



# Journal of Odontological Research

Official Publication of  
Indira Gandhi Institute of Dental Sciences  
Nellikuzhy, Kothamangalam 686 691, Kerala

## CHIEF EDITOR

Dr. Romel Joseph M.D.S.  
Principal,  
Indira Gandhi Institute of Dental Sciences,  
Nellikuzhy P.O., Kothamangalam, 686 691,  
Kerala, India.

## EDITOR-IN-CHARGE

Dr. Anis Ahmed M.D.S.  
Reader,  
Department of Oral Medicine & Radiology  
Indira Gandhi Institute of Dental Sciences,  
Nellikuzhy P. O., Kothamangalam, 686 691,  
Kerala, India.

## CO-EDITORS

Dr. Subramaniam R. M.D.S.  
Dr. Jithin Jose M.D.S.  
Dr. Anoop Kurian Mathew M.D.S.  
Dr. Meera Gopalakrishnan M.D.S.  
Dr. Bijoy John M.D.S.  
Dr. Fiaz Shamsudeen M.D.S.  
Dr. Tony Jose M.D.S.  
Dr. Prasanth P.S. M.D.S.  
Dr. Binsu S. M.D.S.  
Dr. Cinil Mathew M.D.S.

Journal of Odontological Research is the official publication of the Indira Gandhi Institute of Dental Sciences, Nellikuzhy P. O., Kothamangalam 686 691, Kerala. It is a peer-reviewed journal published bi-annually. The journal will cover studies related to dentistry and applied basic subjects. The articles will be published under the categories of Original Research, Review, Case Reports and Guest Column. The manuscripts for publication may be sent to the journal's e-mail : [jorigids@gmail.com](mailto:jorigids@gmail.com) / [journal@igids.org](mailto:journal@igids.org)

## EXPERT PANEL OF CONSULTANTS

### **Dr. George Varghese**

Principal  
Government Dental College  
Kottayam, Kerala

### **Dr. Chandu G. N.**

Professor  
Department of Preventive and Community  
Dentistry College of Dental Sciences  
Davangere, Karnataka

### **Dr. Umashankar K.**

Professor  
Department of Orthodontics Saveetha Dental  
College and Hospital, Chennai,  
Tamil Nadu

### **Dr. Pradeep Kumar**

Professor and Head  
Department of Prosthodontics  
KMCT Dental College  
Mukkom, Kozhikode, Kerala

### **Dr. B. R. R. Varma**

Consultant Periodontist  
Dr. Varma's Centre for Advanced Dental Care,  
Cochin, Kerala

### **Dr. B. Shivapathasundaram**

Professor and Head  
Department of Oral Pathology, Meenakshi  
Ammal Dental College Chennai, Tamil Nadu

### **Dr. Srilal**

Professor  
Department of Prosthodontics  
Sri Mookambika Institute of Dental Sciences,  
Kulasekharam, Tamil Nadu

### **Dr. Rezy Cheru T.**

'Shalom', TC 12/639  
Champion Bhasker Road,  
Kunnukuzhy,  
Trivandrum, Kerala

### **Dr. Prashant G. M.**

Reader  
Department of Preventive and Community  
Dentistry College of Dental Sciences  
Davangere, Karnataka

### **Dr. D. S. Mehta**

Professor and Head Department of  
Periodontics, Bapuji Dental College and Hospital,  
Davangere, Karnataka

### **Dr. R. Rajendran,**

Professor of Oral Pathology  
College of Dentistry  
King Saud University  
Kingdom of Saudi Arabia

### **Dr. Shashikanth Hegde**

Professor and Head  
Department of Periodontics,  
Yenepoya Dental College  
Mangalore, Karnataka

### **Dr. Vijayalakshmi Acharya**

Acharya Dental  
Nungambakkam  
Chennai, Tamil Nadu

### **Dr. U. S. Krishna Nayak**

Professor and Head, Department of Orthodontics  
A. B. Shetty Memorial Institute of Dental Sciences  
Mangalore, Karnataka

### **Dr. V. Gopikrishna**

Professor  
Department of Conservative Dentistry and  
Endodontics  
Thai Moogambika Dental College, Chennai

### **Dr. K. Ranganathan**

Professor and Head  
Department of Oral Pathology,  
Ragas Dental College and Hospital,  
Chennai, Tamil Nadu

### **Dr. Sakeenabi B.**

Reader  
Department of Preventive and  
Community Dentistry, College of  
Dental Sciences Davangere, Karnataka

# editorial



Before quoting anything, I should take time and space to congratulate the hands behind this great venture. They have done the job with great hubris. Every reports and articles are mind blowing and attributing finality. Surely it will help us to sharpen our academic excellence in focused and opinionated way. In a world where ideas are increasingly preferred over ideology, we also move in the direction craving for excellence in the professional standards. The journal will create a space for the faculty and students to exhibit the clinical acumen and theoretical talents in a better way, wishing all success to climb more triumphant steps.

