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## Office:

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St. GREGORIOS DENTAL COLLEGE  
Chelad, P.O., Kothamangalam,  
Ernakulam Dist.  
Kerala Pin - 686 681  
Phone: 0485 - 2571429, 2572529  
Fax: 2572530  
www.ijoonline.net

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# Editorial

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The field of dentistry has long existed at the nexus of science and art. This industry has changed dramatically over the years, going from barbers extracting teeth as a primitive process to complex, tech-driven operations today. As we get ready to explore the most recent findings and innovations in this field, it is imperative that we take a moment to consider our progress and future directions.

Dental care has always involved more than simply teeth. It has been about enhancing quality of life, regaining function, and reducing discomfort. The early practitioners relied mostly on their abilities and instincts, working with little resources and knowledge. The core dental values of accuracy, compassion, and patient comfort have not changed in spite of these limitations.

With the development of improved tools, methods, and knowledge about oral illnesses, the 20th century was a watershed. Dentistry became recognised as a legitimate and important branch of medicine with the founding of dental schools and professional associations.

The increasing understanding of the connection between systemic and oral health is another important development in contemporary dentistry. Studies have repeatedly demonstrated the connection between systemic problems like diabetes, cardiovascular disease, and even Alzheimer's disease and oral health diseases like periodontitis. This change in perspective emphasises the value of a patient-centered approach in which dentists work closely with other medical specialists to provide complete patient management. The field of dentistry has both opportunities and problems in store for the future. More innovation will be sparked by the growing need for individualised treatment, especially in the areas of genomics and regenerative dentistry.

On behalf of the editorial board, I extend my heartfelt gratitude to the Principal, Prof. Dr. Jain Mathew and the Management of St Gregorios Dental College, for their invaluable support in crafting this journal.

**Dr. Tina Elizabeth Jacob**  
**Editor**

# Evaluation of patient satisfaction with existing complete denture

\* William Thomas, \*\* George Francis, \*\*\* Mathew M. Alani,  
\*\*\*\* Silppa Thulasidharan, \*\*\*\* Minu Elsa Jose, \*\*\*\* Anil Poullose Padayatti

## Abstract

**BACKGROUND:** The objective of this study was to evaluate the effect of socio demographic factor on the quality of satisfaction towards denture treatment. Except for denture quality many other factors are related to a patient's satisfaction with complete dentures.

**METHOD:** A total of 15 patients who has been wearing complete dentures for varying periods of time took part in the study. Patients were decided based on certain criterias which were proved to be sure of contributing to the overall denture satisfaction of an individual. A questionnaire devised for the purpose of study was divided into two parts. In the first part patients answered questions about their age, gender, marital status, education, general health, socioeconomic status, period of edentulousness and previous denture experiences. In the second part patients graded their complete dentures depending on the level of satisfaction into (satisfied or partially satisfied).

Response to queries about their denture wearing experiences with regard to aesthetics and functions came out to be with wide variations in concepts and viewpoints.

**RESULT:** Patients were mostly satisfied with the quality of the denture, but a small percentage of dissatisfaction existed.

>Aesthetic aspect of a denture was best accepted by

1. Females (In the gender wise criteria)
2. Older denture wearers (in the age wise criteria)
3. Patients categorized under low socio-economic status
4. Patients below primary educational level.

>Functional aspects of complete denture were best accepted by

1. Males (in gender wise criteria)
2. Young denture wearers
3. Patients under low and moderate socioeconomic status
4. Patients below and upto primary level of education.

**CONCLUSION:** Psychological factors are definite to play a major role in changing attitudes and mindset of complete denture wearing patients. It provides valuable information for the prediction of satisfactory outcomes of complete denture treatment.

**Keywords:** Psychology, Complete denture, Socioeconomic status.

## Introduction

Although the edentulism is falling in all age groups, the number of older patients is still increasing. Rehabilitating edentulous patients with complete denture has been the treatment of choice.

### Aims and objectives

This study attempted:

1. To clarify the degree of contribution of

various factors to the overall patient satisfaction.

2. To assess the relationship between denture satisfaction in context with patient types and approaches towards treatment.

### Method

A total of 15 patients took part in the study. A questionnaire consisting of two parts were completed by the patients. Subjects were categorized based on their age, gender, education level, and socioeconomic status. Their responses recorded and compared. All recruitment for study was done from the department of prosthodontics, St. Gregorios Dental College. Subjects had the opportunity to withdraw at any time and were voluntarily involved in this study. Patients who had been wearing their denture regularly

\* Reader, \*\* HOD, \*\*\* Professor, \*\*\*\*Interns, Department of Prosthodontics, St.Gregorios Dental College, Chelad, Kothamangalam, Kerala.

*Send correspondence:* Dr.William Thomas, Reader Department of Prosthodontics, St.Gregorios Dental College, Chelad, Kerala.

Table 1: Gender wise distribution of patients regarding of quality satisfaction of complete denture

Criteria	Level of acceptance	Males	Females
Mastication	Satisfied	6	5
	Partially satisfied	3	3
Aesthetics	Satisfied	4	6
	Partially satisfied	5	4
Speech	Satisfied	6	7
	Partially satisfied	4	3
Retention/ support	Satisfied	5	3
	Partially satisfied	3	3

Table 2: Age wise distribution of patients regarding quality satisfaction towards complete denture

Criteria	Levels of acceptance	55-65 yrs	65-75 yrs	Above 75 yrs
Mastication	Satisfied	1	3	4
	Partially satisfied	3	2	2
Aesthetics	Satisfied	2	4	5
	Partially satisfied	3	1	0
Speech	Satisfied	1	3	4
	Partially satisfied	4	2	1
Retention and Support	Satisfied	3	2	1
	Partially satisfied	2	3	4

Table 3: Socioeconomic status level distribution of quality satisfaction towards completedenture

Criteria	Levels of acceptance	Low	Mod-erate	Sound
Mastication	Satisfied	4	2	1
	Partially satisfied	2	3	3
Aesthetics	Satisfied	5	3	1
	Partially satisfied	1	2	3
Speech	Satisfied	4	3	2
	Partially satisfied	1	3	2
Retention and Support	Satisfied	3	4	2
	Partially satisfied	1	2	3

Table 4: Educational level distribution of patients regarding quality satisfaction towards complete denture

Criteria	Levels of acceptance	Below primary	Upper primary	Grad-uates
Mastication	Satisfied	5	3	1
	Partially satisfied	0	2	4
Aesthetics	Satisfied	5	3	1
	Partially satisfied	0	2	4
Speech	Satisfied	4	3	2
	Partially satisfied	1	2	3
Retention and Support	Satisfied	4	3	2
	Partially satisfied	2	1	3

(everyday for at least 8 hours) were included in the study.

**Results:**

**Gender wise perception results**

Males were found to be more satisfied with the speech and mastication<sup>1</sup>. Regarding aesthetics males were more demanding as they were more concerned about how they present themselves in the society.

Females in our area lead a less social life compared to males and hence were readily satisfied with the aesthetics of their complete denture. Moreover retention and support were more in males. This may be attributed to the increased rate of Residual Ridge Resorption in females.

**Age wise perception results**

In general young denture wearers with more demands regarding aesthetics were found to be less satisfied. The sudden transition to edentulousness

posed a major problem to their overall acceptance to their complete denture<sup>2</sup>. But retention and support was more in younger individuals.

Elder citizens those who were previous denture wearers were easier to satisfy because they had a basic idea of how it would be to be wearing a complete denture and had a better neuromuscular co-ordination. Aesthetics was their second concern, were function came in first.

To conclude elder patients were easy to satisfy compared to younger individuals even though their ridge conditions were not as ideal as others. This is because elder patients especially previous denture wearers easily understood the instructions and limitations of an artificial replacement of their teeth<sup>3</sup>.

**Economic status based perception results**

India is a developing country and hence the socioeconomic status here cannot be expected to be very sound with more chances of citizens to

come under low or moderate levels of economic status<sup>4</sup>. Complete dentures fabricated in our college is charged the same cost irrespective of the varying levels of difficulty in each step of denture fabrication which in turn depends on patients oral conditions.

Patients with poor economic status were easily motivated and were more satisfied with their complete denture. Patients with better self perception of their affective status and quality of life showed better level of general satisfaction irrespective of their economic status.

These findings revealed that poor income group subjects are more concerned with function rather than aesthetics<sup>5</sup>. But for higher income group subjects aesthetics comes first and this may be attributed to their improved and increased opportunities of social interaction with people who belong to equal or higher levels of economic status<sup>6</sup>.

#### Educational level based perception results

As the educational level went down satisfaction levels were found to increase. This finding is not to highlight their illiteracy, instead it's based on the fact that as educational levels went higher the demands too grew up and in some patients it's been proved to reach a level where only demands and expectations matters, and such patients are not willing to accept the fact that their oral conditions had to be ideal in order to reproduce a denture, meeting all their qualifying points and hence were difficult to satisfy.

Therefore as the educational levels improved the higher opinions and ideas of patients were found to be conflicting with those of the dentist and

hence were difficult to satisfy them completely.

On the contrary there were a few well educated patients who were really reasonable in their demands and were ready to accept the shortcomings of their denture when its because of the nonideal oral condition.

#### Conclusion

Little is known about the outcomes of treatment and patient satisfaction with complete denture in adult keralite population. Therefore patient satisfaction with their complete dentures in relation to various socioeconomic variables are necessary to be taken into account. Although these variables may represent important co-factors in the patient's acceptance of dental prosthesis outcomes.

Aged over 75 years, males, higher income level and higher literacy are significantly associated with denture satisfaction with many but not all domains.

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## TRAIL BLAZER FOR THE FUTURE

The AAID study club, A first in India is inaugurated on 21<sup>st</sup> of August at St. Gregorios Dental College. SGDC will be the pinnacle hub of knowledge for practitioners and students alike to share, discuss and acquire experience concerning implantology. These series of CDE's named INTEGRA conducted thrice yearly under the guidance of AAID faculty began on 21<sup>st</sup> August 2013, followed by next event on December 2013.

# Commonly occurring edentulous patterns and reasons for tooth loss-A survey from suburban belt of Kerala.

\* William Thomas, \*\* George Francis, \*\*\* Mathew M Alani,  
\*\*\*\* Amrutha A.S., \*\*\*\* Anjaly Unni C., \*\*\*\* Sumi P.M.

## Abstract

Treatment for partial edentulism occupies a major portion in prosthodontic practice. Partial edentulism (single to multiple tooth loss) is a matter of concern of people for restoration in permanent dentition starting from ages 14-80 or more. The survey was conducted in the suburban belt of north east Kerala to find out the most prevalent partial edentulous pattern, etiology of tooth loss according to age and also gender. The eating habits and lifestyle of population in the suburban belt is different from that of its urban counterpart. The methodology selected was a questionnaire survey followed by a clinical examination of rural community which reported as out patient population in SGDC, Chelad, Kothamangalam. From this survey we found that Kennedy's class-III pattern is the most common condition, with a female predilection and contributing etiological factor is caries. Study also revealed a lack of awareness and need to educate the rural population.

## Introduction:

The survey was conducted in St.Gregorios Dental college, Chelad, Kothamangalam. The geographical distribution of the region is hilly midland, tropical evergreen and deciduous gateway of north-east highrange<sup>1</sup>. The survey was conducted in 30 days and subjects evaluated was 345 who reported to treat edentulism.

## Aim:

The survey aim to find out the most commonly occurring partial edentulous pattern found in the survey area and also to find out the common cause of edentulism, and gender predilection and possible methods to prevent the same condition.

## Methods of survey

A questionnaire was prepared on the basis of 3 categories:

A) Pattern of tooth loss in the surveyed individuals, which is subdivided into 6 categories based on the age.

- Such as
- i) 21-31yrs
  - ii) 31-41 yrs
  - iii) 41-51yrs
  - iv) 51-61yrs
  - v) 61-71yrs
  - vi) 71-81yrs

\* Reader, \*\* HOD, \*\*\* Professor, \*\*\*\*Intern, Department of Prosthodontics, St.Gregorios Dental College, Chelad, Kothamangalam, Kerala.

Send correspondence: Dr. William Thomas, Reader, Department of Prosthodontics, St.Gregorios Dental College, Chelad.

B) Etiology of tooth loss in above six subdivisions.

C) Etiology of tooth loss in the male and female categories.

## Type of Kennedy's classification found

Kennedys classification	21-31 yrs	31-41 yrs	41-51 yrs	51-61 yrs	61-71 yrs	71-81 yrs
Class I			12	12	6	3
Class II	3	6	3	15	3	
Class III	15	21	27	15	3	
Class IV		3		3	3	

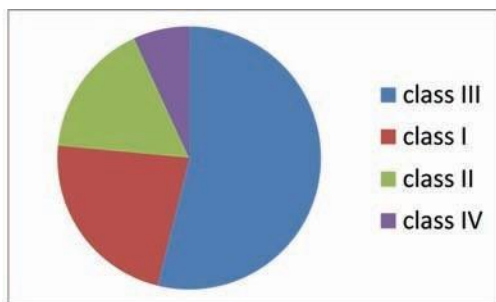
## Reasons for tooth loss

Reason	21-31 yrs	31-41 yrs	41-51 yrs	51-61 yrs	61-71 yrs	71-81 yrs
Caries	18	27	24	21	9	
Periodontal problem		3	6	18	3	3
Trauma	3					

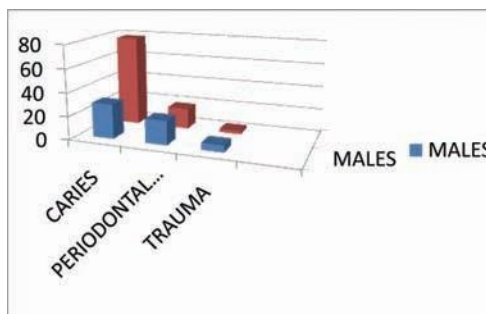
## Result/inference:

a. According to the 1st category of questionnaire, the study shows kennedys class III being the most common case and partial loss of

### Kennedy's classification



### Gender predilection in partial edentulism



teeth was most commonly observed in patients in 30-40yrs of their life.

b. The second questionnaire shows that the main etiological factors for partial edentulism were caries, followed by periodontal problem and then trauma.

c. According to 3<sup>rd</sup> category etiology for tooth loss in females was found to be caries, due to oral hygiene negligence which is because of household chores and in males the reason for tooth loss was attributed to habits like alcoholism and smoking leading to periodontal problems. The study showed a female predilection for partial edentulism.

The study evaluated the shift in condition from a Kennedy's class III to Kennedy's class I and II with age progression. Partial loss of teeth was most commonly observed in patients in the age of 30-40yrs. The study showed a female predilection with Kennedys Class III being the most common case. Etiology in females was found to be caries due to oral hygiene negligence, and in males' habits like smoking and alcoholism. Therefore from this study the main etiological factors were caries, periodontal problems and trauma of which caries was found to be the most common and also we could also infer that 1st molar is the most commonly affected tooth.

### Discussion

The survey was conducted to study the prevalence of partial edentulism; pattern of tooth loss and etiology of tooth loss in different age groups. Initially Kennedy's class I and class II cases were most common, whereas lately the pattern of edentulism has shifted to Kennedy's class III. A similar study conducted in India by Mr. Mc Dermant<sup>4</sup> for Baqai Dental journal proved the same Kennedy's class III pattern was mostly found in semirural population.

According to survey conducted by R K Celeste<sup>2</sup>, among Brazilian population he found that partial edentulism was commonly found in age group of 35-44years. On the otherhand in our survey observed, partial edentulism commenced earlier

among the mass mainly in age of 30-40years.

Etiology in elderly patients in their 60s was mostly periodontal problems in regressive changes that occur after this age group resulted in formation of sclerotic dentin<sup>6</sup> is highly resistant to caries. In South India a study conducted by B.George<sup>5</sup> in 2011 in adults over 60yrs showed more than 10 teeth missing in this population. Our study shows prevalence of female population, which is supported by a survey done in South America in June 2007 by Fernando Neves Hugo and Juliana-Balbinot Hilgert<sup>3</sup>.

### Conclusion

It is of utmost importance to adopt various preventive methods, of which a few could be [i] compulsory dental health education, right from primary school level so that the need and importance of oral health can be instilled in the budding generation, along with regular dental checkups and motivate the parents through parent counseling programmes. [ii] conducting dental awareness programmes targeting smaller communities and to motivate individuals with talks from effective personalities or any known person who has an upper hand in addressing local communities. [iii] Finally, at a larger scale, establishment of Public Health Centers can also contribute to prevention of edentulism, if proper initiative methods are carried out. Unlike Western developed countries, in a country like India the facilities and care doesn't reach the lower strata of society. This can be ensured by supporting the authorities and Government to start PHCs in areas where the rural population resides.

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# Pharyngeal airway in patients with class I malocclusion

\* P.C. Sunil, \*\* Tony Michael, \*\*\* Renji K Paul, \*\*\*\* Sajana P.S, \*\*\*\* Sara Ivan, \*\*\*\* Mary Sebastian

## Abstract

**Objectives:** To test whether there is any difference in any pharyngeal airway width in class I malocclusion patients in accordance to McNamara analysis.

**Materials and methods:** 15 girls with class I Malocclusion (mean of  $13.6 \pm 1.5$  years) participated in this study. On each girls, lateral cephalograms were taken and correlations were made between the horizontal positions of each point and also upper and lower pharyngeal widths were examined.

**Results:** In the present study the mean upper pharyngeal width is of 18.7mm and mean lower pharyngeal width is of 9.6mm. The results of this study were in accordance with the McNamara analysis with a normal upper pharyngeal width of 15 -20 mm and lower pharyngeal width of 10-12mm.

**Conclusion:** The study shows no significant difference in upper and lower pharyngeal airway in patients from Chelad having class I malocclusion when compared to the normal values of McNamara analysis.

