mesiodens has certain characteristics, which are as follows: [3]

• They are usually located between the permanent maxillary central incisors but rarely erupt labially.

• They erupt during childhood.

• They usually have complete root formation ahead of the adjacent teeth.

• They rarely cause delay in eruption of central incisors, but may cause alteration of path of eruption of these teeth.

A labially positioned mesiodens may cause palatal deflection of an incisor that may erupt with a rotation or in reverse bite rotationship. Other clinical problems associated with mesiodens are the development of malocclusion, ectopic eruption of adjacent teeth, cystic changes in the follicle, etc. Detection of mesiodens or supernumerary teeth is best achieved by clinical examination and radiography (IOPA, Occlusal, Orthopantomogram).

In case of unerupted mesiodens, before surgical extraction is attempted, the location of the tooth/teeth and the state of root formation of adjacent teeth must be ascertained.

In the present case, the erupted conical mesiodens in the boy was of not much concern to the parents and the boy. The extraction was delayed until the eruption age of permanent central incisors as the parents were not willing and agreed to do the same as soon as a problem could be detected.

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Case report

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The Surgical Management of Oro-Antral Fistula by Modified Rehrmann's Flap

R.K. Suryavanshi*, Neelakamal Hallur, Kiran Raddar***, Syed Zakaullah****, Chaitanya Kothari*****, Santosh Kumar S. Mathpati******, Vijayanath V*********

Abstract

Objective : The aim of this study was to evaluate the efficacy of Rehrmann's flap in oro-antral communication, acute and chronic oro-antral fistula along with its Critical evaluation, indications and contra-indications, complications and compare with other studies.

Study Design : In this prospective study, 20 patients with oro-antral communication, actue and chronic oro-antral fistula's, treated with modified rehrmann's flap is presented. Out of which nine cases were oro-antral communication, seven cases were acute oro-antral fistula and four were of the chronic oro-antral fistula.

Results : The successful closure of oro-antral communication, acute & chronic oro-antral fistula's were treated by modified Rehmann's flap. Caldwell luc & intranasal antrostomy were carried out whenever indicated. recurrence was seen in one case of chronic oro-antral fistula which was carried out by palatal flap operation. One patient complained of pain two months after surgery which was treated by symptomatic treatment & one patient failed to come for the follow-up.

Conclusion : This study concludes that, modified buccal Rehmann's flap is effective in oro-antral communication. Acute oro-antral fistula gives better results following the control of sinus infection while the chronic oro-antral fistula there can be some failures.

Key words: Oro-antral fistula; Oro-antral communication.

Introduction

Maxillary sinus is one of the largest of paranasal sinuses. The close relationship between maxillary sinus & the upper posterior teeth is an interesting subject for all oral & maxillofacial surgeons, this is because of ultra short distance between the apices of upper posterior teeth & the floor of the maxillary sinus. A common accident seen during an extraction of upper posterior teeth is the creation of an oro-antral perforation.

A fistula may arise due to several causes like the extraction of maxillary teeth, trauma to the face, surgery of maxillary sinus, osteomyelitis of the maxilla, gumma involving the palate, infected upper implant denture and malignant granuloma.

An oro-antral fistula is definded as "an unnatural communication between the oral cavity and the maxillary antrum" depending on the duration and lining of the communication tract, it is divided into oro-antral communication, acute oro-antral fistula and chronic oro-antral fistula.

Oro-antral communication is a fresh or recently diagnosed at the time of extraction or less than 48 hrs after the extraction & is not lined by epithelium.Acute oro-antral fistula is one which is diagnosed within 14 days and is lined by epithelium, chronic oro-antral fistula

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is one which is diagnosed after 14 days and is also lined by epithelium

Most of the sinus preforations may heal spontaneously but a surgical intervention is required to prevent the fistula formation. There are numerous techniques which have been broadly described as local flaps, distant flaps & grafts local flaps can be further divided into buccal flaps, palatal flap & a combination of both.

VON REHRMANN'S was the first to describe buccal advancement flap in 1936. Later in 1971 KRUGER modified the free end of the buccal flap by making a step excision of the mucosal layer which has additional advantages

1. The step preparation provides a double layer closure

2. The periosteal structure line rest on sound palatal bone.

3. Structures are at different levels (mucosal & periosteal) so that there are no chances of tissue break down.

Materials & Methods

All procedures & materials described in this prospective clinical study were treated in the department of Oral & Maxillofacial Surgery, K.L.E.S Dental College & Hospital, Belgaum.