Dr. Romel Joseph  
Chief Editor

## TABLE OF CONTENTS

1. Editorial

### **ORIGINAL RESEARCH ARTICLES**

2. Sexual dimorphism in the location of maxillary sinus and mandibular canal  
*Shahin KA, LaxmikanthChatra, Prashanth Shenai, Veena KM, Prasanna Kumar Rao, Rachana V Prabhu.* 5
3. The oral health related quality of life before and after wearing complete dentures fabricated by dental undergraduate students in a dental college in Kothamangalam - a six months follow-up study  
*Pius AV, Sanjeev R, Meenu Merry C Paul, Suneesh Kuruvilla, Subramaniam R.* 11

### **REVIEW ARTICLES**

4. Go green periodontics  
*Sugumari Elavarasu, Arthiie Thangavelu, Jayashakthi Saravanan, Mohammed Shereef.* 18
5. Obstructive sleep apnea (OSA)- an over view  
*Sanu Tom Abraham, Meenu Merry C Paul.* 25
6. Autoimmunity - a brief insight  
*Jithin Jose, Ambika K, Niveditha Baiju, Pramod Mathews, Skariah KS.* 30
7. A review of maxillofacial prosthesis materials  
*Shilpa Joseph, Pius AV, Seema George, Cinil Mathew.* 36

### **CASE REPORT**

8. Palato- radicular groove and localized periodontitis:  
*Sugumari Elavarasu, Thangakumaran suthanthiran, Arthiie Thangavelu, Saranya Selvaraj.* 45
9. Esthetics by root submergence technique - a novel approach  
*Narendra Kumar Gupta, Devendra Chaudhary, Nitika Sachan, Pradyumna Misra.* 50
10. Prosthodontic management of mandibular deviation using palatal ramp appliance  
*Binsu S, Meenu Merry C Paul, Pius AV, Cinil Mathew.* 55

## ORIGINAL RESEARCH ARTICLE

# SEXUAL DIMORPHISM IN THE LOCATION OF MAXILLARY SINUS AND MANDIBULAR CANAL

### Authors:

Shahin KA<sup>1</sup>  
LaxmikanthChatra<sup>2</sup>  
PrashanthShenai<sup>3</sup>  
Veena KM<sup>3</sup>  
Prasanna Kumar Rao<sup>4</sup>  
Rachana V Prabhu<sup>5</sup>

<sup>1</sup> Senior Lecturer, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

<sup>2</sup> Senior professor and Head, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India

<sup>3</sup> Professor, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

<sup>4</sup> Associate Professor, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

<sup>5</sup> Reader, Department of Oral Medicine and Radiology, Yenepoya Dental College, Yenepoya University, Mangalore, Karnataka, India.

### ABSTRACT

**Back ground:** It is important to evaluate the bone thickness, bone density, location of vital anatomic structures and also height and width of the jaws in many dental clinical situations especially in implant placement and forensic applications. Further, sexual dimorphisms differ widely and thus the quality and quantity of the bone and anatomic location also vary and will have an impact on various dental surgical procedures.

**Objectives:** The purpose of this study was to assess the sexual dimorphism in the anatomic location of the vital structures like maxillary sinus and mandibular canal in the jaws by using linear tomography.

**Methods and methodology:** The mean location of the maxillary sinus and the mandibular canal from the alveolar crest of posterior teeth was done on 90 healthy dentulous patients divided in the two equally divided groups (males=45 and females=45) by using cross sectional linear tomograms.

**Results:** The results showed the mean distance of the location of maxillary sinus and the mandibular canal with respect to the alveolar crest in males and females.

**Conclusion:** This study proved that there was a high significance in the location of the mandibular canal in relation to the alveolar crest between males and females though there was no significance in the location of the maxillary sinus.

**Key words:** Maxillary sinus, mandibular canal, alveolar crest, cross sectional radiograph, implant planning.

J Odontol Res 2014;2(2):5-10.