**Keywords:** Lateral cephalogram; pharyngeal airway; malocclusion

## Introduction

The craniofacial growth and development which includes maxilla and mandible in children are affected by both genetic and environmental factors. Patients with normal respiratory activity influences the growth of maxillofacial structures, favoring their harmonious growth and development.<sup>1,2</sup> The presence of any obstacle in the respiratory system, especially in the nasal and pharyngeal regions, cause respiratory obstruction and force the patient to breathe through the mouth.<sup>3</sup> The close association between mouth breathing and maxillofacial morphology<sup>4, 5</sup> suggests that more attention should be paid to the effect of an obstructed airway on maxillofacial growth and development in children. Some articles have assessed the nasal and pharyngeal airways from lateral cephalograms.<sup>6,7</sup>

McNamara<sup>8</sup> noted that in 8-year-old children, (1) The wider the lower pharyngeal airway, the more anterior the position of the tongue in the oral cavity, either as a result of habitual posture

or due to an enlargement of the tonsils, and (2) Prognathism can be associated with a forward tongue position and enlarged tonsils. In other words, habitual mandibular posturing associated with the enlargement of the tonsils might be associated with prognathism. Therefore, the aim of this study was to examine whether pharyngeal airway width in class 1 malocclusion patients was within normal values according to McNamara analysis.

## Materials and methods

Fifteen subjects with normal maxilla and mandible with class I molar relation and mean age of  $13.6 \pm 1.5$  years, who visited St.Gregorios Dental college (Chelad) to receive orthodontic treatment, participated in this study. Upper pharyngeal width was measured from the posterior outline of the soft palate to the closest point on the posterior pharyngeal wall, and the lower pharyngeal width was measured from the intersection of the posterior border of the tongue and the inferior border of the mandible to the closest point on the posterior pharyngeal wall, according to the method of McNamara (Figure 1).

## Results

The upper and lower pharyngeal width in class I malocclusion patients is shown in Table 2. In the present study, the mean upper pharyngeal width is 18.7mm and mean lower pharyngeal width is 9.6mm. The results of this study were in

\* Professor, \*\* Reader, \*\*\* Senior Lecturer, \*\*\*\* Intern, Department of Orthodontics, St.Gregorios Dental College, Chelad, Kerala.

Send Correspondance: Dr. Renji K Paul, MDS, Senior Lecturer, Department of Orthodontics, St.Gregorios Dental College, Chelad, Kerala.

Data Preparation:

Table 1. Upper and Lower pharyngeal airway widths in 15 class I malocclusion girls

Upper pharyngeal airway width	Lower pharyngeal airway width
19mm	9mm
21mm	9mm
20mm	12mm
21mm	6mm
19mm	12mm
20mm	9mm
19mm	10mm
20mm	5mm
19mm	10mm
20mm	10mm
17mm	10mm
16mm	10mm
17mm	10mm
17mm	12mm
16mm	11mm

accordance with the McNamara analysis with a normal upper pharyngeal width of 15-20mm and lower pharyngeal width of 10-12mm.

Discussion

The association between mouth breathing and craniofacial morphology has been well studied.<sup>9,10</sup> Patients with “adenoid face” and “long face syndrome” have been characterized with obstructed airways either because of enlarged tonsils or anterior positioning of the tongue.<sup>11</sup> Many previous studies have shown that adenoid or tonsillar obstruction of the airway might cause abnormal maxillofacial development.<sup>12,13</sup> Freitas et al.<sup>14</sup> suggested that patients with Class I or Class II malocclusions and vertical growth patterns had significantly narrower upper pharyngeal airways than patients with Class I or Class II malocclusions with normal growth patterns. Abu Allhaja and Al-Khateeb<sup>15</sup> reported the average lower pharyngeal airway width of 15 skeletal class I girls from 14 to 17 years of age to be 12.9 ± 5.2 mm.

The evaluation of upper and lower pharyngeal widths in this study followed the method of McNamara. He noted that the standard lower pharyngeal width was 10 mm to 12 mm and that it did not change appreciably with age. The present

Table 2. Mean Upper and Lower Pharyngeal airway width (mm) of Class 1 Patients

Class 1 Malocclusion		
Distance	Mean	SD
Upper pharyngeal width	18.7	2.7
Lower pharyngeal width	9.6	3.9

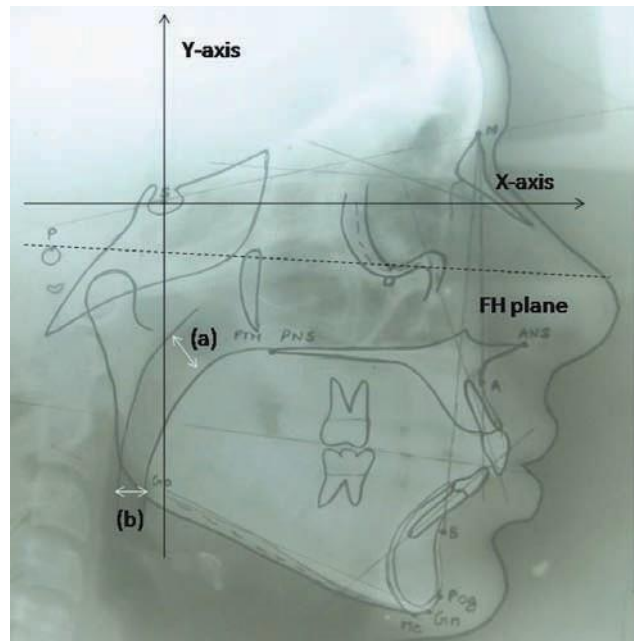


Fig. 1. Measurements of a) upper and b) lower pharyngeal airway widths taken using cephalometric skeletal landmarks

study showed the lower pharyngeal width mean value to be 9.6 mm. These results of this study indicate that unless the patient is having abnormal neuromuscular activity or tonsillar hypertrophy the values are in accordance with McNamara analysis.

Conclusion

The following conclusion can be drawn from the present study:

- ♦ Careful evaluation must be done during the orthodontic treatment when patient is having upper airway problem.
- ♦ The study shows no significant difference in upper and lower pharyngeal airway in patients from Chelad with class I malocclusion when comparing to the normal values of McNamara analysis.

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# Giant cell fibroma - a case report with review of literature

\* T.P Sajeevan, \*\* Joseph Sebastian, \*\*\* Charis Chandy Joseph, \*\*\*\* Sreena T, \*\*\*\*\* Joe Manuel

## Abstract

Giant cell fibroma is a localized reactive proliferation of fibrous tissue, much like the irritation fibroma. It usually a nontender, small, sessile or pedunculated swelling. It contains cells with large, stellate shaped fibroblasts, near the surface of the fibrous mass, beneath the overlying epithelium. In this article, we report a case of 32 year old female patient with a swelling on the right buccal mucosa, which was provisionally diagnosed as Irritation fibroma. On histopathological examination, the lesion was diagnosed as "giant cell fibroma".

Key Words: Giant cell fibroma, Multinucleated fibroblasts, Stellate fibroblast.

## Introduction

Fibrous hyperplastic connective tissue lesions are common in the oral cavity and may be similar both clinically and histologically. Fibrous hyperplasias are generally considered to be reactive in nature rather than neoplastic. Usually the stimulus is chronic irritation. Fibrous hyperplasia has different clinical and histologic features, so pathologists classify these lesions as separate entities based on their histopathological features.<sup>1-3</sup> A reactive fibrous hyperplasia with unusual histopathologic finding is discussed in this article.

## Case report

A 32 year old female patient presented with a swelling on the right buccal mucosa adjacent to 47 region of duration 8 years. On oral examination a nontender, sessile swelling of size 3x2 cm with smooth surface was seen. The opposing 18 was in contact with the swelling on occlusion. The lesion was non hemorrhagic, firm consistency and was covered by intact smooth mucosa. The rest of the oral mucosa was normal and the patient's oral hygiene was satisfactory. The results of routine blood investigations were normal. Based on the

lesion's history and clinical appearance the lesion was provisionally diagnosed as irritation fibroma. The other differential diagnosis considered were pyogenic granuloma, neurofibroma, papilloma and giant cell fibroma. An excision biopsy of the lesion was performed

The excised specimen was sent for histopathological examination. Microscopically the section showed an atrophic keratinized stratified squamous epithelium in association with fibrovascular connective tissue. The underlying connective tissue was fibrous in nature and comprised of dense bundles of collagen fibers and vascular spaces. In many foci, subepithelially the connective tissue showed large stellate shaped fibroblast and multinucleated giant fibroblast. Few inflammatory cells are also seen. These histopathological features were consistent with the features of giant cell fibroma. This case was followed up for 6 months and no signs of recurrence were seen.

## Discussion

Fibroma is the most common non neoplastic growth in the oral cavity. The identification of a Giant cell fibroma as a separate entity by Weathers and Callihan added a new dimension to the discussion. It was named for its characteristically large, stellate-shaped, mononuclear and multinucleated giant cells.<sup>1,2</sup>

Reibel, as well as Savage and Monsour, disputed the distinction of the lesion as a separate entity among fibrous hyperplasias and tumors. Reibel concluded that, due to the varying nature of the lesions and different ages at which the stellate and multinucleated cells are found, the so called Giant cell fibroma should not be considered as belonging

\* Reader, Department of Oral and Maxillofacial Pathology, \*\* Post graduate student, Department of Oral and Maxillofacial Pathology, \*\*\* Senior lecturer, Department of Oral medicine and Radiology, \*\*\*\* Post graduate student, Department of Oral and Maxillofacial Pathology, Mar Baselios Dental College, Kothamangalam, Kerala State, India

Send Correspondence: Dr Joseph Sebastian BDS  
Post graduate student, Department of Oral and Maxillofacial Pathology, Mar Baselios Dental College, Kothamangalam, Kerala State, India



Fig. 1 Black arrows point a sessile swelling of size 3x2 cm with smooth surface on the right buccal mucosa adjacent to 47 region.

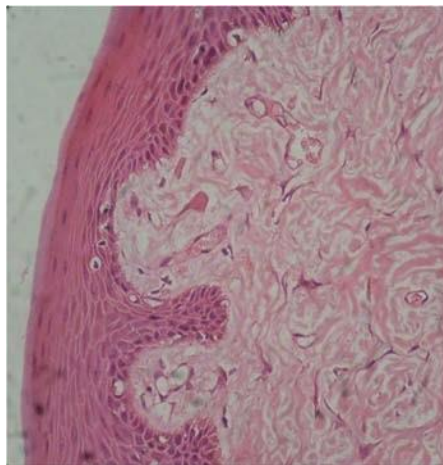


Fig. 2: Black arrows point stellate shaped large fibroblasts in fibrous connective tissue (10x)

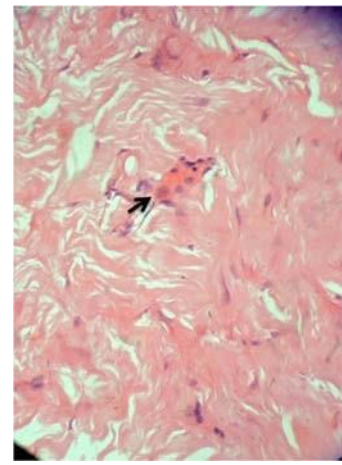


Fig. 3 Black arrows point a multinucleated fibroblast in fibrous connective tissue (10x)

to a separate entity<sup>4,5</sup> Fibrous hyperplasias are considered reactive proliferations of fibroblastic tissue rather than neoplastic proliferations due to chronic injury or irritation. Therefore giant cell fibromas is believed to arise as a result of a stimulus, the source of which cannot always be determined<sup>6-8</sup>.

Clinically Giant cell fibroma appears usually as an asymptomatic, sessile or pedunculated fibrous lesion with the color of normal mucosa. There is no gender predilection for the occurrence of giant cell fibroma, but it is often a lesion of the young, found most commonly in the first three decades of life.<sup>6-9</sup>

The characteristic histopathologic feature of this pathology is multiple large stellate-shaped and sometimes multinucleated fibroblasts (giant cells) in a loosely arranged vascular fibrous connective tissue. These cells have oval nuclei with abundant eosinophilic cytoplasm and are most copious just under the epithelium, but they may also be distributed throughout the lesion<sup>4,5,10,11</sup>. Magnusson and Rasmusson reported that stellate and angular cells of GCF were vimentin-positive. Odell et al. found that these cells were positive for prolyl-4-hydroxylase and vimentin, indicating a functional fibroblast differentiation.<sup>12</sup> A conservative surgical excision is usually curative.<sup>6-8</sup> Usually there won't be any recurrence.<sup>13,14</sup>

### Conclusion

Several fibrous nodular lesions in the oral cavity have similar clinical appearances. They often require histopathologic examination for reaching a definitive diagnosis. Giant cell fibroma should also be considered as a differential diagnosis for these type of lesions.

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# Dental restoration metal intolerance syndrome

\* AlphyAlphonsa Sebastian, \*\* Soumya Sasikumar, \*\* Parvathy M.

## Abstract

Lichenoid amalgam restoration also known as amalgam associated oral lichenoid reaction, is an uncommon allergic reaction following long-term exposure to dental amalgam restorations. This is a case of oral lichenoid reaction associated to amalgam restorations in a 18 year-old male patient. He presented with a greyish white discoloration on his left & right cheek 2 yrs after a non-contributory medical and dental history. On examination, the presence of class I (buccal pit) silver amalgam restorations in relation to left & right Mandibular first and second molars was observed. Management included removing the amalgam restoration and using composite resin as a substitute.

## Introduction

Silver amalgam has been used as a dental restorative material for more than 150 years. Even today, with the advent of new synthetic non-metallic materials and novel time-saving procedures, silver amalgam is the most widely used and cost-effective dental material in restorative dentistry<sup>1</sup>. Its superior compressive strength and minimal technique sensitivity makes it an ideal material for posterior restorations and core build-ups. In addition to corrosion and metallic colour, amalgam has got a major disadvantage. Amalgam fillings are in direct contact with the oral mucosa and may directly alter the antigenicity of basal keratinocytes by the release of mercury and other metal salts as corrosion products<sup>1</sup>.

In susceptible individuals, therefore, amalgam fillings may induce amalgam-contact hypersensitivity lesions (ACHL) with features similar to oral lichen planus (OLP)<sup>2</sup>. Such lesions are likely to occur on mucosal surfaces in contact with amalgam fillings and could be expected to improve following removal of the fillings. Pinkus in 1973 coined the term Lichenoid lesion. Koch et al 1999 proposed "Dental restoration metal

intolerance syndrome"<sup>2</sup>. Skoglund showed that removal of amalgam usually affects the lesions favorably and that epi-cutaneous patch tests are of little prognostic value in patients with oral mucosal lesions of lichenoid character<sup>2</sup>. Bratel et al proposed that vast majority of contact lesions (CL) can be resolved by selective replacement of restorations of dental amalgam, provided that correct clinical diagnosis had been established<sup>3</sup>.

## Case report

A 18 year-old male patient reported to the Department of Oral medicine and Radiology St.Gregorios Dental College, Chelad with a chief complaint of greyish discoloration on his left & right cheek since 2yrs with a non-contributory medical and dental history. On detailed hard tissue examination, the presence of class I (buccal pit) silver amalgam restorations in relation to right & left Mandibular first and second molars was observed. On further detailed soft tissue examination of the entire oral cavity, an unilateral greyish white striae which has ill-defined borders at the occlusal level extending from 1<sup>st</sup> premolar to retromolar pad region & of size 7 x5cm on right buccal mucosa & there was a whitish & blackish striae with ill-defined borders at the occlusal level extending from 2<sup>nd</sup> premolar to retromolar pad region with a size of 6x5cm (fig1).

The patient gave a dental history of undergoing silver amalgam restorations of his decayed teeth in relation to left & right mandibular first and second molars 2 years back with no presence of any other decayed or restored teeth in the oral

\* Reader, \*\* Intern, Department of Oral Medicine & Radiology, St.Gregorios Dental College, Chelad, Kerala

Send correspondence: Dr.AlphyAlphonsa Sebastian, Reader, Department of Oral Medicine & Radiology, St.Gregorios Dental College, Chelad, Kerala



Figure 1

cavity. The whitish discoloration was diagnosed as a reaction of the oral mucosa to silver amalgam restorations – Lichenoid reaction.

### Management

The management was the replacement of silver amalgam restorations with composite resin. Amalgam restorations were removed using a high speed rotary handpiece with a round bur following the occupational and safety health administration (OSHA) regulations<sup>4</sup>. After removal of the entire amalgam restorations, Glass ionomer cement was placed as base on the pulpal floor and was temporarily restored with Zinc Oxide Eugenol cement<sup>5</sup>. The whole procedure was done in a dental clinic as outpatient procedure.

### Discussion

Oral mucosal lesions related to dental restorative materials may be caused by delayed cell-mediated hypersensitivity reaction<sup>6</sup>. In the present case histopathological examination was not done, because it is an invasive procedure; the intention was to use a more conservative approach for the management of the patient. The most common contact lesions of the oral mucosa due to metal hypersensitivity are caused by nickel or chromium in orthodontic appliances or frame-work for partial dentures<sup>7</sup>. A review of cases reported as Mercurial hypersensitivity from mercury exposure in dentistry has been given by Bauer and First. Accumulations of mercury have been found in lysosomes of macrophages and fibroblasts of submucous connective tissue of contact lesions, and also in normal mucosa. These seems to be a great discrepancy in the manifestation of the incidence of hypersensitivity reactions inherent with the use of amalgam restorations as treatment of choice for the restoration of carious teeth<sup>8</sup>.

Wong and Freeman in their study confirms the mercury allergy is a factor in the pathogenesis of oral lichenoid reaction and healing of oral lichenoid reaction after replacement of amalgam restorations with Glass ionomer or composite resin<sup>9</sup>. It has been proposed that hypersensitivity to mercury from corroding amalgam fillings plays an important part in the etiology of oral lichen planus. Some studies have demonstrated hypersensitivity to mercury among 16.0-62.0% of patients with oral lichen planus, whereas mercury hypersensitivity has been found in 1.0-4.0% in the general population of Sweden<sup>10</sup>. Only in 10.0% of the patients the mucosal affections disappeared after replacement of type II glass ionomer cements or composite resins<sup>11</sup>. Further, the presence of lichen planus on the oral mucosa may well render the patients more susceptible to mercury hypersensitivity because of the increased penetration of the affected oral mucosa by mercury<sup>12</sup>.