Treatment strategy of our hospital is that oroantral acute and chronic oroantral fistulas should not be left to heal spontaneously, owing to ethical reasons.

Accordingly, twenty patients out of which nine patients with oro-antral communication, seven patients with acte oro-antral fistula & four patients with chronic oro-antral fistula were treated with Kruger's modification of rehrmann's flap.

The patients age range from 10 to 80 years with an average of 40 years out of which 13 were male & 7 female patients

Pre-operative Preparations

Paients with chronic oro-antral fistula were given warm normal saline flushing twice a day till a clear return was obtained. They were also given a palatal acrylic plate to cover the fistulous opening & were kept on antibiotic, analgesic, antiinflammatory, multivitamins, nasal drops & tincture of benzoin inhalation.

Acute cases of oro-antral communication were treated immediately.

Operative Procedure

All the patients were given intra oral rinsing with antiseptic mouth wash & local anesthesia was administered after scrubing & draping of the patients.

Using a no.11 blade, a circular incision was given around the periphery of the fistula. The fistulous tract was held with Allis-forceps & separated with the pointed end of the Howarths periosteal elevator & dissected out. Then two divergent incisions were given from the fistulous opening on the buccal side to the depth of the vestibule. The mucoperiosteal flap was now elevated from the buccal side. Extreme care was taken not to tear adherent tissue. Elevation was then continued anteriorly and posteriorly at the flap. High & irregular alveolar process was smoothened. Tension on each side of the object was relieved by reduction of the buccal & palatal alveolar ridge. The bucccal flap was mobilized by giving a horizontal releasing incision on the under surface. Care was taken to incise only the periosteum and not the mucosa, so that blood supply was not compromised.

Another incision was made perpendicular to the flap approximately 0.2cm away from the free end. This incision was limited only to the mucosal layer for at least 0.3cms. The free end of the buccal flap now consists only a very thin portion of submucosa and the periosteal layer. The width of the step excision of the force end must be sufficient enough in order to be treated under the palatal mucoperisteum at a later stage. Then the periosteal step of the

free buccal end is pulled underneath the palatal mucoperiosteal layer by means of 2 or 3 horizontally placed mattress sutures, so that the buccal periosteum now lies underneath the palatal periosteum. The horizontal mattress sutures are held by means of hemostats. The mucosal margins of the buccal and palatal flaps are brought into contact by pulling these horizontal mattress sutures on the palatal aspects. The anterior and posterior incisions were also closed by means of interrupted sutures. Then horizontal matssress sutures, which were held by means of hemostats are tied at this stage. This technique was combined