## INTRODUCTION

It is a well-known fact that the human species display tremendous sexual dimorphism in size, shape, and behaviours and males have larger and more robust physical features, along with greater muscularity and strength. The jaw of male is robust, and presents marked ridges in the area of insertion of the masseter and medial pterygoid muscles, exhibit gonial eversion and a flexure in the posterior edge of the mandibular ramus at the height of occlusal plane and mandibular heads more voluminous than females.<sup>1</sup>

Various Imaging Techniques including conventional radiography and computed tomography, are proposed to localize the mandibular canal<sup>2</sup>. Preoperative bone height was evaluated from the top of the alveolar crest to the superior border of the mandibular canal on a standard panoramic radiograph and it was concluded that panoramic examination can be considered a safe preoperative evaluation procedure for routine posterior mandibular implant placement. However American Academy of Oral and Maxillofacial Radiology has acclaimed that cross sectional imaging be used for implant cases & that conventional cross-sectional tomography is optimal for acquiring the information needed for implants patients.<sup>3</sup>

The aim of the present study was to assess any sexual dimorphic changes in the location of the maxillary sinus and the mandibular canal in the jaws.

### Materials and methods;

Ninety healthy dentulous individuals between 16 and 45 years, consisting of equally divided males and females were chosen with their informed consent. Patients included had intact posterior teeth from premolars to molars and were devoid of any developmental defects After obtaining the approval from the ethical committee panel of our institution,

linear tomographic radiographs were taken in the standardized position for the left maxillary and mandibular jaw along with proper radiation protective measures.[figure 1 &2] Film was then developed in the automatic processor. Then the distance between the buccal alveolar crest and lingual alveolar crest up to the anatomical structures (the lowest position of maxillary sinus and the superior position of mandibular canal) with respect to maxillary and mandib-



Figure 1  
Linear tomographic radiographs in the standardized position for the left maxillary jaw



Figure 2  
Linear tomographic radiographs in the standardized position for the left mandibular jaw

ular posterior teeth was measured using Adobe Photoshop 7. Then the average of the distance between the buccal and lingual alveolar crests up to the anatomical structures was calculated. Then the derivatives were calibrated with the 1 cm scale measurements in the same radiograph. The magnification factor for the tomographic radiograph in promaxplanmeca that is 1.5 was also considered and calculated before arriving at the final values. Unpaired 't' test was used for statistical analysis.

## RESULT

In the maxillary posterior region from the first premolar to second molar there was no gender wise statistical significance in the location of the maxillary sinus from the alveolar crest. [Table 1, Chart 1] In case of mandible there was a very high statistical significance with respect to the alveolar crest of first premolars to the mandibular canal between males and females as the distance showed 19.4mm and 17.18mm respectively. At second premolars also there was high significance as the distance was 18.56mm and 16.66 mm in males and females respectively. In case of mandibular first molars it was 17.7mm and 16.01mm and in mandibular second molars it was 16.86mm and 15.28mm in males and females respectively showing that the statistical significance was high. [Table 2, Chart 2] Thus gender wise a very high statistical significance was seen in the location of the mandibular canal with respect to first premolar and high statistical significance in the posterior part of the jaws at the region of mandibular 2nd premolar, 1st molar and 2nd molar. There was about 1.9+/- 0.3mm difference in the mean location of the mandibular canal with respect to the alveolar crest between the two genders.

## DISCUSSION

The mean location of lower border of the maxillary sinus and the superior border of the mandibular

canal from the alveolar crest in 90 equally divided male and female patients are obtained in Indian population. Similar studies have been conducted in various populations like Japanese<sup>4</sup>, Berne<sup>5</sup>, Turkish<sup>6</sup>.

In Turkish population the maxillary vertical height in dentate group had no statistical significance between the genders, whereas in mandible, the vertical height showed high statistical significance in the anterior part and statistical significance in the posteriors<sup>6</sup>. This difference in the maxillary and mandibular vertical height between the alveolar crest and anatomic location was also noted in our study.

Yet another study in Turkish population found that the lower border of the maxillary sinus to alveolar crest in edentulous molar region was 6.58+/-3.53mm in females and 6.14+/-3.97mm in males.<sup>7</sup> And, superior border of the mandibular canal in molar edentulous region upto alveolar crest was 9.24+/-3.81mm in females and 11.44+/-5.43mm in males.<sup>7</sup> This study also showed that there was high statistical significant difference between the two genders in mandibular molar region and no statistical significance in upper maxillary jaws.<sup>7</sup>

In the Berne population the average measured bone height from the mandibular canal to the alveolar crest in the panoramic radiograph was 13.9+/-2.66mm and the average bone height in linear tomography was 14.87+/-3.3mm.<sup>6</sup> In Japanese population<sup>5</sup> the distance from the alveolar crest of the mandibular molar region to the superior wall of the mandibular canal was 9.1+/-5.54mm on the right side and was 9.9+/-5.05mm on the left side of the edentulous jaws.