A recent study demonstrated a different response of lichenoid mucosal lesions to replacement of amalgam fillings depending on the extensions of the lesions: those lesions, denoted contact lesions, which were confined to the area of contact with amalgam showed a total or almost disappearance without recurrence after replacement, whereas lesions exceeding the contact zone showed minor changes only<sup>13</sup>. In Conditions like lichenoid reactions secondary to silver amalgam restorations, using composite restoration having added advantages like good aesthetic and wear resistance properties compare to other restorative materials.<sup>13</sup>

### Conclusion

Silver amalgam has been used as a dental restorative material for more than 150 years. Even today, with the advent of new synthetic tooth coloured materials, silver amalgam is the most widely used and cost-effective dental material in restorative dentistry<sup>14</sup>. Local allergic reactions are rare, and when they occur, they can be eliminated by substitution with glass ionomer or composite resin<sup>15</sup>. In the present case, amalgam restorations were removed & temporary restorations were done & the patient was recalled after 1 month. According to the studies conducted so far, tissues will become normal within 1 month after the removal of amalgam restoration. The present article gives information about allergic reactions related to silver amalgam restorations and its managements.

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# Fusion in deciduous dentition

\* Ebin T.M., \*\* Archana A. Thomas

## Abstract

Fusion of teeth refers to the union of two normally separated tooth germs. Depending upon the stage of development of the teeth at the time of union, fusion may be either complete or incomplete. Fusion in deciduous dentition can be of great clinical significance as it may contribute to esthetic concerns, space problems, occlusal disturbances, and delayed eruption of the permanent successors. Here we report a case of fusion of a deciduous mandibular lateral incisor with canine. Clinical observation along with intra oral periapical radiograph confirmed the diagnosis. This case report emphasizes the need for careful examination and treatment planning as they may be associated with anomalies in the succeeding permanent dentition.

Key words: Deciduous dentition, fusion, lateral incisor and canine

## Introduction

Fusion of teeth refers to the union of two normally separated tooth germs, and depending upon the stage of development of the teeth at the time of union, it may be either complete or incomplete. They are joined by dentin, pulp chambers and canals may be linked or separated depending on the developmental stage when the union occurs. This process involves the interaction of epithelial and mesenchymal germ layers resulting in irregular tooth morphology.<sup>1</sup>

The etiology of double teeth may be attributed to evolution, trauma, heredity and environmental factors. Tooth germs in the same developmental stage and located close to each other are also postulated to have a high occurrence of adjacent anterior double teeth. Some researchers proposed that this alteration occurs as a result of physical forces that bring the developing teeth in contact, by causing necrosis of the epithelial tissue which usually separates them and finally leading to fusion. Others believed that fusion results from embryological persistence of the inter-dental lamina between 2 germs.<sup>2,3</sup>

This anatomic irregularity occurs more often in the deciduous (0.5%) than in the permanent (0.1%) dentition with a rare chance of bilateral involvement in the primary dentition (0.01-0.04%)

as compared to the permanent dentition (0.05%). Fewer cases of fusion involving molar and premolar teeth have been reported, also, in both the dentitions, the prevalence is higher in the anterior region as compared to the posterior.<sup>4,5</sup>

## Case report

A 4-year-old boy came to the Department of Pedodontics and Preventive Dentistry, St. Gregorios Dental College, Chelad, Kerala, with the chief complaint of pain in the mandibular posterior region of the jaw for one week. The pain was severe, localized, radiating in nature, and aggravated on taking food. Medical history was not significant. Extra oral examination did not reveal any abnormalities. Intraoral examination revealed mixed dentition along with fusion of the mandibular left primary lateral incisor and primary canine (Fig. 1). Caries involvement along with sinus opening in the attached gingival was present in relation to 74, and dental caries was evident in tooth numbers 65, 84, 85.

The child's dentition exhibited Angle Class I molar relation on both sides. Further investigations included periapical radiograph of the left mandibular canine region and left mandibular posterior region. The intra oral periapical radiograph (Fig. 2) of mandibular left anterior region showed the following characteristics:

- Primary left lateral incisor and canine (72; 73) were fused.
- Two separate pulp chambers and root canals were present.

Based on clinical and radiographic findings, the diagnosis of fusion of the mandibular left primary

\* Senior Lecturer, \*\* Reader and HOD., St. Gregorios Dental college, Chelad, Kothamangalam, Pin- 686681

Send Correspondance: Dr. Ebin T.M, Senior Lecturer, St. Gregorios Dental College, Chelad, Kothamangalam, Pin- 686681; email: [ebinebintm@yahoo.com](mailto:ebinebintm@yahoo.com)



Fig. 1



Fig. 2

lateral incisors and primary canine was confirmed. Intraoral periapical radiograph of 74 confirmed the pulpal involvement indicating endodontic intervention.

Pulpectomy of 74 was carried out and carious tooth were restored with glass ionomer cement. Patient was recalled on a later date for stainless steel crown placement on 74. Patient and parent were informed about the fused teeth and periodic recall was advised.

### Discussion

The anomaly of double teeth has been described in several different terms, such as Fusion, Gemination double teeth and twinning.

While the literature on the occurrence of double teeth is extensive, there is still much discussion concerning the nomenclature. According to Shafer et al, twinned, conjoined, double, or triple teeth can be grouped under the following headings: gemination, fusion, and concrescence

Fusion arises through the union of two normally separated tooth germs resulting in bifid crown and two root canals where as Gemination arises from an attempt at division of single tooth germ resulting in bifid crown with a single root or root canal<sup>1,6</sup>.

Concrescence is actually a form of fusion that occurs after root formation has been completed, and the teeth are united by only cementum.<sup>1</sup>

In clinical situations, cases of fusion have the appearance of a congenitally missing tooth, while in gemination the number of teeth in the dentition is normal, provided the double tooth is counted as one unit.<sup>4</sup>

According to Neville et al gemination is defined as a single enlarged tooth or joined (i.e. double) tooth in which the tooth count is normal when anomalous tooth is counted as one and fusion is defined as a single enlarged tooth or joined (i.e. double) tooth in which the tooth count reveals a missing tooth when anomalous tooth is counted

as one<sup>5</sup>.

The differential diagnosis between fusion and gemination, based on the number of teeth present on the dental arch, is not, however, always accurate.<sup>7</sup>

Since fusion can also be the union of a normal tooth bud to a supernumerary tooth germ, the number of teeth is also normal and differentiation from gemination may be very difficult, if not impossible. Finally, some authors simply call the phenomenon "double teeth" or "connoted teeth" to avoid confusion over their terminologies.<sup>4</sup>

Deep grooves present between the fused teeth may be susceptible to caries and periodontal disease; they may require endodontic intervention in some cases.

These grooves are very pronounced in cases of incomplete fusion and are difficult to clean and considered to be caries prone zone.<sup>8,9</sup>

Many a times, these grooves form an easy portal for organisms to enter the periodontium and cause a risk of space infection. In such cases, prophylactic application of pit and fissure sealants or adhesive restorative cements, like glass ionomer as early as possible may prove to be most effective option.<sup>11</sup>

The greater root surface area of fused primary teeth may delay its resorption, which in turn will cause delayed eruption of the successional teeth.<sup>4</sup>

Treatment of a fused tooth will depend on the clinical situation. When detected the progression of eruption of permanent teeth should be monitored closely by careful clinical and radiographic observation. When appropriate, extraction may be necessary to prevent abnormality of eruption. Occasionally fusion in primary dentition is associated with absence of underlying permanent dentition.

General preventive advice should be given to parent and the child, and caries already exists, a restoration should be performed.

Advanced treatment like sectioning and restoration, reconstruction with metalloplastic crown, amputation of one root, etc. greatly depends on location and extent of fusion.<sup>11</sup>

### Conclusion

Fused teeth contribute to esthetic concerns, space problems, occlusal disturbances, and delayed eruption of the permanent successors. Also, they raise concerns about periapical pathologies. Hence, careful monitoring of the condition is recommended. Meticulous history taking, clinical and radiographic examinations can provide vital information required for the diagnosis of such abnormalities. Long term follow up of treated case is mandatory. Thus, to establish a right treatment to this anomaly, the early proper examination and knowledge to recognize this anomaly is a prerequisite.

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# A rare case report of anhidrotic ectodermal dysplasia in a family

\* Harikumar M., \*\* Sivakumar M., \*\*\* Rahul R., \*\*\*\* Abhilash Krishnan, \*\*\*\*\*Plato Palathingal \*\*\*\*\* Joseph Mathew Thachil

## Abstract

Anhidrotic ectodermal dysplasia (EDA) is a rare genodermatosis characterised by developmental defects of structures derived from ectoderm. The clinical triad consists of hypodontia, hypotrichosis, and anhidrosis with other additional symptoms. Orofacial characteristics of this syndrome include anodontia or hypodontia, hypoplastic conical teeth, underdevelopment of the alveolar ridges. In this article we present two male patients with hereditary ectodermal dysplasia in same family.

Keywords:

Christ-Siemens-Touraine syndrome  
Anhidrotic / Hypohidrotic ectodermal dysplasia  
Hypotrichosis  
Oligodontia  
HED- Hypohidrotic ectodermal dysplasia

## Introduction:

Anhidrotic ectodermal dysplasia (EDA) also termed as Christ-Siemens-Touraine syndrome was first described by Thurman in 1848 and later mentioned by Darwin. However, the different aspects of this disorder, such as its genetics, inheritance pattern, and clinical presentations were further elaborated by Christ Siemens, and Touraine, hence the name Christ-Siemens-Touraine syndrome.<sup>1</sup> This case report of Anhidrotic ectodermal dysplasia (EDA) in south Indian family was aimed at raising the local index of clinical suspicion by highlighting the reality of rarities, with appropriate diagnostic support.

## Case Report:

A 24 year old male and his younger male sibling of age 3 years presented to the department of Oral Medicine, Raja Muthiah Dental College with chief complaint of missing tooth and sparse hair over the scalp (Fig. 1&2). Patients gave a history of complete absence of sweating and intolerance to heat since birth. As they grew, there was failure of

teeth eruption, progressive hyper pigmentation around eyes and mouth. Patient also gives history of loss of hair mainly over scalp region. Family history revealed that patient's parents had consanguineous marriage. Family members were systematically evaluated to characterize the pattern of inheritance and clinical features.

On extra oral examination there was frontal bossing, loss of one third of eyebrow, low set ears, parrot beak nose and depressed nasal bridge. Lips were protuberant due to absence of permanent teeth. Skin was soft, thin and dry with hyper pigmentation around eyes and hair line region (Fig. 1 & 2).

Intraoral examination revealed partially edentulous upper arch and completely edentulous lower arch. Teeth appeared hypoplastic and conical (Fig. 3 & 4). In view of the above short listed positive findings, both the cases were provisionally diagnosed as anhidrotic ectodermal dysplasia.

Differential diagnosis considered were Naegeli syndrome, Rapp Hodgkin syndrome, Ellis van creveld syndrome.

Orthopantomograph of 24 year old male showed absence of all permanent teeth except right maxillary first premolar and left canine and second molar and underdeveloped maxillary and mandibular alveolar ridges (Fig. 5).

Lateral cephalogram of younger male sibling showed absence of all primary teeth except maxillary right primary molars and incisors and unerupted maxillary left primary molars and mandibular incisor (Fig. 6). There was no evidence of permanent tooth buds.

\* Senior Lecturer, Rajas Dental College, Tirunelveli,  
\*\* Dental Surgeon in ESI V Ayanavaram; \*\*\* Senior Lecturer, Azeezia College of Dental Sciences and Research, Meeyannoor, Kollam \*\*\*\* Senior Lecturer, Sri Sankara Dental College, Varkala, \*\*\*\*\* Senior Lecturer, PSM Dental College, Akkikkavu \*\*\*\*\* Senior Lecturer, St. Gregorios Dental College, Chelad

Send correspondence: Dr. M. Harikumar, Senior Lecturer, Division of Oral Medicine & Radiology, Rajas Dentaal College, Tirunelveli (dist), Tamilnadu Mob. 9443687513 Email: [drhari.omrd@gmail.com](mailto:drhari.omrd@gmail.com)



Fig. 1 & 2



Fig. 3 & 4



Fig 5

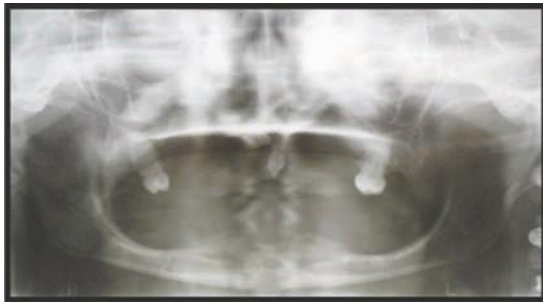


Fig 6

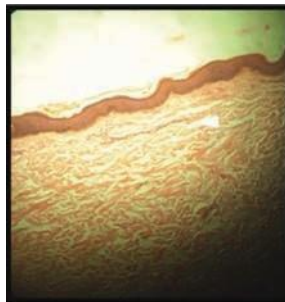


Fig 7

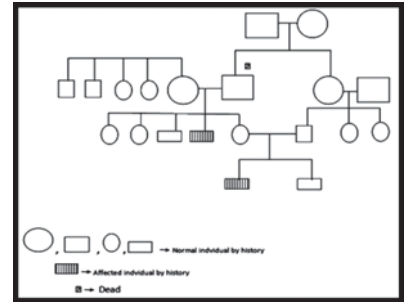


Fig 8

Laboratory investigations were carried out and found to be within normal limits. Biopsy specimens of 24 year old male obtained from the outer surface of thigh was examined for sweat glands and skin appendages. There was reduction in the number of sweat glands, hair follicles, sebaceous glands and the epidermis was thin and flattened (Fig. 7). Eccrine sweat glands were few and very rudimentary. Histopathologic findings were in favour of ectodermal dysplasia and the case was finally diagnosed as Anhidrotic ectodermal dysplasia.

**Discussion:**

According to by Freire-Maia [1971, 1977], Ectodermal dysplasia's (EDs) are defined as congenital disorders characterized by alterations in two or more ectodermal structures, at least involving one in hair, teeth, nails, or sweat glands.<sup>2</sup>

Ectodermal dysplasia's (EDs) represent a vast group of diseases comprising more than 170 different clinical conditions. They occur mainly due to developmental impairment of epidermal appendages and are characterized by a primary defect in at least one of the following tissues: nails (dystrophic, hypertrophic, abnormally keratinized), hair (hypotrichosis, partial or total

alopecia), teeth (abnormal or absent) and sweat glands (hypoplastic or aplastic). EDs are rare diseases with an estimated incidence of seven in 10,000 births. They follow all possible Mendelian modes of inheritance (autosomal dominant or recessive, X-linked dominant or recessive) but sporadic cases are also described.<sup>3</sup> In this case the pedigree of the last two generations of the family was constructed (Fig. 8). Based on the pedigree, we suggest that the EDA is X-linked, manifesting in males.

According to the state of sweat glands involvement, two major groups are distinguished: (1) Hypohidrotic or anhidrotic (Christ-Siemens-Touriane syndrome) in which sweat glands are either absent or significantly reduced in number; (2) Hydrotic (Clouston syndrome) in which sweat glands are normal.<sup>4</sup>

This X-linked recessive disorder affects males and is inherited through female carriers. The diagnostic tool is the typical clinical physiognomy. EDA is also characterized by the triad of signs comprising sparse hair (atrichosis or hypotrichosis), abnormal or missing teeth (anodontia or hypodontia) and inability to sweat due to lack of sweat glands (anhidrosis or hypohidrosis). The lack of teeth and the special

appearance were reported to be major concerns. Most patients with EDA have a normal life expectancy and normal intelligence. However, the lack of sweat glands may lead to hyperthermia, followed by brain damage or death in early infancy, if unrecognized. Thus an early diagnosis is important.<sup>5</sup>

The oral phenotype includes multiple congenitally missing teeth, root and crown dysmorphism, mainly conical-shaped crowns, and reduced salivary flow. Microdontia is frequently observed in affected individuals. Moderate to severe taurodontism is known to preferentially affect the second primary mandibular molars in some individuals with HED.<sup>7</sup>

Abnormalities of hair are present in all affected individuals. Most individuals have sparse, fine, slowly growing scalp hair. Some individuals become completely bald by their middle teens, whereas other individuals have normal amounts of scalp hair, though it may exhibit an abnormal texture. Sparse eyebrows and eyelashes were frequently observed. Most individuals show decreased body hair, pubic hair, and/or axillary hair, but these features are more variable. However, beard and moustache hair are normal. About half of the affected individuals exhibit mild fingernail abnormalities and nail dystrophy. Slow nail growth and split nails are most often reported.<sup>7</sup>

Mucosal involvement frequently leads to atrophic rhinitis, sinusitis, dry mouth, dysphagia, hoarseness of voice, and bronchitis. Corneal opacities, cataracts, and subluxation of the lens are also reported in the literature. Absence of lacrimal puncta is also a typical finding. Conductive deafness and hypoplasia or aplasia of the breasts has also been reported.<sup>10</sup>

The radiograph is of invaluable service in ascertaining the presence of hypo or anodontia and in ruling out pseudoanodontia.<sup>8</sup>

Fetal skin biopsy with fetoscopy can further assist in prenatal diagnosis of some congenital skin genetic disease like EDA when gene analysis is not entirely clear, so that enough information can be collected for the pregnant women to make an informed choice on the continuation or termination of pregnancy.<sup>11</sup>

Children with ectodermal dysplasia present with plethora of clinical problems from early childhood through adolescence and also present a life-long need for maintenance care and revisions. For the patients as well as the dentists tooth agenesis and its secondary effects on growth

and development of the jaws is main clinical concern. The goal of the treatment is to restore the form and function of the teeth, normalise the vertical dimension and support the facial soft tissues.<sup>7</sup> Implant supported prostheses are used with a relatively high implant survival rate in persons with HED.<sup>9</sup>

Recently, groundbreaking experimental approaches with recombinant EDA or transgenesis of EDA-A1 were developed from the perspective of systemic treatment and appear very promising.<sup>9</sup>

### Conclusion:

Young patients with EDA need to be evaluated early by a dental professional to determine the effects of EDA on oral tissues and the overall psychological aspects. Prosthetic and aesthetic rehabilitation will improve patient's quality of life. The most important factor is genetic counselling of the involved family which plays an important preventive role.