Fig 1: Pre-operative view

Fig 2: Incision line

Fig 3: Buccal flap reflection

Fig 4: Step preparation

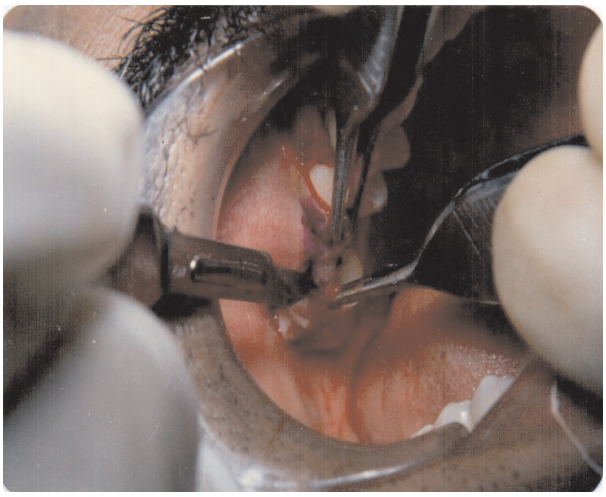


Fig 5: Sutures in position

Fig 7: Pre-operative radiograph

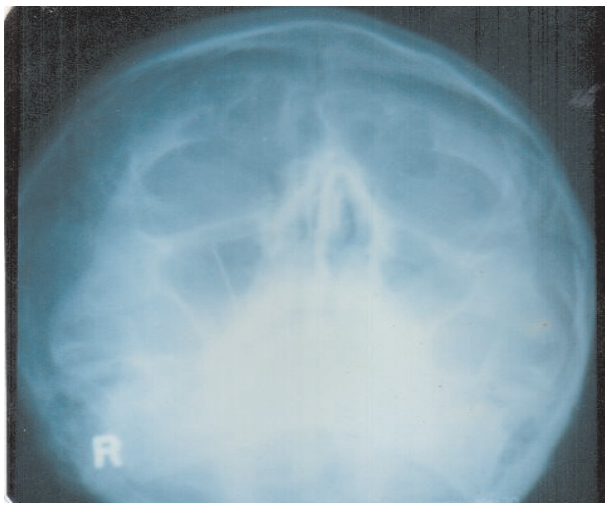
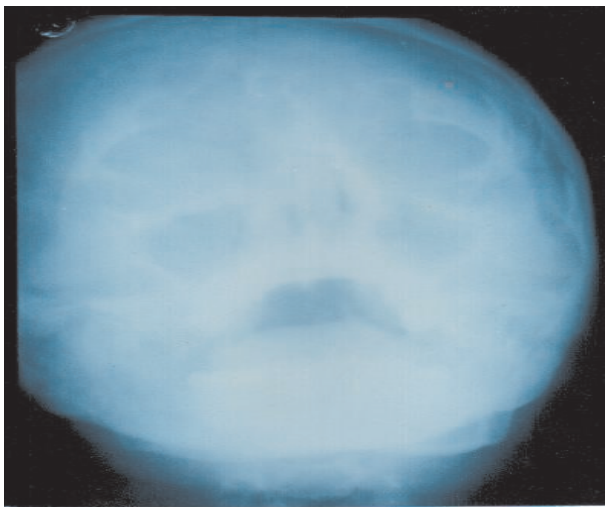


Fig 8: Post-operative radiograph



with the Caldwell-luc operation and intra-nasal antrostomy whenever indicated.

Discussion

Maxillary sinus has posed numerous problems to the patient and surgeon. One condition which commonly affects the maxillary sinus is oroantral communication and fistula. Numerous techniques have been described to close oroantral fistula and communication. A study was carried out to evaluate one technique of closure of oroantral fistula i.e modified Rehrmann's flap.

In this study the incidence of oroantral communication was in 9 cases(45%) acute oroantral fistula in 7 cases (35%) and the chronic oroantral fistula in 4 cases (20%).

Most common etiological factor was due to extraction of maxillary posterior teeth. Among these teeth 35% were due to extraction of second molar and 30% due to the first molar, of the remaining two cases were due to extraction of second premolar. One case each due to extraction of first premolar, third molar and impacted canine. Two cases were due to enucleation of radicular cyst associated with lateral incisor. The occurrence of oro-antral fistula was found to be more common in males than in females (2:1).

Radiological diagnosis included the intra oral periapical x-ray to rule out the presence of root piece & foreign body in the sinus. P.A sinus view was taken for all patients. Diagnosis in all the cases were confirmed by passing a 26 gauge wire in the sinus through the oroantral fistula (or) communication and taking the x-ray.

In one case of chronic maxillary sinusitis Caldwell Luc operation was performed with enucleation of maxillary sinus lining followed by intra nasal antrostomy.

All the cases of oroantral communications were treated symptomatically with antibiotic, analgesics anti-inflammatory multivitamins, nasal drops, tincture of benzoin, inhalations depending on the condition of the sinus.

The main disadvantage that was cited with the modified Rehrmann's flap was the reduction in the buccal sulcular depth which prevented adequate retention for a future prosthesis. In this study no such problems were encountered as in all the cases the preoperative sulcular depth was achived within 3 months.

In this study we have found that the success of closure of a oroantral fistula primarily depends not only on the flap but also on the condition of the sinus. A sinus teeming with microorganisms there is absolute certainty that there will be recurrence of the oroantral fistula. This was the prime reason why all the oroantral communications were closed with a rehrmann's flap immediately not giving any chance for infection to set in the sinus.

The preparation of the free end of the flap is the most important step, it demands the utmost patience of the surgeon. Careful splitting of mucosa and periosteum is done to achieve superior layer of epithelium measuring 2-5mm in width.

While closing two mattress sutures have to be employed to pull the buccal periosteum under the palatal mucoperiosteum. The other incision's were sutured with interupted sutures and then the matress suture's are tied.

Conclusion

The communication between the oral cavity and the maxillary sinus is most commonly seen after extraction of maxillary posterior teeth (1st molar 30%, 2nd molar 35%). It is more common in males than in females (2:1). It has an equal chance of occurring on both sides (left & right).

All the cases were treated by modified Rehrmann's flap, Caldwell Luc and intranasal antrostomy were carried out whenever indicated.

Follow up of the patients were continued for a period of 3 to 12 month's to see recovery of the maxillary sinus. This study concludes that, modified buccal Rehrmann's flap is effective in oro-antral communication. In acute oroantral fistula. It gives better results following the control of sinus infection while the chronic oro-antral fistula there can be some failures.

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Chapter in book

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