In our study, an attempt was done to correlate the sexual dimorphic differences present in the location of the maxillary sinus and the mandibular canal in this study population. In maxillary region there was no statistical significance seen, whereas in mandible there was a very high statistical significance between males and females as the distance between

Chart 1: Genderwise comparison of location of maxillary sinus

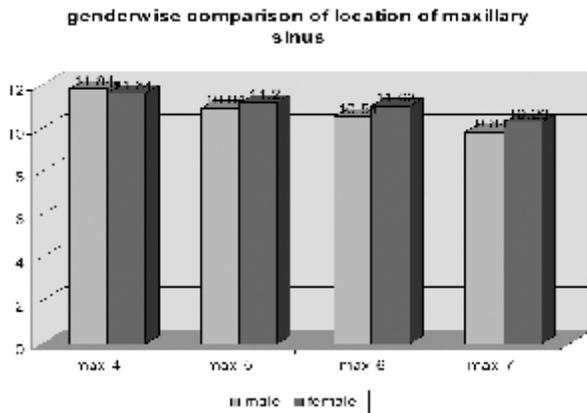


Table 1; Gender wise comparison of location of maxillary sinus

Gender		N	Mean	Std deviation	T
Max 4	male	45	11.8439	2.9454	.35600 p=.722ns
	female	45	11.6447	2.3191	
Max 5	male	45	10.9434	2.3003	.58000 p=.564ns
	female	45	11.2035	1.9406	
Max 6	male	45	10.5449	2.4575	.97600 p=.332ns
	female	45	11.0295	2.2473	
Max 7	male	45	9.8393	2.3609	.91000 p=.365
	female	45	10.2885	2.3234	

Chart 2: Genderwise comparison of location of mandibular canal

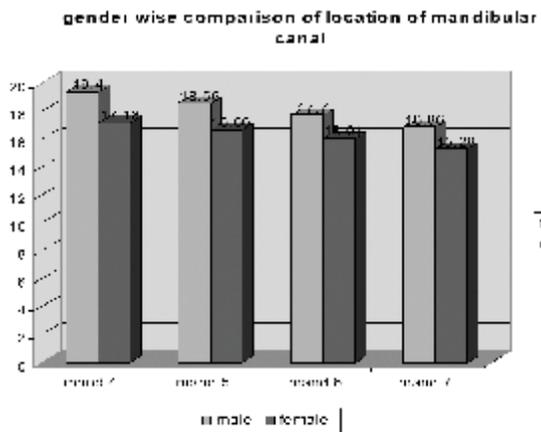


Table 2; Gender wise comparison of location of mandibular canal

Gender		N	Mean	Std deviation	T
Max 4	male	45	19.4027	2.9379	3.84200 p=.001vhsns
	female	45	17.1840	2.5256	
Max 5	male	45	18.5613	3.1839	3.25300 p=.002hs
	female	45	16.6632	2.2761	
Max 6	male	45	17.7019	2.9994	2.89100 p=.005hs
	female	45	16.0134	2.5203	
Max 7	male	45	16.8602	2.9115	2.67100 p=.009hs
	female	45	15.2803	2.6955	

the alveolar crest to the mandibular canal in males showed 19.4mm and in females it was 17.18mm in case of first premolars. The gender wise difference was also statistically highly significant in case of second premolars, first molars and second molars. The mean distance between the alveolar crest and the mandibular canal was decreasing as it was moving posterior in both the genders suggesting that mental foramen was more inferiorly placed than mandibular foramen.

In the maxilla there was no statistical significance, may be due to the variable degree of pneumatization in different individuals. But in case of mandible, the statistical significant is due to the sexual dimorphism,<sup>8</sup> which may be due to the relative development of the musculoskeletal system, particularly the masticatory muscles, which are attached to the mandible. Therefore, the size and shape of the mandible is influenced by variable lifestyles, division of labour and activity by sex, chewing habits, and also ethnic groups. Moreover, there are different growth rates and developmental stages of male and female mandibles. Since females reach puberty earlier than males, development of their mandible and skull appear to either stop or slow down earlier than that in maturing males.<sup>8</sup>

Literature review suggests most of the studies are done on edentulous jaws for implant planning. Our study with reference to implant placement helps to assess the preoperative jaw height in the males and female patient of this population, but keeping in mind the apicocoronal changes occurring post extraction. It can also be used to estimate the average location of the mandibular canal before any minor dental surgical procedures like extractions, impactions and periapical surgeries. Further it can also be used in forensics in mass destruction cases for gender identification.

This study was on ninety healthy dentulous patients of a local area and therefore represents only for this

population. For a more accurate assessment, this study should be further conducted for a larger sample residing in various parts of the world.