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# Ellis-Van Crevald Syndrome

\* Arun Roy James, \*\* Shanthala B.M.

## Abstract

Ellis-Van Crevald syndrome is an autosomal recessive disease, associated with mutations in two nonhomologous genes. Its prevalence is 1 per 60,000 in general population. Patients show pre/postnatal short stature which is characterized by skeletal anomalies, abnormalities of heart, respiratory and urogenital system, with involvement of nails and hair. The characteristic oral findings are multiple frenal attachment in the maxillary arch with hypodontia and hypoplasia. The infantile mortality is high in this syndrome as a result of pulmonary insufficiency with the involvement of multiple systems of the body. The management of EVC syndrome requires a multidisciplinary approach. This paper presents a case report of 19 month old female with characteristic features of EVC syndrome.

Key words – EVC syndrome; skeletal abnormality; polydactyly; multidisciplinary approach.

## Introduction

Richard W.B Ellis and Simon Van Crevald first described the Ellis Van Crevald syndrome in 1940. It is a rare genetic disorder and manifests as a chondroectodermal dysplasia. It is characterized by short limbed dwarfism, polydactyly, congenital heart disease and dysplastic nails and teeth<sup>1,2</sup>. The inheritance is as autosomal recessive trait<sup>3</sup>. Its incidence is reported 5 per 1000 live births in populations like Amish and Arabs of Gaza strip and in general population is 1 per 60,000 live births<sup>4</sup>.

In most of the cases in EVC syndrome multiple organs is involved. For instance 60% of cases congenital heart disease of atrium or septal defect is reported. The respiratory insufficiency is seen in 50% of cases and occasional involvement of urogenital and central nervous system is also seen<sup>5</sup>. The respiratory insufficiency is mainly due to defective skeletal rib cage development. Approximately one half of the patients die in early infancy due to cardiorespiratory problems.<sup>6</sup>

The oral finding in EVC syndrome include dystrophic philtrum, fusion of the middle portion of the upper lip to the maxillary gingival margin

eliminating the maxillary labial vestibule and the presence of numerous frenula tethering the upper lip to gingiva. At the crest of edentulous mandibular incisor region multiple small alveolar notches is present giving a serrated appearance. Hypodontia, enamel hypoplasia, delayed eruption, anodontia and abnormal teeth position of primary and permanent dentition is seen. Natal teeth is reported in 25-30% of cases and supernumerary teeth in some cases<sup>7,8</sup>.

The management of EVC syndrome is multidisciplinary comprising of cardiologist, pulmonologist, orthopedician, urologist, physical and occupational therapist, dentist, psychologist, developmental pediatrician and pediatric neurologist. It is relevant to our consideration as it exhibits multiple intra-oral manifestations.

## Case report

A 19 month old female patient reported to our department with chief complaint of delayed eruption of teeth. (Fig-1) Family history revealed consanguineous marriage among the parents. General examination revealed disproportionate physical growth with hypoplastic nails and polydactyly of both hands and feet. (Fig-2&3) The recorded infantogram showed normal spine, cardiomegaly, short ribs in the anterior aspect, short femur, humerus, ulna and radius. Radiographs of both upper limb and lower limb showed polydactyly and short tibia, fibula, femur,

\* Reader, Dept. of Pedodontics, Mar Baselios Dental College, Thangalam P.O, Kothamangalam, Ernakulam District, Kerala - 686 691 e-mail: drarunroy@gmail.com

\*\* Prof. HOD Dept. of Pedodontics, Coorg Institute of Dental Sciences, Virajpet, Karnataka.



Fig. 1 Obliteration of philtrum noticed



Fig. 2 Polydactyly of hands located postaxially with dysplastic nails



Fig. 3 Polydactyly of legs located postaxially with dysplastic nails



Fig. 4 Intra oral appearance of maxilla



Fig. 5 Intra oral appearance of mandible

humerus, ulna and radius. The delivery was full term and normal. The milestone in development till age is found to be normal.

The oral examination revealed obliteration of philtrum. The upper lip was fused to the maxillary gingival margin obliterating the labial vestibule and with the presence of numerous frenal attachment.(Fig-4) In mandible multiple notches giving a serrated appearance of the ridge was seen.(Fig-5) The teeth present were 55 65 and 74. (Fig-4&5) In cognizance our patient presented with characteristic features of Ellis-Van Creveld syndrome.

### Discussion

The Ellis-Van Creveld syndrome or chondroectodermal dysplasia is a genetic disorder inherited as autosomal recessive trait<sup>9</sup>. The clinical features of EVC syndrome is skeletal dwarfism, polydactyly and multiple frenal attachments in the maxilla. Skeletal dwarfism is due to short femur, tibia, and fibula of the lower limb and short humerus, radius and ulna of the forearm. Postaxial

polydactyly is seen in both the limbs. In 60% of cases congenital heart diseases is reported either of only atrial or septal defect<sup>10</sup>. The other features of the syndrome are poorly developed ribs, hypoplastic or aplastic nails with occasional renal disorder and mental retardation. Pulmonary insufficiency is reported as a consequence of poorly developed ribs and approximately 50% of the patients die in early infancy due to cardiorespiratory problems<sup>6</sup>.

The diagnosis of EVC is based on clinical and radiological features. Clinically features of multiple frenal attachment in the maxilla, short stature and polydactyly. Radiographically from fused carpal bones, slanting proximal tibial metaphyses and cone shaped epiphyses<sup>5</sup>. The differential diagnosis of EVC syndrome is made from asphyxiating thoracic dystrophy, achondroplasia, chondrodysplasia, morquio syndrome, and cartilage-hair hypoplasia<sup>3</sup>. The present case presented with characteristic dental and skeletal findings to diagnose as EVC syndrome.

The multidisciplinary approach in the



management of EVC syndrome has improved the quality of life and life expectancy of such patients. The multidisciplinary approach comprises of dentists, cardiologist, pulmonologist, orthopedician, urologist, physical and occupational therapist, psychologist, developmental pediatrician and pediatric neurologist<sup>10</sup>. The dental management comprised of pedodontist, periodontist, prosthodontist and orthodontist. Pedodontist for caries prevention, frenectomies and prosthesis during early dentition period.

Orthodontist for growth assessment of developing jaws and timely interventions for orthognathic corrections, periodontist for vestibuloplasty and prosthodontist for construction of prosthesis in later stages of permanent dentition. The role of cardiac and thoracic surgeon is to rehabilitate cardiothoracic deformities and orthopedic surgeon for the correction of polydactyly and genu valgum. The present case is diagnosed in the early age with cardiomegaly. The specialist management requires corrective surgery for genu valgum by orthopedician and pediatric cardiologist for screening of the condition to intervene when required. The dental management comprises of frenectomies, vestibuloplasty, prosthesis for missing teeth, caries prevention and periodic maxillary and mandibular growth assessment.

The EVC syndrome is inherited as autosomal recessive trait with parents as carriers of defective homologous genes located at chromosome location 4p165. In 30% of EVC syndrome parental consanguinity is reported<sup>3</sup>. The chance of inheritance pattern is 25%. Our present case is first child of such consanguineous parents. So it is advisable in future pregnancy for the molecular biological testing and preconceptional vitamin

therapy along with prenatal diagnosis by level II ultrasound scan and mid-trimester anomaly scan at 12 weeks and 16 weeks respectively to look for skeletal abnormality.

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# Oral Papilloma with an unusual koilocytic dysplasia

\* B S Sreenivasan, \*\* Giju Baby George, \*\*\* Jubin Thomas, \*\*\*\* Jassim K A, \*\*\*\*\* Deepu George Mathew

## Abstract

Benign epithelial proliferations in the oral mucosa like papilloma are often induced by Human Papilloma virus (HPV). The HPV infected epithelial cells (koilocytes) shows characteristic alterations like pyknotic nuclei with perinuclear clear zones. The presence of koilocytes is usually documented in the superficial layers of the epithelium, not on the basal layer. There are very few reported cases of oral papillomas exhibiting dysplastic features.

We report an unusual case of oral Papilloma presenting clinically as a white papillary growth which on histologic examination exhibited dysplastic features and basal cell koilocytes (koilocytic dysplasia). The role of HPV subtypes in the etiology of benign proliferation and malignant transformation of epithelial cells are discussed.

Keywords: Koilocytic dysplasia, Human Papilloma virus, Oral Squamous Papilloma.

## Introduction

Oral Squamous Papilloma (OSP) is a benign proliferation of the stratified squamous epithelium. The usual sites of these lesions are the tongue and soft palate.<sup>1</sup> Its average size is less than 1.0 cm of duration ranging from weeks to 10 years.<sup>2</sup>

The Human Papilloma virus (HPV) has important role in the etiology of the lesion.<sup>1</sup> The HPV DNA have been detected in 50 to 68% of oral squamous papillomas.<sup>1,3</sup> The HPV infected epithelial cells (koilocytes) shows characteristic alterations like pyknotic nuclei with perinuclear clear zones.<sup>1</sup> The presence of koilocytes is usually documented in the superficial layers of the epithelium, not on the basal layer.<sup>4</sup>

There are very few reported cases of oral papillomas exhibiting koilocytes with dysplastic features.<sup>5</sup> This is a case report of a papilloma on the soft palate which on histologic examination exhibited dysplastic features and basal cell koilocytes (koilocytic dysplasia).<sup>6</sup>

## Case presentation

A 70 year old female patient presented with a complaint of a small growth in the posterior palate since six months which gradually increased in

size. The lesion presented as a small nontender, pedunculated, pinkish white swelling of size 4x4 mm (Fig.1).

It had a rough surface with numerous projections and was firm in consistency. There was no associated skin or genital lesion.

Based on the history and clinical features a provisional diagnosis of squamous papilloma was made and the differential diagnoses considered were verruca vulgaris, condyloma acuminatum, focal epithelial hyperplasia and fibroma.

Excision of the lesion was done and histopathological examination showed a hyperplastic parakeratinized stratified squamous surface epithelium forming papillary projections in association with a fibro vascular connective tissue core (Fig.2). The epithelium exhibited basilar hyperplasia, acanthosis, increased nuclear-cytoplasmic ratio (Fig.3), and koilocytes in the basal and suprabasal regions (Fig.4). The dysplastic cells were limited to the basal third only. Immunohistochemical study was done to assess the proliferation with a proliferative marker. Cells on the lower third of the epithelium showed nuclear positivity for MIB-1 (Fig.5).

Based on the clinical, histopathological and immunohistochemical examination, final diagnosis of Viral Papilloma with Koilocytic Dysplasia-Mild was made. Post operative follow up was done for 3 months and no evidence of recurrence was seen.

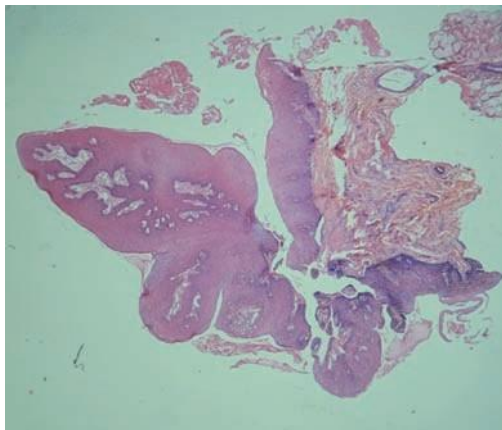
## Discussion

Oral squamous papilloma (OSP) is a benign proliferation of the stratified squamous

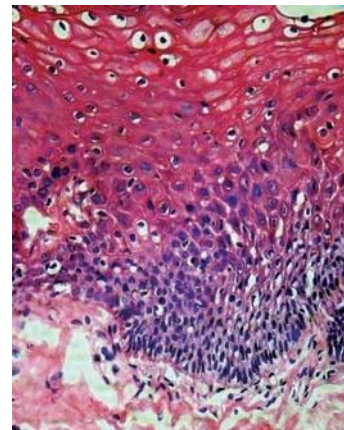
\* Professor & HOD, Department of Oral Pathology & Microbiology; \*\* Professor & HOD, Department of Oral Medicine & Radiology; \*\*\*Senior Lecturer, \*\*\*\* P G Student, \*\*\*\*\* Reader, Department of Oral Pathology & Microbiology, Mar Baselios Dental College, Kothamangalam, Ernakulam (Dist). Kerala. INDIA. PIN-686691.



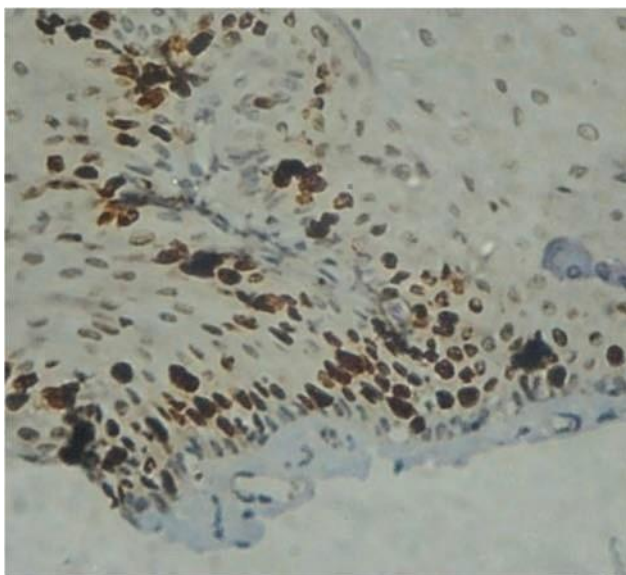
*Fig. 1* The lesion presenting as a small pedunculated swelling in the posterior palate as indicated by the black arrow.



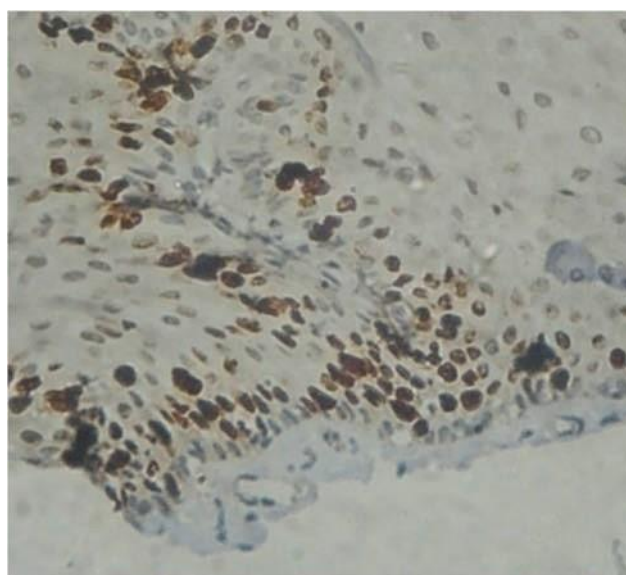
*Fig. 2* Scanner view showing a papilloma with parakeratinized stratified squamous surface epithelium in association with a fibrovascular connective tissue core (Hematoxylin and Eosin staining).



*Fig. 3* Low power view showing epithelium with basilar hyperplasia, acanthosis, increased nuclear-cytoplasmic ratio (Hematoxylin and Eosin staining).



*Fig. 4* High power view showing epithelium showing koilocytes in the basal and suprabasal regions with basilar hyperplasia as indicated by white arrows (Hematoxylin and Eosin staining).



*Fig 5* High power view showing epithelial cells at basal one third being positive with Mib1.

epithelium.<sup>7</sup> At least 150 different types of HPV have been identified. They are predominantly located in the squamous epithelium, causing hyperplastic, papillomatous and verrucous lesions.<sup>8</sup> The HPV infected epithelial cells (koilocytes) shows perinuclear cytoplasmic vacuolization of cells of the spinous layer of the epithelium, producing perinuclear pale/clear halos, and pyknosis.<sup>1</sup>

In the present case koilocytes could be seen in the proliferating basal and suprabasal layers of the epithelium. The epithelium also exhibited dysplastic features like basilar hyperplasia,

acanthosis, and increased nuclear-cytoplasmic ratio and the dysplastic cells were confined to the basal one third of the epithelium. To assess the proliferative activity of the lesion, immunohistochemical analysis was done with MIB-1; a proliferative marker which showed nuclear positivity for cells on the basal third of the epithelium. There are few reported cases of viral papilloma exhibiting koilocytic dysplasia and the koilocytes were seen on the spinous and granular layers of the epithelium.<sup>4</sup> But in our case, the koilocytic cells were seen on the basal and

suprabasal layers also. This could be probably due to an infection by a new variant of HPV.

In the present case, other pathologies considered under differential diagnosis were verruca vulgaris, condyloma acuminatum, focal epithelial hyperplasia and fibroma. Verruca vulgaris is usually seen as a skin lesion and occurs in the oral cavity due to autoinoculation.<sup>1</sup> In our case, the lesion in the oral cavity was isolated and single. There was no associated skin lesion. Condyloma acuminatum is usually seen in the genital region.<sup>7</sup> It is usually seen secondarily in the oral cavity. Since our patient did not have genital warts, the possibility of condyloma acuminatum was also excluded. Focal epithelial hyperplasia was also ruled out since it occurs as multiple lesion and our case was an isolated swelling.<sup>1</sup> Histopathology showed proliferation of epithelial layer without any connective tissue changes. So the possibility of fibroma was also excluded.

High prevalence of koilocytes (koilocytosis) has been reported in Oral Squamous Cell Carcinoma (OSCC) cases.<sup>9</sup> This has led many scientists to believe that presence of koilocytes in histopathologic sections from OSCC cases makes it simple and reliable criteria to detect the presence of HPV in these lesions.<sup>10</sup> Following the HPV infection, the HPV genome is integrated into the host genome and two products are formed – ‘E6 protein’ and ‘E7 protein’ that induces proliferation and inhibition of apoptosis resulting in uncontrolled growth.<sup>10</sup>

#### Conclusion:

Human papilloma viruses are a group of genetically related organisms that infect stratified squamous epithelium. HPVs can induce proliferative changes in these cells resulting in both benign and malignant tumors.<sup>7</sup> Oral squamous papillomas often considered as a benign epithelial tumor which can be infected with HPV and present with dysplastic features. In our case koilocytes were seen on the basal layers, which is

an unusual histological feature. The clinical significance and potential for malignant transformation of koilocytic dysplasia remain to be investigated.

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# Peripheral giant cell granuloma

\* Varsha.V.K, \* Smitha.G.P, \* Yathindra Kumar .B.N, \*\* Smitha.K

## Abstract

Peripheral Giant Cell Granuloma or so called "Giant cell epulis" is the most common oral giant cell lesion. It normally presents as a soft tissue purplish-red nodule consisting of multinucleated giant cells in a background of mononuclear stromal cells and extravasated red blood cells. This lesion probably does not represent a true neoplasm but rather may be a reactive in nature, believed to be stimulated by local irritation or trauma but the cause is not certainly known.

This article reports a case of peripheral giant cell granuloma arising at the right mandibular free gingiva in a 18 year old man.

The lesion was completely excised to the periosteum level and there is no residual or recurrent, swelling or bony defect apparent in the area of biopsy after a follow-up period of 6 months.

## Introduction

Peripheral giant cell granuloma (PGCG) is a non-neoplastic lesion representing a local hyperplastic reaction to injury or inflammation<sup>1</sup>. BERNIER & CAHN proposed the term "peripheral giant cell reparative granuloma" for the peripheral lesion. Today, the term "peripheral giant cell granuloma" is universally accepted and used since the reparative nature of these lesions has not been verified so far<sup>2</sup>.

The pathogenesis of oral cavity PGCGs is still uncertain. It is considered to occur in response to local irritation or chronic trauma<sup>2</sup>. These are soft tissue lesions that rarely affect the underlying bone, though the latter may suffer erosion<sup>1</sup>.

The lesion can develop at any age, though it is more common between the fifth and sixth decades of life, and shows a slight female predilection<sup>3</sup>. Clinically they manifest as a soft to firm, bright nodule or as a sessile or pediculate mass, which is predominantly bluish red with a smooth shiny or mamillated surface, localized in the gingival tissue or alveolar processes of the incisor and canine region, through according to Pindborg the preferential location is the premolar and molar zone<sup>1</sup>.

\* Senior Lecturer, Department of Oral Pathology and Microbiology, Rajarajeshwari Dental College and Hospital, Bangalore; \*\* Reader, Department of Periodontics, Government Dental College and Hospital, Bangalore.

## Case report

A 18 year old male patient presented with a 15 days old history of pain in the lower right back region of oral cavity. Clinical examination revealed a sessile fibrous growth on the labial aspect of 46 arising from free gingiva measuring about 1.5cm x1cm (Photograph 1). It was tender on palpation. Radiographic examination did not reveal any abnormality.

After excision of mass, histopathological observation revealed nonencapsulated mass of tissue, containing numerous multinucleate giant cells lying in a very cellular stroma exhibiting large numbers of plump mononuclear cells, elongated or oval in shape and numerous blood vessels (Photomicrograph No 1 & 2)

## Discussion

PGCG is an infrequent reactive, exophytic lesion of the oral cavity, also known as giant-cell epulis, osteoclastoma, giant cell reparative granuloma, or giant cell hyperplasia. It is the most frequent giant cell lesion of the jaws, and originates from the connective tissue of the periosteum, gingiva or periodontal ligament<sup>4</sup>. Usually as a result of local irritating factors after tooth extraction, poor dental restorations, food impaction, ill-fitting dentures, plaque, and calculus<sup>5</sup>.

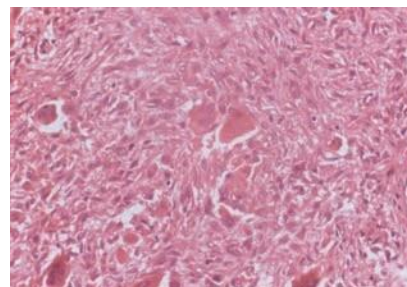
Clinically PGCG manifests as a sessile or pedunculated red-purple nodule located in the region of the gums or edentulous alveolar margins, commonly in the lower jaw<sup>3</sup>. The posterior part



Photograph 1



Photomicrograph 1



Photomicrograph 2: PGCG showing stroma composed of predominantly ovoid mononuclear cells and irregularly shaped multinucleated giant cells. (x40 magnification, H&amp;E stain)

of mandible premolar and molar area, appears to be most common site<sup>2</sup>. These are soft tissue lesions that rarely affect the underlying bone, though latter may suffer erosion and cup shaped radiolucency occurs<sup>1</sup>.

Histologically, PGCG presents as a not-well circumscribed mass, constituted by fibrillar collagenous stroma containing two types of mononuclear cells (spindle and ovoid cells) and interspersed numerous multinucleated giant cells "osteoclasts-like" or larger than typical osteoclasts, having rarely normal bone resorptive function. Sometimes these cells are also localized in the internal wall of vessels. It is present a chronic and often acute inflammatory infiltrate and hemosiderin-laden macrophages surround areas of haemorrhage. It is characterized by rich vasculature, particularly in the peripheral areas, consisting mainly of thin walled, small sized vessels.<sup>1</sup>

The differential diagnosis of PGCG particularly includes non ossifying fibroma which differs from PGCG lesions in consistency and colour; pyogenic granuloma which is difficult to distinguish from PGCG lesions; CGCG which is an expansive and destructive intraosseous lesion that can perforate the cortex, mimicking PGCG; chondroblastoma which, localized in the gum, may provoke irregular bone destruction below the exophytic lesion; odontogenic cyst; parulis, which is frequently associated with a necrotic tooth or with periodontal disorder; haemangioma cavernosum, which is distinguished from PGCG lesions by their pulsatile nature; fissured epulis<sup>6</sup>.

The treatment of PGCG comprises surgical resection, suppression of the underlying etiologic factors, and eliminating the lesion from the entire base of bone. If resection is only superficial, the

growth may recur<sup>7</sup>. Exposure of all bony walls following thorough surgical resection responds satisfactorily most of the time. In the case of periodontal ligament involvement, adjacent teeth may be extracted to ensure thorough resection<sup>3</sup>. Neville et al. claims that recurrence rates in large series of cases range from 11% to 50%<sup>8</sup>.

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# Root and root canal anatomy in mandibular first and second premolars: A literature review

\* Jain Mathew, \*\* Vijit Narayana, \*\* Tobin C. Paduvil

## Abstract

In all teeth, the incidence of the number of roots and the number of canals varies greatly. Mandibular premolars, in particular, also have been reported with numerous variations in dental literature. The overall success of root canal therapy is primarily dependent on a thorough knowledge of the root and root canal morphology. This article aims to present a literature review of the anatomy of the mandibular first and second premolars along with their various aberrations.

## Introduction

The overall success of root canal therapy is primarily dependent on a thorough knowledge of the root and root canal morphology. Both students and clinicians need to familiarize themselves with the intricacies, complexities and aberrations that are likely to occur within the pulp space<sup>1,2</sup>. Many of the difficulties in root canal treatment are due to variations in tooth morphology. Even treatment of uncomplicated multirooted teeth requires knowledge of the most frequent anatomical formations and of possible variations<sup>3</sup>.

Studies of variations have primarily described dental crown morphology rather than the root form. Variations in root form and number are likely to have a direct influence upon the configuration of the root canals in affected teeth. In all human teeth, the incidence of the number of roots and the number of canals varies greatly<sup>2</sup>. From a clinical standpoint, it is not always possible to observe these variations from radiographs. Thus, it is essential to develop a visual picture of the expected locations and numbers of canals in a particular tooth.

The pulp space is complex and root canals may divide and rejoin, and possess forms more complex than the simplified textbook descriptions. Many roots have additional canals and a variety of canal configurations. Numerous pulp space configurations have been identified<sup>4-6</sup>. In the simplest form, each root has a single canal and a single apical foramen. Commonly, however, other canal complexities are present and exit the root as

one, two or more apical canals<sup>7</sup>. In addition to the multiplicity of canals, the pulpal space also commonly contains isthmuses, lateral canals, apical ramifications and other irregularities.

Of the various tooth forms, the anatomy of the permanent mandibular premolars has received little attention in dental literature in comparison to the permanent molar teeth. Mandibular premolars have been shown to present with complex external and internal anatomical variations as reported in various ex-vivo studies and clinical case reports. The present article aims to present an anatomic review of the mandibular first and second premolars and additional root and canal aberrations.

## Anatomic studies

Methods of study of the internal anatomy of human teeth have included replication techniques<sup>8,9</sup>, ground sections<sup>10</sup>, clearing techniques<sup>4,11,12</sup> and radiography<sup>13-15</sup>. Advanced modes of radiographical imaging and analysis has allowed the appreciation of pulp space anatomy in three dimensions, increased our knowledge of the pulp space and allowed the identification of missed anatomy. These methods include Micro-computed tomography<sup>17</sup>, Spiral Computed Tomography<sup>18</sup> and Cone Beam Computed Tomography (CBCT)<sup>19</sup>. CBCT by means of its accuracy and minimal radiation exposure is proving to be a significant investigative tool to obtain a confirmatory clinical diagnosis with regards to the tooth anatomy<sup>20,21</sup>.

## Root anatomy

In most instances, mandibular first and second premolars have one root containing a single canal. More commonly encountered variations include

\* Professor & HOD, \*\* Sr. Lecturer, Dept. of Conservative Dentistry and Endodontics, St. Gregorios Dental College, Chelad, Kothamangalam

two roots and/or two canals<sup>22, 23</sup>. The solitary root frequently has developmental depressions or grooves on both the mesial and distal surfaces. The depression on the distal surface of the root has been described as the deeper of the two, especially in the first premolar<sup>24</sup>. However, a mesial invagination of the root of mandibular first premolars, with maximum depth in the middle third of the root, has also been reported in an Indian population<sup>18</sup>.

Numerous factors contribute to variations found in the root and root canal studies reported<sup>25</sup>. These factors include ethnicity<sup>26</sup>, age<sup>27,28</sup> and sex<sup>29</sup>. Higher incidences of teeth with additional canals and roots have been reported in Chinese, Australian, and sub-Sahara African populations<sup>30</sup>.

### Root and canal anatomy

#### a) Mandibular first premolars

Although most mandibular first premolars have a single root (95.42%), two- (5.76%), three-, and even four-rooted forms have been reported. The majority of mandibular first premolar teeth have a single canal (70.51%) but about 24.87% have two canals, while three or more canals have been reported in 1.66%.<sup>4, 5, 10, 15, 17 - 19, 31-52</sup>

#### b) Mandibular first premolars

Mandibular second premolars have an extremely high incidence of a single root (98.91%) and are more likely to have a single canal (87.75%). Studies have reported that the incidence of two or more canals in the second mandibular premolars can vary between 1.2% and 34.4%. An extremely low incidence of mandibular second premolars with three roots (0.1-3.4%) and/or three root canals (0.4% -2%) have been reported<sup>4, 5, 14, 15, 19, 31, 33,</sup>

<sup>36, 38, 42, 43, 48-51, 53-56.</sup>

#### c) C-shaped canals

An interesting and complicated anatomic variation in human teeth is the C- shaped canal configuration and is most commonly seen in the Mongoloid population<sup>57</sup>. Lu et al<sup>10</sup>, reported an extremely high incidence of C-shaped canals ranging from 18-24%, which included C-shaped canals and circumferential canals. Fan et al<sup>58</sup>, using micro- computed tomography, evaluated the root surface and root canal systems in mandibular first premolars with C-shaped. In 86 C-shaped roots, 93 radicular grooves were noted, with 78.5% grooves located on the mesiolingual surface of the root. The C-shaped canal varied considerably in shape at different levels, with 80% forming two canals at the apical level<sup>58</sup>. In 1992, Baisden et al<sup>59</sup>, using the cross section method, reported a 14% incidence of C-shaped canals in 106 mandibular first premolars in a United States population.

Sikri<sup>43</sup> reported 10% mandibular first premolars exhibiting C-shaped canals in an Indian population, while Sandhya et al<sup>18</sup> reported the variation in 2% teeth of the same population.

#### d) Clinical case reports

In addition to these numerous population studies, several case reports have also documented anatomic variations along with their endodontic management. Case reports tend to mislead the clinician with regards to the incidence of various aberrations; however their didactic value is of extreme importance. It allows the clinician to observe and diagnose various in-vivo tooth anatomical forms and also replicate them when treating patients. The anatomic aberrations reported as endodontic case reports in the literature include mandibular first premolars with 2<sup>60</sup> or 3 canals<sup>61</sup> in 1 root or 2 roots<sup>62, 63</sup>; 3 roots and 3 canals<sup>64</sup>; and 4 canals in 4 roots<sup>65</sup>. Mandibular second premolars have shown variations which include 2, 3<sup>61</sup>, 4<sup>66</sup> and 5 canals<sup>67</sup> in 1 root; 2<sup>68</sup>, 3<sup>63</sup> and 4<sup>69</sup> canals in 2 roots; 3 roots and 3<sup>64</sup> or 4 canals<sup>70</sup>.

#### e) Radicular developmental anomalies

Adding to the complexity of the mandibular premolars are various developmental anomalies. Dens invaginatus is a condition wherein the surface of the tooth is formed with a deep pit into the pulp space during tooth development, which subsequently becomes a route for infection into the pulp. Depending on the severity of the dens invaginatus, endodontic treatment could be difficult or very challenging. In 1997, Hartup<sup>71</sup> reported a Type III dens invaginatus and a bifurcated root of the mandibular first premolar. Tavano et al<sup>72</sup> reported a dens invaginatus wherein the clinical crown was larger than the contralateral first premolar. No case reports of dens invaginatus in the mandibular second premolar have been reported.

In the opposite condition dens evaginatus, the surface of the tooth formed into a very protuberant cusp during tooth development. There is a high risk of this cusp fracturing during function creating a route for infection of the pulp space. It is best managed by apexogenesis or prophylactic endodontic treatment<sup>73</sup>. The mandibular premolar is most frequently affected and is more often found in Mongoloid people. Stecker and DiAngelis<sup>74</sup> reported a dens evaginatus on the occlusal surface of the crown of all erupted premolars in a patient (maxillary first and second premolars and the mandibular first premolars).

Aryanpour et al<sup>75</sup> reported root canal and periodontal treatment of a geminated mandibular first premolar with three canals. Clinical



examination showed two distinct crowns with united roots. One canal was independent along its length while two canals joined.

### Clinical management

Slowey<sup>76</sup> has suggested that mandibular premolars may present with the greatest difficulty of all teeth to be treated endodontically. The use of magnification has been demonstrated to improve the clinician's ability to visualize and access canals<sup>77</sup>. Pre-operative radiographs are the most widely used diagnostic tool to detect internal and external anatomic aberrations of extra canals and/or roots. The following clues from diagnostic information and techniques might help clinicians detect additional root(s) and canal(s). A second radiograph from 15–20 degrees from either mesial or distal from the horizontal long axis of the root is necessary to accurately diagnose the number of roots and canals in premolar teeth<sup>78</sup>. Martinez-Lozano et al<sup>79</sup> have suggested a 40-degree mesial angulation of the x-ray beam to identify additional canals. A sudden narrowing of the canal system on a parallel radiograph or an abrupt straightening or loss of a radiolucent canal in the pulp cavity is suggestive of an extra canal in the same root or in the other, independent roots<sup>76</sup>.

Modified access cavity preparation is often required for successful management of extra canals. To achieve a straight-line access, the conventional access cavity can be modified depending on the particular clinical situation<sup>76</sup>. Careful observation of the pulpal floor can give important clues in detecting variable anatomy. Negotiation of the offshoot canal is often difficult due to a ledge of dentin that covers its orifices, the inclination of its orifices on the pulpal floor and the angle at which it exits the pulp floor. Most of these obstructions can be eliminated by 'troughing or countersinking' with ultrasonic tips. Care must be taken to avoid furcal / lateral wall perforation as concavities exist on its mesial and distal surfaces. The direction that a file takes upon introduction into an orifice is also important. If the initial file placed for example points to the buccal or the lingual, one should suspect a second canal. If two canals are present each will be smaller than a single canal<sup>2,12</sup>.

### Prognosis

Numerous endodontic failures after a routine treatment and flare-ups during the course of endodontics have been reported for mandibular premolars<sup>60,76</sup>. A study at the University of Washington in 1955 assessed the failure rate of endodontics in all teeth<sup>7</sup>. The mandibular first premolar had the highest failure rate in the study at 11.45%. Possible reasons for this conclusion are the numerous variations in root canal

morphology and difficult access to additional canal systems when present. However, various advancements in diagnostics, magnification, operative instruments and an updated knowledge with regards to the anatomy of mandibular premolars could certainly improve the endodontic success rates of even the most challenging cases.

### Conclusions

A review of the literature has revealed that the human mandibular premolars can have an extremely complex root and root canal morphology; however, the incidence of both multiple roots and multiple canals in the mandibular second premolar is lower than that found in the mandibular first premolar. Traditional descriptions of the frequently occurring root and canal forms of permanent teeth are based largely on studies conducted in Europe and North America, and may not be wholly applicable to teeth of non-Caucasoid origin. Thus, the variations from the norm and the incidence of that variation should be familiar to general practitioners who regularly treat different populations of diverse ethnicities. The use of 3-dimensional imaging methods in future anatomic studies would be of value in assessing the occurrence and the frequency of anomalous canal morphology.

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# Review on importance of Matrix Metalloproteinase

\* Jacob Kurian, \*\* Eapen Cherian, \*\*\* Jayasekharan V P

## Abstract

Matrix metalloproteinases (MMPs) – these wonder molecules are zinc-dependent endopeptidases; and they further subdivide into many; other family members are adamalysins, serralysins, and astacins.

The MMPs are highly organized molecules performing various functions and they are from family of proteases known as the metzincin superfamily. Collectively they are capable of degrading all kinds of extracellular matrix proteins, but also can process a number of bioactive molecules. MMPs were described by Jerome Gross and Charles Lapiere (1962) who observed enzymatic activity (collagen triple helix degradation).<sup>1</sup> MMPs are also thought to play a major role on cell behaviours such as cell proliferation, migration (adhesion/dispersion), differentiation, angiogenesis, apoptosis and host defense. Many more molecules were discovered in other organisms. They were first described in vertebrates (1962), including humans, but have since been found in invertebrates and plants.

Key words: chemokines, metamorphosis, cysteine, domains.

## Introduction – The Beginning

“Specialization is learning more and more about less and less”

Initially, the complex nature of biomolecules were given importance once technological advancements were made and need for finer details to complete the ‘vicious cycle’ of understanding various processes came up in research circles. The MMPs are known to be involved in the cleavage of cell surface receptors, the release of apoptotic ligands (such as the FAS ligand), and chemokine/cytokine in/activation.<sup>2</sup> Later it was purified from human skin (1968).<sup>3</sup> During tadpole tail metamorphosis (by placing a tadpole tail in a collagen matrix plate),<sup>4</sup> minute observations led to further insights in truly appreciating the molecule. The enzyme was named interstitial collagenase (MMP-1) and was recognized to be synthesized as a zymogen.<sup>5</sup> However, these hypotheses were insufficient and incongruous in imbibing the exact nature of the molecule. The jumbled links were corrected once the “cysteine switch” was described in 1990.<sup>6</sup>

## Structural Properties

The finer gamut of details and configurations are important for evaluating and in need,

replicating the essence of the same molecules. The MMPs share a common typical domain structure. The three common domains are the pro-peptide, the catalytic domain and the haemopexin-like C-terminal domain which is linked to the catalytic domain by a flexible hinge region.

## The pro-peptide

The MMPs are initially activated and initiated as a result of various biostimulating agents and co-ordinates. They are synthesized as inactive zymogens with a pro-peptide domain that must be removed before the enzyme is active. The pro-peptide domain is part of the “cysteine switch.” These molecules thus maintain the synergistic relations between the host cell and activities which further stimulates propagation. The switch contains a conserved cysteine residue which interacts with the zinc in the active site and prevents binding and cleavage of the substrate keeping the enzyme in an inactive form. In the majority of the MMPs, the cysteine residue is in the conserved sequence PRCGxPD. These complex architecture are understood for further transition and formulations of specific reactions. Some MMPs have a prohormone convertase cleavage site (Furin-like) as part of this domain which, when cleaved, activates the enzyme. MMP-23A and MMP-23B include a transmembrane segment in this domain.<sup>7</sup>

## Domain positioning

The domains which arise in these molecules are of varied importance and represent the true

\* Professor & HOD, \*\* Reader, \*\*\* Senior Lecturer, St Gregorios Dental College, Chelad, Kothamangalam, Kerala.

(Table 1)

MMP	Non-traditional substrate	Resultant effector	Matrix substrates
<b>Minimal domain</b> MMP-7/Matrilysin	Pro-a-defensin [41*] Decorin [13] Cell surface bound Fas-L [27*,28*]  B4 integrin [31] E-cadherin [32,33*] Plasminogen [60,61*] Pro-TNF $\alpha$ [39*] Pro-MMP-2,7	$\alpha$ -Defensin Bioavailable TGF $\beta$ Active soluble Fas-L Inactive soluble Fas-L Release of B4 integrin Bioactive E-cadherin ectodomain Angiostatin Bioavailable TNF $\alpha$ MMP-2,7	Proteoglycans, laminin, fibronectin, gelatin, collagen III/IV/V/IX/XI, fibrin/fibrinogen, entactin, tenascin, vitronectin
MMP-26/ Matrilysin-2/Endomatase	$\alpha$ 1-proteinase inhibitor [62] MMP-9 [63]	inactive serpin Pro-MMP-9 [63]	Gelatin, collagen IV, fibronectin, fibrinogen [62-64]
<b>Collagenases</b> MMP-1/Collagenase-1	Parlocan [12] IGFBP-2,3 $\alpha$ 1-antichymotrypsin $\alpha$ 1-proteinase inhibitor Pro-MMP-1,2 Pro-TNF $\alpha$	Bioavailable FGF Bioavailable IGF inactive serpin inactive serpin MMP-1,2 Bioavailable TNF $\alpha$	Collagen I/II/III/VI/X, gelatin, entactin, aggrecan, tenascin
MMP-8/Collagenase-2	$\alpha$ 1-proteinase inhibitor Pro-MMP-8	inactive serpin MMP-8	
MMP-13/Collagenase-3	$\alpha$ 1-antichymotrypsin Pro-MMP-9,13	inactive serpin MMP-9,13	
<b>Stromelysins</b> MMP-3/Stromelysin-1	Parlocan [12] Decorin [13] Pro-HB-EGF [18] Pro-IL-1-B [21] Plasminogen [59] E-cadherin [33*,65] IGFBP-3 $\alpha$ 1-antichymotrypsin $\alpha$ 1-proteinase inhibitor Pro-MMP-1,3,7,8,9,13 Pro-TNF $\alpha$ Pro-MMP-1,8,10	Bioavailable FGF Bioavailable TGF $\beta$ HB-EGF IL-1- $\beta$ Angiostatin Bioactive E-cadherin ectodomain Bioavailable IGF inactive serpin inactive serpin MMP-1,3,7,8,9,13 Bioavailable TNF $\alpha$ MMP-1,8,10	Proteoglycans, laminin, fibronectin, gelatin, collagen III/IV/V/IX/XI, fibrin/fibrinogen, entactin, tenascin, vitronectin
MMP-10/Stromelysin-2			
MMP-11/Stromelysin-3	$\alpha$ -1-proteinase inhibitor IGFBP-1	inactive serpin Bioavailable IGF	Laminin, fibronectin, aggrecan
<b>Gelatinases</b> MMP-2/Gelatinase A	Decorin [13] Pro-TGF-B2 [20*] Pro-IL-1-B [21] MCP-3 [36**] IGFBP-3/5 ProTNF $\alpha$ FGF-R1 [23] Pro-MMP-1,2,13	Bioavailable TGF $\beta$ TGF- $\beta$ 2 Active IL-1- $\beta$ inactive chemoattractant Bioavailable IGF TNF $\alpha$ Bioactive FGF-R1 ectodomain MMP-1,2,13	Gelatin, elastin, fibronectin, collagen I/IV/V/VI/IX/XI, laminin, aggrecan, vitronectin
MMP-9/Gelatinase B	Unknown [37**] Pro-TGF-B2 [20*] Pro-IL-1-B [21] Cell-surface bound IL-2Ra [22*] Plasminogen [60,61*] $\alpha$ 1-proteinase inhibitor [66*] Pro-TNF $\alpha$	Bioavailable VEGF TGF- $\beta$ 2 IL-1- $\beta$ Release of IL-2R $\alpha$ Angiostatin inactive serpin TNF $\alpha$	

structure of these molecules. These domains are mainly catalytic domains which are formulated for further enhancements of biomolecule reactions. X-ray crystallographic structures of several MMP catalytic domains have shown that this domain

is an oblate sphere. The active site is a 20 Å (2 nm) groove that runs across the catalytic domain. In the part of the catalytic domain forming the active site there is a catalytically important Zn<sup>2+</sup> ion, which is bound by three histidine residues found

in the conserved sequence HExxHxxGxxH. Hence, this sequence is a zinc-binding motif and this finding was one of the important key which truly projected these molecules in the foray of modern day research activities.

The gelatinases, such as MMP-2, incorporate Fibronectin type II modules inserted immediately before in the zinc-binding motif in the catalytic domain.<sup>7</sup>

### Riddle solved - pro-peptide described

The MMPs are initially activated and initiated as a result of various biostimulating agents and co-ordinates. They are synthesized as inactive zymogens with a pro-peptide domain that must be removed before the enzyme is active. The complex nature of pro-peptides had to be recognized in initiating and further proceeding with the developmental cascade. The pro-peptide domain was described as a part of the "cysteine switch." These molecules thus maintain the synergistic relations between the host cell and activities which further stimulates propagation. The switch contains a conserved cysteine residue which interacts with the zinc in the active site and prevents binding and cleavage of the substrate keeping the enzyme in an inactive form. These complex architecture are understood for further transition and formulations of specific reactions. MMP-23A and MMP-23B include a transmembrane segment in this domain.<sup>8</sup>

### The "delicate" cycle - Catalytic mechanism.

- The first mechanism proposed by Browner M.F. and colleagues<sup>9</sup> investigated the base-catalysis mechanism, in which multiple catalysts and molecules were involved. These were carried out by specific procedures involving conserved glutamate residue and the Zn<sup>2+</sup> ion, which provided the much needed binding in reactions.
- The second mechanism - the Matthews-mechanism, provided vital information regarding interdependence of these molecules in the dynamic state. Kester and Matthews<sup>10</sup> suggested an interaction between a water molecule and the Zn<sup>2+</sup> ion during the acid-base catalysis.
- The final mechanism – also known as the Manzetti-mechanism linked the interaction and non-interaction of biomolecules in shaping up the final output of synthesis, thus governing further reactions. Manzetti Sergio and colleagues<sup>11</sup> provided evidence that a co-ordination between water and zinc during catalysis was unlikely, and suggested a mechanism where in a histidine from the HExxHxxGxxH-motif participates in catalysis by allowing the Zn<sup>2+</sup> ion to assume a quasi-penta coordinated state, via its dissociation from it.

### ♦ Classification: (see table 1)

These details of mammalian MMPs and substrates<sup>12</sup> are useful in determining and understanding the true nature of these molecules and it proved significant in various in door and out door projects which involved complex mechanisms. The initial gaping hole in balancing the mechanism of biosynthesis and application of these molecules were removed once they were classified into specific categories (table 1) and thus MMPs became "talk of the town" in the realms of investigators.

The MMPs can be subdivided in different ways.

### Evolutionary

Use of study analytic methods and bioinformatic methods to compare the primary sequences of the MMPs guided the further protocols. The findings suggested the following evolutionary groupings of the MMPs:

- MMP-19
- MMPs 11, 14, 15, 16 and 17
- MMP-2 and MMP-9
- all the other MMPs

Analysis of the catalytic domains in isolation suggests that the catalytic domains evolved further once the major groups had differentiated, as is also

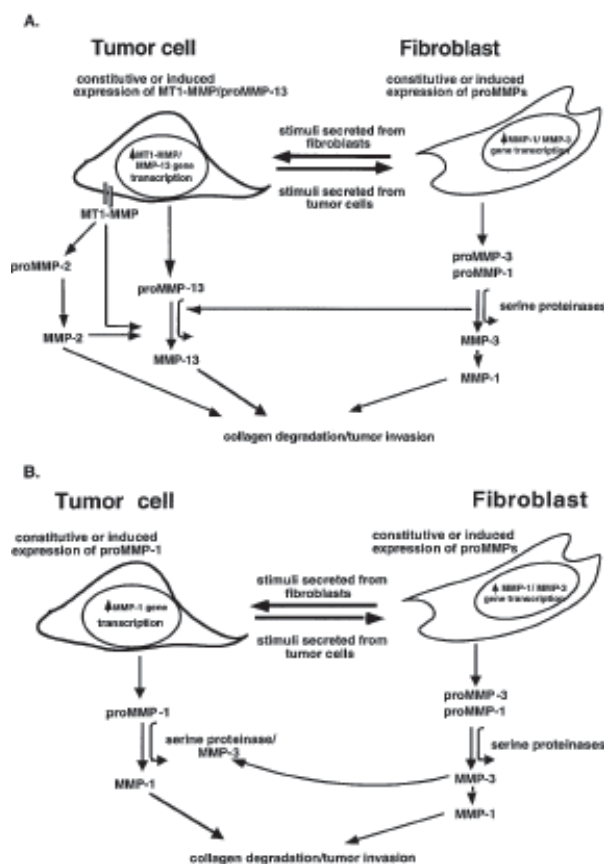


Fig. 1

indicated by the substrate specificities of the enzymes.

### Functional

The groupings were generated taking into consideration the substrate specificity of the MMPs and partly, the cellular localization. These groups are the collagenases, the gelatinases, the stromelysins, and the membrane type MMPs (MT-MMPs).

The collagenases are capable of degrading triple-helical fibrillar collagens into fragments. These collagens are the major components of bone and cartilage, and MMPs are the only known mammalian enzymes capable of degrading them. For example, Collagen #14 has been shown to cleave fibrillar collagen. The current list of collagenases includes #1, #2, #8, #9, and #13. #14 is not listed as a collagenase, while #11 is included in stromelysins.

The main substrates of the gelatinases are type IV collagen and gelatin. This gelatin-binding region is positioned immediately before the zinc binding motif, and forms a separate folding unit which does not disrupt the structure of the catalytic domain. The gelatinases are #2 and #9. The minimal domain positions included #2 and thus reactivation of the bio synthesis were analyzed using specific target molecules..

The role of MMPs in proteolytic cascades for activation of collagenases<sup>13</sup> in tumor cell invasion (see fig. 1)

### Functional importance

The MMPs are essential in cleavage of various biomolecules and plays an important role in tissue remodeling. They script the process of morphogenesis, angiogenesis, tissue repair and metastasis in functional events involved. MMP-2 and MMP-9 are thought to be important in up regulation and down regulation of molecular events. MMP-1 is thought to be important in rheumatoid and osteo-arthritis. Recent data suggests active role of MMPs in the pathogenesis of Aortic Aneurysm. Excess MMPs degrade the structural proteins of the aortic wall.

### Conclusion

The advancements in dentistry are of many folds now-a-days. More and more research activities and proposals are taken up by various core organizations and groups of individuals which certainly provides a pathway for a bright future in the field. But, the end of the tunnel is not near. One has to blend older technologies with

the future ones and sandwich it with the recent upcoming advancements to foresee the horizon of advancemental researches and further results. Matrix metalloproteinases is one such key element which can be highly credential and useful in understanding various molecular events which determine the success of a research. Further, more and more pioneer molecules and elements are to be understood for reaching the zenith of technological intricacies.

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# Importance of record-keeping in mass disaster victim identification

\* Eapen Cherian, \*\* William Thomas, \*\*\* Winnie Wilson, \*\*\* Annie Ramya Joji

## Abstract

The natural teeth are the most durable organs in the bodies of vertebrates, and human. Understanding of their past and evolution relies heavily upon remnant dental evidence found as fossils. The use of features unique to the human dentition as an aid to personal identification is widely accepted within the forensic field. Comparative dental identifications play a major role in identifying the victims of violence, and mass disaster. This article focuses the importance of record keeping by a general practitioner who can play an important role in the victim identification following a mass disaster.

## Introduction

Mass disasters can be caused by natural or man-made events following which visual identification of victims may be unpleasant or even difficult. In such situations, identifying victims using dental records play pivotal role in forensics.

Every practising dentist has a legal duty as in keeping some sort of record of each patient for whom they are providing dental care. A general dentist plays a vital role in writing case histories, storing records, casts and radiographs of each and every patient, so that in situations like case disputes, mass disasters, details can be looked up.

Everything from recording of broken appointments, serial number of the implants used, postal address, occupation, previous dentist name, dentition details, to the drug that was prescribed, the telephone conversation or preserve the referral letters and personalized denture markers should be stored in a customized manner.

## Discussion

"India is a disaster prone country hit by floods, cyclones, droughts, earthquakes and epidemics. Even major accidents occur in railways, mines and factories causing extensive damage to human life and property. During all these disasters, the bodies of the most of victims are mutilated beyond recognition. Under this kind of situation, forensic dental identification is extremely valuable."<sup>1</sup> From this we can establish the victim

identity. This can be inferred by matching ante-mortem and post-mortem dental data since calcified tissues of body and many dental materials are not charred especially in fire and aviation mishaps<sup>3</sup>.

Following mass disasters, a team of police, forensic doctor and dentist and auxiliary group must act for conducting a systematic post-mortem for collection of DNA, fingerprints and dental records<sup>6</sup>. Post-mortem dental profile include oral and maxillofacial examination, radiographs, DNA fingerprinting. Forensic dentist produce post mortem records based on careful charting and written description of dental structures and radiographs of the deceased<sup>2</sup>. Hence, ante-mortem (before death) data is needed for comparison with post mortem data for mass disaster victim identification<sup>4</sup>.

Dental identification of an individual include:

1) Comparative methods of dental identification

2) Post-mortem dental profiling

Changes brought about by age, developmental disturbances, pathological conditions, and oral procedures done by dentist can serve as an important data for identification of those personnel. Importance of different aspects of dentistry can be seen in forensic investigation.

Case history of each patient provides the skeletal structure in ante-mortem material. It includes age, sex, occupation, religion, address, socio-economic status, personal, medical and dental history, habits, general and local examination of the patient. Presence of erosion on teeth can suggest alcohol or substance abuse and eating disorder or even hiatus hernia, while stains can indicate smoking, tetracycline use or betel nut chewing<sup>3</sup>. Unusual dental wear results from pipe

\* Reader, Department of Oral Pathology, \*\* Reader, Department of Prosthodontics; \*\*\*Intern, St.Gregorios Dental College, Chelad, Kothamangalam

Send correspondence: Dr. Eapen Cherian, Department of Oral Pathology, St.Gregorios Dental College, Chelad, Kothamangalam

stems, cigarette holders, hair pin or previous orthodontic treatment. These help in localization of the individual and as an adjuvant data in victim identification<sup>2</sup>. Pre and post operative casts shows structures like the rugae<sup>5</sup> (unique pattern to each individual), tori (uncommon in Indian population) which are important identification tools.

Surgical reconstruction of oral and maxillofacial region requires metals like stainless steel or titanium. These can assist in individual identification. In the field of prosthetics, we have miniplates, cast metal dentures, ceramic crown and bridges, ceramic (withstand high temperatures since ceramics are sintered at 1400 degrees) or titanium implants. Periodontal disease progression, excessive wear of teeth and bone also serve as ante-mortem data. Individuals with numerous complex restorations (including inlays, onlays, gold restorations) are often easier to identify than those with little or no restorative treatment. No two amalgam restorations are alike, especially on a radiograph<sup>3</sup>.

Dental tissue is resistant to incineration, immersion, trauma and decomposition, so it represents an excellent reservoir of DNA material and is used for DNA fingerprinting<sup>3</sup>.

American board of forensic odontologist recommended only 4 conclusions when reporting dental identification<sup>3</sup>

1. Positive identification –ante –mortem and post mortem record match in details with no unexplainable discrepancy

2. Possible identification – ante mortem and post mortem data have consistent features but due to poor quality, identity can't be positively established.

3. Insufficient evidence – available information is insufficient to form basis for a conclusion.

4. Exclusion-ante mortem and post mortem data are clearly inconsistent.

There are 2 types of discrepancies<sup>3</sup>–

a) Explainable discrepancies – are those related to time lapse between the ante-mortem and post mortem records such as extracted teeth or extended or enlarged restorations.

b) Unexplainable discrepancies – cannot be resolved by time lapse between ante-mortem and post-mortem records. For example, an ante-mortem tooth which was missing on the post-mortem data. Problems can arise during the identification. For example, ante-mortem images are film based and post-mortem images are recorded digitally. Knowledge of distortion in the image due to the difference in projection geometry between ante-mortem and post-mortem images plays a role.

## Conclusion

Dental examination is a powerful tool in identification of the deceased. The key to successful master disaster victim identification is preparedness. Maintenance of dental records is legally mandatory in most of the European and American countries. Unfortunately, the law is not very clear in India and awareness among the population is poor. Under Article 51 A(h) of Constitution of India, there is a moral obligation on the doctor and a legal duty to maintain and preserve medical and medico-legal and legal documents in the best interest of social and professional justice<sup>1</sup>. The IDA recommends that for practicability that the doctor may maintain records upto a minimum of 5 years to satisfy the consumers and judiciary for protection against medical negligence and complications. Electronic records with the help of computers have great quality and patient safety benefits and will likely increase as more dental clinics and hospitals become computerised. Hence, primary dental records of a patient can be stored systematically and can be used for communication with other dentists. A centralised system with good networking is also needed. The government must take strong initiative for dental records to be made mandatory. Every Indian must be assigned a Unique Identification Number (UIN) that should include dental records as well. It is said that dentists and patients forget but good records remember. With calamities like the Uttarakhand flood, thousands of bodies are left unidentified. Not only creating awareness among the Government and people about forensic dentistry is needed but also the practising dentist in the country must be responsible for storing the patient record.

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# The significance of Neural Crest in developmental process

\* Jayasekharan V P, \*\* Jacob Kurian, \*\*\* Eapen Cherian

## Abstract

Epithelial-mesenchymal interactions are a series of programmed, sequential and reciprocal communications between epithelium and mesenchyme resulting in differentiation of one or both the cell populations involved. Development of teeth and many other organs like lungs, hair, kidney, salivary gland, mammary gland, oral mucosa are characterized by such interactions. Many organs like salivary glands, lungs, kidney, mammary glands, hair follicles, limb bud depend upon such interactions for their development and differentiation. During early development, these organs exhibit many morphological and molecular similarities. Early in embryogenesis, soon after the neural tube forms by invagination of the overlying ectoderm, migratory pluripotent neuroepithelial cells, the neural crest cells, migrate from dorsal midline region to neural tube.

Key Words: neural tube, pluripotent, neural crest, neurulation, neuropore.

Early in embryogenesis, soon after the neural tube forms by invagination of the overlying ectoderm, migratory pluripotent neuroepithelial cells, the neural crest cells, migrate from dorsal midline region to neural tube. In existing structure, the neural crest cells after exiting from neural tube lose their epitheloid characteristics and assume a mesenchymal phenotype capable of directed cell migration. <sup>1</sup>As early as 1887, Von Brunn suggested that odontoblasts differentiate only in presence of inner enamel epithelial cells and thus discovering the interesting phenomenon starting from neural crest cells.

### Emergence of neural crest

The neural crest cells are a unique population of cells that arise from the dorsal part of the forming neural tube during neurulation. These cells undergo an epithelial to mesenchymal transformation as they detach from the neural tube. Neural crest cells differentiate first in the mesencephalic zone of the future brain. In the spinal cord portion of the neural tube, the neural crest cells at the end detach after the neural folds have fused. Neural crest cells at the very caudal end of the neural tube are formed from the medullary cord after the caudal neuropore closes on day 26. <sup>2</sup>

After the basal lamina is degraded further, the cells, which by this time have assumed a

mesenchymal morphology, pass through remnants of basal lamina and embark on a series of migrations. <sup>3</sup> In the mammalian embryo these cells separate from the lateral aspect of the neural plate.

During their induction, neural crest cells undergo an epithelial mesenchymal transformation, a process whereby their cell adhesive properties and cytoskeletal organization change, allowing them to delaminate and migrate away from neural tube. <sup>4</sup>

During and after migration, cells differentiate into a wide range of derivatives that are grouped into:

- (1) Ectomesenchymal category
- (2) Non-ectomesenchymal category

In the last stage, the mammalian teeth develop from two type of cells: stomodeal ectoderm, which form ameloblasts and cranial neural-crest-derived (ecto) mesenchymal cells, which finally form odontoblasts and cementoblasts. <sup>5</sup>

### Expansion of neural crest

The neural crest cells derived from midbrain region has its final position in maxillary and mandibular processes which is associated with original position of the cells in neural crest as well as the time when the cells leave the crest. <sup>6</sup> The route that particular neural crest cells take and where they stop migrating along this route determines in part what type of cell they will form. In addition, cranial and more caudal neural crest cells give rise to some identical cell types (neurons) but also some different cell types. <sup>7</sup>

Before neural crest emigrates from the neural tube, they undergo a process called Epithelial Mesenchymal Transition (EMT) that will confer

\* Senior Lecturer, \*\* Professor & HOD, \*\*\* Reader, St Gregorios Dental College, Chelad, Kothamangalam, Kerala

Table 1

System	Trunk crest	Cranial crest
Sensory nervous system	Spinal ganglia	Ganglia of V nerve, facial nerve, vagus nerve (X)
ANS	Sympathetic chain ganglia, celiac and mesenteric	Parasympathetic ganglia: ciliary, ethmoidal
Pigment cells	Melanocytes	Melanocytes
Skeleton	-	Cranial vault, nasal, palate and maxillary, mandible process
Connective tissue	-	Dermis and fat of skin, cornea of eyes, dental papilla, thymus, salivary glands.
Muscle	-	Ciliary muscle, vascular smooth muscle.

Key neural crest – related genes (Table 2)

Gene	Encodes	Expressed	During	Function
Bmp	Growth factor	Non-neural ectoderm	Gastrulation	Neural crest induction
Wnt	Growth factor	Non-neural ecto	Gastrulation	Neural crest ind.
Zic	Transcription factor	Neural fold and plate	Neurula	Neural plate border specifier
Dlx	Transcription factor	Non-neural ectoderm	Neurula	Neural plate border specifier
Ap2	Transcription factor	Premigratory neural crest	Segmentation	Neural specifier
cMyc	Transcription factor	Premigratory neural crest	Segmentation	Neural crest specifier
Sox 9	Transcription factor	Premigratory neural crest	Segmentation	Neural crest specifier
Sox 10	Transcription factor	Premigratory neural crest	Segmentation	Neural crest specifier
Slug/snail	Transcription factor	Premigratory neural crest	Segmentation	Neural crest cell delamination

to them the ability to migrate. A similar Epithelial Mesenchymal Transition (EMT) process in different cellular machineries also occurs. When the Epithelial Mesenchymal Transition is complete, the neural crest cells delaminate from neuroepithelia and migrate along specific pathways.<sup>8</sup>

### Derivatives of Neural crest cells

Neural crest cells are traditionally grouped into four cranial-caudal subdivisions based on their specific regional contributions to structures of the embryo: cranial (caudal forebrain to the level of rhombomere 6 of the myelencephalon) vagal (level of somites 1 to 7) trunk (level of somites 8 to 28) and sacral / lumbosacral (level caudal to

somite 28).<sup>9</sup> The differentiation of neural crest cells are equal in developmental potential and their ultimate differentiation is entirely determined by environment through which they migrate and into which they finally settle. Also, another hypothesis suggest that premigratory cells are already programmed for different developmental fates, and that certain stem cells are favoured while others are inhibited from further development during migration.<sup>10</sup> (see table 1).

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*For details contact*

Dr. Jain Mathew -9846140294

Dr. Mathew M Alani -9446206143

# Dry socket and its management

\* Ahkin John George, \*\*Parvathy T Ajai, \*\*Steffy Simon, \*\*Anjulakshmi M., \*\* Aswathy Devanandan

## Abstract

Alveolar osteitis 'dry socket' remains amongst the most commonly encountered complication following extraction of teeth by general dentist and specialists. That most dry socket appears after extraction of third retained molars is a generally accepted fact. This article is a comprehensive critical review of the available literature addressing the concepts and controversies surrounding alveolar osteitis. We aim to assist the dental healthcare professional with patient preparation and management of this commonly encountered post operative condition.

## Introduction

Crawford 1st used the term 'dry socket' in 1896[1]. Dry socket or alveolar osteitis is a very debilitating severely painful but common complication for dental extractions. Dry socket appears in two forms;

- i. Dry, characterized by a painful syndrome and uninhabited alveolus
- ii. Suppurative, which is identified by provoked pain and filled alveolus.

The recovery period of patients who develops AO typically require multiple post operative visit to manage this condition [2, 3]

## Definition

AO is defined as 'post operative pain inside and around the extraction site, which increases in severity at any time between the first and third day after extraction, accompanied by a partial or total disintegrated blood clot within the alveolar socket with or without halitosis[4]. The inflammation of the alveolus .if this inflammation should surpass the alveolar wall; it would result in alveolar osteitis.

## Etiology and pathophysiology

Several theories have been presented on the etiology of dry socket. They include bacterial infection, trauma, and biochemical agents. Though pathogenesis of AO is not well understood, Birn's classic series of article between

1963 and 1977 provided a better understanding of the pathophysiology[5-7]. He suggested that etiology of AO is an increased local fibrinolysis leading to disintegration of clot. The fibrinolysis is the result of plasminogen pathway activation which can be accompanied via direct or indirect activator substances [5]. The fibrinolytic activity is local because initial absorption of plasminogen into the clot limits the activity of plasmin.

## Contributing /risk factors

### 1. Surgical trauma and difficulty of surgery.

This could be due to more libration of direct tissue activators, secondary to bone marrow inflammation, following the more difficult, hence, more traumatic extractions [8]. Surgical extractions, in comparison to non surgical extractions results in 10-fold increased incidence of AO [9]

### 2. Lack of operator experience

Many studies claim that operators inexperience is a risk factor for the development of AO, Larsen [3] concluded that surgeon's inexperience could be related to a bigger trauma during extractions. Alexander [10] and Oginni et al [11] both reported a higher incidence of AO, followed by extractions performed by less experienced operator, therefore, skill and experience of the operator should be taken into consideration.

### 3. Mandibular 3rd molar

AO is more common following the mandibular 3rd molar [12, 13] extraction due to increased bone density, decreased vascularity and reduced capacity of producing granulation tissue. They are responsible for site specificity [12].

\*Reader, Dept of Surgery, St.Gregorios Dental College, Kothamangalam

\*\* Intern, St.Gregorios Dental College, Kothamangalam

#### 4. Systemic disease

Some researchers have suggested that [5,14] systemic disease could be associated with AO, e.g., diabetes mellitus/immunocompromised patients[9].

#### 5. Oral contraceptives

Only medication associated with developing AO. Estrogen plays a significant role in fibrinolytic process. It is believed to indirectly activates the fibrinolytic systems, and therefore increase lysis of the blood clot [15].

#### 6. Patient gender

Female gender, regardless of oral contraceptive use, is a predisposition for development of AO. Mac Gregor [16] reported a 50% greater incidence of AO in women than that in men in series of 4000 extractions.

#### 7. Smoking

A dose dependent relationship between smoking and occurrence of AO has been reported. The incidence of AO increased to more than 20% among patients who smoked a pack/day and 40% among patients who smoked on the day of surgery [17]

#### 8. Physical dislodgment of clot

Although, a very commonly discussed theory, no evidence exist in the literature verifying that physical dislodgment of blood clot caused by manipulation or negative pressure created by sucking on a straw could be a major contributor to AO[4].

#### 9. Bacterial infection

It has been shown that the frequency of AO increases in patients with poor oral hygiene [18], pre existing local infection such as pericoronitis and advanced periodontal disease[19].

#### 10. Excessive irrigation /curettage of alveolus

It has been postulated that excessive repeated irrigation of alveolus might interfere with clot formation and that violent curettage might injure alveolar bone [5]

#### 11. Age of the patient

Literature supports that older patients have a greater risk of developing AO [10].

#### 12. Single extraction VS multiple extractions

Limited evidence exist indicating higher prevalence of AO after single extraction than multiple extraction [20, 16]

#### 13. Local anesthetic with vasoconstrictor

It has been suggested that the use of local anesthesia with vasoconstrictor increases the incidence of AO. Lehner[21] found that AO frequency increases with infiltration anesthesia

because the temporary ischemia leads to poor blood supply.

#### 14. Saliva

Though no firm scientific incidence exist to support this claim, some authors have suggested that saliva is a risk factor in development of AO [22, 23]

#### 15. Bone/root fragments remaining in the wound

Some authors have suggested that bone or root fragments and debris remnants could lead to disturbed healing and contribute to development of AO [4,5]

#### 16. Flap design or use of sutures

Previous literature claims that design of flap and use of sutures affects the development of AO [24]. In the absence of any significant evidence it is reasonable to assure that these are not major contributing factors [10].

#### Clinical presentation of dry socket

Patients presents with pain, swollen, dusky red gingiva which is tender on palpation, halitosis, enlarged regional lymph nodes, pyrexia and trismus[25]. Pain in the dry socket ranges from boring persistent deep seated dull sever throbbing and localized to the socket or may radiate [26]. Bare bone of dry socket is extremely sensitive to touch[27] due to increased pressure on nerve ending after loss of blood clot[28]. Trismus is related to surgical trauma of extraction[29]. Disintegration of blood clot and accumulation of food debris and its fermentation by bacteria produces halitosis [30]. It is most frequently found in patients with poor oral hygiene [31] and smokers [32].

#### Prevention

- Ø Systemic antibiotics
  - o They include penicillin [33,34], clindamycin[33,35], erythromycin and metronidazole[36,37]. Pre and/or post operative antibiotic prophylactically is disputed though due to the development of resistant bacterial strains, possible hypersensitivity and unnecessary destruction of host commensals[4,38]
- Ø Topical antibiotics
  - o Among the many antibiotic studies, topical tetracycline has shown promising results [39,40,41,42]. Various methods of delivery include powder, aqueous suspensions, gauze drain and gel foam sponges
- Ø Chlorhexidine
  - o It is an antiseptic that act upon the bacteria of oral cavity, altering their cytoplasmic permeability and causing the precipitation of

proteins and nucleic acids. At pH values of 5-8, chlorhexidine is bactericidal against gram positive bacteria and also against many gram negative species. Its action is rapid and prolonged, but decreases in the presence of blood and organic material.

Ø Parahydroxybenzoic acid

o It is an anti fibrinolytic in extraction wounds that decreases the incidence of AO [43,44]. It has also been reported to have some anti microbial properties [45].

Ø Tranexamic acid

o It is an anti fibrinolytic agent that prevents AO, when topically applied in extraction wounds [46].

Ø Polylactic acid

o It is a clot supporting agent, and a biodegradable ester that once was thought to be the ultimate solution for preventing AO. It was suggested that PLA would provide a stable support for the blood clot and subsequent granulation tissue and osteoid tissue.

Ø Steroids

o It was found that corticosteroids decreases post operative complication but failed to prevent the development of AO [47]. Most recent studies showed that topical application of an emulsion of hydrocortisone and oxytetracycline significantly reduced AO after impacted third molar removal [48,49].

Ø Eugenol containing dressing

o Some authors have promoted the use of eugenol containing dressing to prevent development of AO [50]

Ø Lavage

o Copious intraoperative lavage reduces incidence of AO

Ø 9-aminoacridine

o There is one study in which 9-aminoacridine, an antiseptic agent was evaluated for its effectiveness in reducing incidence of AO [51]

Ø Sterile gloves

o Use of sterile gloves over clean non sterile gloves has not demonstrated a decrease in the incidence of AO [52,53]

### Management of alveolar osteitis

On an average, a time period of 7-10 days is required for exposed wound to become covered with new granulation tissue and efforts must be made to relieve the patient discomfort during this time period [54]. Many possibilities of treating dry socket has been reported, including a variety of materials, irrigation solutions and the procedures within the alveolus. In 1929, investigators reported irrigation with heated saline solutions, powdered sodium perborate, gauze with iodoform.

Prescription of codeine and subsequent irrigation of sodium perborate [55]. The use of a paste (composed of acetylsalicylic acid, perubalsam, eugenol, sodium benzoate and lanolin) for intra alveolar application is also indicated by Pell [56] in 1934. Schofield et al [57] suggested treatment with glycerin or guaiacol eugenol or paste from these components combined with zinc oxide introduced within the alveolus helps to relieve the pain [57]. Some adopted systemic antibiotic therapy and made dressing with zinc oxide and eugenol or neomycin. Other investigators suggested simple and palliative treatment, consist of debridement and ablution with saline solution followed by dressing with a gauze impregnated with 5% iodoform and eugenol [58]. The primary aim of dry socket management as indicated by Fazakerley [59] is pain control until commencement of normal healing, and in majority of cases, local measures are satisfactory. In some cases, systemic antibiotics and analgesics is indicated.

### Summary

The literature regarding alveolar osteitis is not consistent and often conflicting. Studies are poorly designed, lack analysis and have statistical biases. The risk factors for this temporary and debilitating condition are clearly identified. Surgeons must identify the additional risk factors in patients with particular medical condition and include this information as a part of the consent. Treatment options for this condition are generally limited and directed towards palliative care. The formula to management of this complication should begin with patient education and patients with identifiable risk factors should be informed in detail about the anticipated complication.

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# Efficacy of Antibiotics in Preventive Prophylaxis: A Literary Review

\*John Aby, \*\* Titus Peter, \*\*\* Renju V Thomas, \*\*\*Rahul M.S., \*\*\* Reeves Manikat, \*\*\*Abdul Majeed

Antibiotic prophylaxis for surgery is the prescription of antibiotics to prevent the development of infection at a surgical site. (6) The definition of wound infection should include the following: The presence of cellulitis, the presence of fluctuation, purulent discharge from the extraction site for more than 72 hours after surgery, pain and swelling that either worsens or fails to improve 48 hours after surgery, and persistent hyperpyrexia, more than 39°C at 48 hours or more after surgery. (6) Formal recommendations from the American Heart Association concerning antibiotic prophylaxis for patients who have cardiac conditions and are undergoing invasive procedures go back more than 50 years, and virtually all professional association guidelines, textbooks, and journal articles quote these recommendations. (3) Bacteria commonly enter the circulation from the oral cavity, and there is a long-standing concern about the potential for pathogenic species to cause distant site infections such as infective endocarditis. (1) Intraoral surgery always causes transfer of micro-organisms from the mucous membrane to the surgical wound, resulting occasionally in infection of the wound. Intraoral injuries can be similarly infected, e.g. in cases of traumatic injury to the teeth, or jaw fractures penetrating the oral cavity. (8) The cause of the disease is the blood-borne spread of micro-organisms that can attach to damaged heart valves and endothelium, multiply, and result in infectious endocarditis. The micro-organisms most commonly implicated originate on the skin and in the oral cavity.

Altemeire et. al emphasized the necessity of determining the specific indications for prophylactic antibiotic therapy on the basis of existing knowledge in the 1950s. (4) These recommendations came into being and have been sustained for several reasons:

- The focal infection theory,
- Early animal studies attempting to replicate IE in humans

- The high incidence of viridans group streptococci as a cause of IE and the high frequency of VGS bacteremia after dental office procedures

- Hundreds of poorly documented case reports implicating dental procedures (3)

However a number of studies suggest a benefit. A Dutch case-controlled study, which was also the only study found eligible for a Cochrane review, suggested a reduction in risk of only 49%. This was based on 48 cases with endocarditis after a dental or non-dental procedure, but, importantly, excluded high-risk patients with prosthetic valves. In a study specifically of prosthetic valves there were 6 cases of IE in 304 who were unprotected by antibiotics, but no cases in 229 protected patients. A French study estimated an incidence of IE in patients with valve disease of 1 case per 46,000 unprotected dental procedures compared with 1 case per 149,000 protected procedures. The protective effect of antibiotics has been estimated at 46%, 49%, 70% and 91%. These clinical observations suggest that animal work showing the effectiveness of a single dose of amoxicillin in preventing streptococcal endocarditis may be relevant to humans. (9) A Dutch study showed that a combination of a heart lesion, natural dentition and a dental procedure gave a relative risk for IE of 4.910. A French case-controlled study showed a significant association between IE and repeated scaling and canal treatment although not for all dentistry. Other studies 12-14 have also found an association between IE and extraction or, less frequently, with root canal work. (9) However, other authors plead for the use of antibiotics but only in certain situations, not indiscriminately. After a thorough bibliographic review, Sands et al. (11) advocate for antibiotic prophylaxis in complicated cases, such as total osseous impaction. In a double blind randomized clinical trial comparing the efficacy of tinidazol versus placebo for the prevention of surgical wound infection following third molar removal, Mitchell et al. (5) detected an incidence reduction in the tinidazol group, nevertheless recommending to restrict antibiotic prophylaxis to deep intraosseous included molars. Similarly, a Spanish study (7)

\* Senior Lecturer, Dept of Oral Surgery \*\* Professor, Dept. of Oral Surgery, \*\*\* Interns, Dept of Oral Surgery, St Gregorios Dental Collge, Chelad, Kothamangalam



comparing the value of amoxicillin-clavulanic acid versus placebo in preventing postoperative wound infection concluded that the combination of 500 mg amoxicillin and 125 mg clavulanic acid was effective in reducing infectious complications, although it should not be prescribed routinely but rather when certain risk factors are present. Classically, certain circumstances are recognized as infection risk factors. These include long-lasting surgical procedures, significant osteotomy degree, previous pericoronitis episodes, placement of foreign bodies in the surgical wound (haemostatic materials or even sutures) and patients' immuneor metabolic disruptions.(10)At the same time, preoperative administration of antibiotics protects the individual patient undergoing surgery from developing post-operative infection which can have serious consequences. Even a minor absolute reduction in risk can be important.(8)

Recently, the use of antibiotic prophylaxis has become controversial with reviews based on clinical studies, rather than opinion, challenging the value of antibiotic prophylaxis.(6)

There is increasing awareness of a lack of evidence to support the practice of secondary prophylaxis, the use of antibiotic prophylaxis to reduce a procedure-related bacteremia that could result in infective endocarditis.(1)Because dental procedures that involve bleeding may induce a transient bacteremia, the American Heart Association recommends antibiotic prophylaxis before procedures associated with significant bleeding from hard or soft tissues, periodontal surgery, scaling, and professional teeth cleaning. However, bacteriemia may occur even in the absence of dental procedures,. Thus, AHA states that patients who are at risk for infective endocarditis should establish and maintain the best possible oral health to reduce potential sources of bacterial seeding.

National Institute for Health and Clinical Excellence (NICE) in England andWales is alone in recommending no antibiotic prophylaxis for any cardiac patients undergoing dental or non-dental procedures except for manipulations at an infected non-dental site. The NICE committee based their advice on the assertions that:

(1) there is no consistent association between having an interventional procedure, dental or non-dental, and the development of infective endocarditis (IE). Regular toothbrushing almost certainly represents a greater risk of IE than a single dental procedure;

(2) the clinical effectiveness of antibiotic prophylaxis is not proven;

(3) antibiotic prophylaxis for dental procedures may lead to a greater number of deaths

through fatal anaphylaxis than a strategy of no antibiotic prophylaxis and is not cost effective.(8)

Arteagoitia et al., who described a 12.9% incidence of postoperative infection incidence after mandibular third molar removal in the group without antibiotic prophylaxis, asserted that every case of infection was resolved with rescue antibiotics without further complications. Subsequently, potential postoperative infectious complications usually relate to teeth with previously underlying infectious pathology.(10)

The incidence of postoperative infection in oral surgery ranges from 1% to less than 6% and most infection is minor.(4)The principles that every antibiotic prophylaxis should follow were classically defined by Peterson. Firstly, he established the local infection risk of any surgical procedure had to be greater than 10% in order to be tributary of antibiotic prophylaxis.(10)Risks in

prophylaxis include adverse reactions to antibiotics and the development of drug-resistant bacteria.(4)Durack has recently suggested that the principle reason for re-evaluating the current prophylactic protocols for bacterial endocarditis is the growing prevalence of bacterial resistance that particularly effects the genus *Streptococcus* spp. The high prevalence of oral bacteria resistant to EM in patients who have not received previous antibiotic therapy may be explained by the possibility of interpersonal transmission of resistant bacteria and/or the transfer of resistance genes between different bacterial species.(5)A

Cochrane systematic review of 980 references, suggest that antibiotic prophylaxis, even if clinically effective, would prevent only a small minority of cases of infective endocarditis.(3)

Nevertheless, there are doubts in relation to this practice. Firstly, transient bacteremia occurs not only after dental treatments such as extractions (35-80%) or periodontal surgery (30-88%). It also occurs in the context of tooth brushing (40%) or while chewing gum (20%), and is proportional to the trauma caused and to the number of germs colonizing the affected zone. Secondly, not only bacteria cause endocarditis, and of those that do cause the disease, many are resistant to the antibiotics administered as prophylaxis (fundamentally amoxicillin). Lastly, it is known that most cases of bacterial endocarditis are not related with invasive procedures, and that dental care is only responsible for a minimum percentage of cases of the disease.(11)Nevertheless, the frequency of infection with indwelling medical devices in general, and the devastating impact of an infection in a cardiac valve, prosthetic joint or vascular graft, are a driving force behind the use

of prophylactic antibiotics.(3)There is insufficient scientific evidence to evaluate the effect of antibiotic prophylaxis on other surgery in the oral cavity or the jaws(8)In principle, antibiotic prophylaxis is only indicated if the risk of infection and/or its consequences clearly outweigh the risk of adverse reactions to the antibiotic(6)Antibiotic prophylaxis is highly controversial, and what drives the use of this practice is long-standing dogma and habit, medicolegal concerns and the potentially devastating consequences of infection in some of these patients.(3)

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# Management of uncontrollable child behaviour in dental clinic

\*Arun Roy James, \*Ektah Khosla

## Abstract

A dentist who treats children should have a variety of behavior guidance approaches and, in most situations, should be able to assess accurately the child's developmental level, dental attitudes, and temperament and to predict the child's reaction to treatment. The child who presents with oral/dental pathology and noncompliance tests the skills of every practitioner. By virtue of differences in each clinician's training, experience, and personality, a behavior guidance approach for a child may vary among practitioners. The behaviors of the dentist and dental staff members play an important role in behavior guidance of the pediatric patient. This paper discusses the management of uncontrollable child behaviour observed during treating children.

Key words- Behaviour management; disruptive behaviour; fear

## Introduction

Dental practitioners are expected to recognize and effectively treat childhood dental diseases that are within the knowledge and skills acquired during dental education. Safe and effective treatment of these diseases often requires modifying the child's behavior. Behavior guidance is a continuum of interaction involving the dentist and dental team, the patient, and the parent directed toward communication and education. Its goal is to ease fear and anxiety while promoting an understanding of the need for good oral health and the process by which that is achieved.

The delivery of dental care to a child is almost always dependent on his/her behavior. Behavior modification is primarily aimed at providing a child quality dental care in a comfortable manner. If the child behavior is disruptive, however, the same is not possible.

### Causes of disruptive child behavior

The disruptive child behavior results due to a variety of reasons in a dental clinic:

1. The child failing to understand the reason for his/her dental care
2. Fear of either a past negative experience with a doctor/dentist (objective fear) or strange, unknown environment (subjective fear)
3. Experiencing pain or discomfort midway

4. Knowledge that disruptive behavior may result in stoppage of procedure

5. Other temporary reasons such as a bad mood, tiredness, not able to concentrate if hungry, wanting to do something else, etc.

### The Child Failing to Understand the Reason for his/her Dental Care

The child's parents always make a decision of taking the child to a dentist. A young child may not understand what parents mean by going to a dentist or getting teeth fixed. Even though a child is explained about what the dentist may do to his/her teeth at the clinic, the child's imagination may not be sufficiently developed to give him/her an idea about what would happen in the dental clinic.

Why should a child want to get the dental treatment done? A child may want to have better looking teeth or pain-free teeth; however, he/she is seldom ready for the dental treatment as such.

The dentist as well as the parents must instill positive attitude in the child's mind regarding dental care during initial dental visits. The child has to be convinced that the people at the dental office are good persons and are harmless. Only then, the reason for his/her dental care such as treatment of decayed teeth could be made apparent to the child. The child may look forward to have his/her teeth fixed only if people around him/her at the dental clinic appear before him/her in a friendly manner, praise him/her and also allow him/her certain privileges. A child who is not sure of what is going around him/her throws a tantrum just to get rid of it.

\* Reader, Department of Pedodontics, Mar Baselios Dental College, Thangalam P.O, Kothamangalam, Ernakulam District, Kerala - 686 691  
e-mail: drarunroy@gmail.com

### Fear of a Past Negative Experience with a Doctor/Dentist (Objective Fear) or Strange, Unknown Environment (Subjective Fear)

There is an issue that is of concern to the child: Will I get pain? If a past visit is associated with bad memories of pain, the child now wants to avoid it. An associated fear of this kind may often result in disruptive behavior particularly when the dentist fails to assess and modify child behavior sufficiently prior to starting treatment. This type of disruptive behavior comes with a strong objection to all dental care and is difficult to control.

### Experiencing Pain or Discomfort Midway

It is important to understand the contribution of pain factor along with the fear factor in precipitating disruptive behavior. Experiencing pain is the most valid reason a child may have for the disruptive behavior. The dentist must concentrate in the initial visits and if possible, always strive to impart pain free dentistry. Once a child's behavior is modified, a slightly painful experience is usually not taken that negatively; hence procedures requiring the child to bear with pain (such as palatal infiltration for extractions) are best scheduled after a few successful accomplishments of simpler treatment procedures.

### Knowledge that Disruptive Behavior May Result in Stoppage of Procedure

If the child has experienced that by throwing a tantrum he/she has averted treatment (or any unwanted situation) successfully in the past, this knowledge comes handy to him/her in the dental clinic. The attitude of parents and the dentist play an important role in such a circumstance. If the child's disruptive behavior makes the dental team stop the procedure and if he/she is left alone, the child has scored a point and senses victory. Now, it would be even more difficult in the subsequent visit to control and modify child behavior unless a different strategy is implemented.

### Other Temporary Reasons such as a Bad Mood, Tiredness, Not able to Concentrate if Hungry, Wanting to Do Something Else, etc.

A usually cooperative child may also have his/her bad day at school, be feeling sleepy, have not got enough time to play on that day or is simply tired. The dental team must respect this and accept the child's negative response. However, the child in such instance should only be subjected to a brief routine of just getting teeth examined and left after that with a promise to cooperate well in the subsequent visit.

### Characteristics of a disruptive behavior

Usually a disruptive behavior manifests with following characteristics:

1. Crying
2. Movements of hands, legs (kicking)
3. Wanting to get down from the dental chair
4. Asking parent to come close, hold hands
5. Desiring to go home
6. Stopping communication, eye contact
7. Solitary Talking
8. Angry/hurt facial expressions

Crying is always associated with disruptive behavior. The crying of a child can be of various types

It is important for a dentist to decide how to control the 'crying' part of the disruptive behavior. The dentist must know the ways to tackle crying in order to restore good behavior.

It is important for a dentist to identify whether the objection on the part of the child is temporary in nature or a more rigid one. The disruptive behavior has to be managed well by a dentist catering to children, but more so, has to be prevented with proper understanding and implementation of behavior modification methods.

Disruptive child behavior in a dental office is a 'crisis' in child management. The dental team must have a proper methodology for this crisis management and not merely start firefighting abruptly. The following discussion describes the methodology in a stepwise manner.

### Managing the parents during disruptive behavior of a child

1. Let everyone know that the situation is under control; do not shout, panic or give unnecessary orders.
2. Tell the parents that there is no need to worry if the child is not crying in pain; at times children cry and they can be confronted with a bit of authority so that unnecessary crying is discouraged. Use voice intonation and if necessary hand-over-mouth only after their approval.
3. Tell parents that only after the child gets a pain-free experience of dental treatment, he/she will realize that there was no reason to cry; however, in order to give him/her such an experience, at times the dental team has to use stern measures.
4. The parents, if present in the operator, may be asked to wait outside. At times, a child may be crying to seek attention of his/her parents. Also, once the parent has left, the child has no choice but to listen to the dentist. The child also learns that he cannot dominate the proceedings thereafter.

Type of cry	Description	What should be done
Hysterical cry	A loud and continuous crying to create commotion in order to achieve immediate attention and scare others	Wait for a minute to see the progress, do not panic. Do not allow the child to get down from chair. Ask the child that only if he/she stops crying, attention will be given to him/her; ignore it for a while. Voice control HOME (after informing parents) if everything else fails. In most children, it does stop after 2-3 minutes; carry out a non-invasive small procedure or a demonstration after that and create an opportunity to praise the child again and develop a good rapport
Frightened cry	Crying may not be loud or continuous but is associated with withdrawal (child turning face away, suddenly pulling the hand back while demonstrating airway syringe in TSD, starting to panic on seeing a needle)	Give a proper TSD demonstration Desensitize Model the procedure. Comfort and reassure the child Engage the child in a conversation of interest to him/her. Distract the child
Hurt cry	After experiencing pain; for example, a palatal or intrapulpal administration	Reassure that the pain is over and shall not be repeated. Divert attention; for example, ask the child to rinse mouth a couple of times after LA administration Offer sympathy. Tell him/her that he/she was brave to tolerate that much of pain and will be appropriately rewarded
Compensatory cry	Continuous, low volume but Irritating crying mainly to relieve himself/herself than to protest	Be prepared to listen to it! (It may not be stoppable in some children) Ignore! Don't discourage when not controllable and does not come in the way of treatment!

5. Tell the parents that there exist only two ways of managing children for dental care: by such behavior modification techniques and under GA in a hospital set-up. (Most parents choose the first!)

#### Protocol for managing the child during his/her disruptive behavior

1. Wait for a minute to see the progress, do not panic.
2. Do not allow the child to get down from chair; let the assistant restrict the child movements.
3. See to it that the child does not cause an injury to himself or anyone else and does not damage anything.
4. Tell the child that only if he/she stops crying, attention will be given to him/her.
5. You may use a temporary threat but do not leave the child scared.

6. Use a behavior modification technique that has not been attempted till this point. For example: parental separation (send the parent/s out and ask them to come in only after being called in; tell the child that the parent/s would be called in only after he/she stops crying and follows all instructions).

7. Ignore it for a while, once necessary instructions are given. Give the child time to control himself/herself.

8. Use voice intonation.

9. Use HOME if everything else fails after informing parents.

10. Do not stretch it further. Do not feel defeated by the child. Control your anger. Inform parent/s that your best attempts have failed to achieve cooperation; you may give it another try some other day. Ask them that they also need to prepare the child better at home and get him/her back. If

the child cooperation is not attained they may have to take the child to another specialist or consider treatment pharmacologically.

### Conclusion

The management of disruptive behavior is a learned skill. The efforts often yield positive outcome if the dental team is focused on achieving the result. Also, it is not unusual to see a good behavior at the next visit from the same child who demonstrated disruptive behavior earlier. Remember, children do take pride in performing and feel guilty after realizing their mistakes/misconduct. If sincere intentions of the dental team have reached the child's mind, the mind of a child more often than not, responds favorably.

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