#### CONCLUSION:

This study has been conducted keeping in view, broad aspects of variability of anatomic position of vital structures in males and females, the minute variation of which can impede with the effective dental treatment outcome. The mean distance between the alveolar crest and the maxillary sinus and the mandibular canal was decreasing as it was moving posterior in both the genders. A very high statistical significance was observed in the mean distance of the mandibular first premolar region with a p value of 0.001 and a high significance was seen with respect to mandibular second premolar, first molar and second molar. This study gives an approximate idea about the location of the mandibular canal in this population and the sexual dimorphism between the genders. This information can help one to assess and apply before any minor dental and surgical procedures. There is still a need for further research in assessing the location of anatomical structures like the inferior dental canal, incisive canals of the mandible, maxillary sinus and the incisive canal and foramen of the maxilla in various large study samples and thus to possess an accurate assessment value of the distances.

#### REFERENCES

1. Galdames ICS, Matamala DAZ, Smith RL; Evaluating Accuracy and Precision in Morphologic Traits for Sexual Dimorphism in Malnutrition Human Skull: a Comparative Study. *Int. J. Morphol* 2008; 26:877-81.
2. Saulacic N, Belser U, Bernard JP. Efficacy of panoramic radiographs in the preoperative planning of posterior mandibular implants: a prospective clinical study of 1527 consecutively treated patients. *Clin Oral Implants Res*. 2008;19: 81-5.

3. American Academy of Oral and Maxillofacial Radiology, Tyndall DA, Brooks SL. Hill C, Arbor A, Mich. Selection criteria for dental implant site imaging: a position paper of the American Academy of Oral and Maxillofacial radiology. *Oral Surg Oral Med Oral Pathol Oral RadiolEndod* 2000; 89: 630-7
4. Katsutoshi H. Study of the Maxillary Sinus Floor and the Mandibular Canal as Seen in Panoramic Radiographs of Edentulous Jaws [in Japanese]. *The Journal of the Kyushu Dental Society*. 1996;5 :1-12 .
5. Frei C, Buser D, Dula K. Study on the necessity for crosssection imaging of the posterior mandible for treatment planning of standard cases in implant dentistry. *Clin. Oral Impl. Res.* 2004; 15:490–97
6. Saglam AA. The vertical heights of maxillary and mandibular bones in panoramic radiographs of dentate and edentulous subjects. *Quintessence Int.* 2002 Jun;33(6):433-8
7. Güler AU, Sumer M, Sumer P, Biçer I. The evaluation of vertical heights of maxillary and mandibular bones and the location of anatomic landmarks in panoramic radiographs of edentulous patients for implant dentistry. *J Oral Rehabil.* 2005 ; 32:741-6
8. Ongkana N, Sudwan P. Gender difference in Thai mandibles using metric analysis. *Chiang Mai Med J.* 2009; 48:43-8.

ORIGINAL RESEARCH ARTICLE

# THE ORAL HEALTH RELATED QUALITY OF LIFE BEFORE AND AFTER WEARING COMPLETE DENTURES FABRICATED BY DENTAL UNDERGRADUATE STUDENTS IN A DENTAL COLLEGE IN KOTHAMANGALAM - A SIX MONTHS FOLLOW-UP STUDY

Authors:

Pius A V<sup>1</sup>

Sanjeev R<sup>2</sup>

Meenu Merry C Paul<sup>3</sup>

Suneesh Kuruvilla<sup>4</sup>

Subramaniam R<sup>4</sup>

<sup>1</sup>Professor,

Department of Prosthodontics,  
Indira Gandhi Institute of Dental Sciences,  
Nellikuzhy P. O., Kothamangalam,  
Kerala - 686691, India.

<sup>2</sup>Professor,

Department of Periodontics,  
Indira Gandhi Institute of Dental Sciences,  
Nellikuzhy P. O., Kothamangalam,  
Kerala - 686691, India.

<sup>3</sup>Professor and Head

Department of Prosthodontics,  
Indira Gandhi Institute of Dental Sciences,  
Nellikuzhy P. O., Kothamangalam,

<sup>4</sup>Senior Lecturer,

Department of Public Health Dentistry,  
Indira Gandhi Institute of Dental Sciences,  
Nellikuzhy P. O., Kothamangalam,

Address for correspondence

Dr. Subramaniam R.

Department of Public Health Dentistry,  
Indira Gandhi Institute of Dental Sciences,  
Nellikuzhy P. O., Kothamangalam,  
Kerala-686691, India.

Phone No. + 91 9633381024(M)

E-mail: subbds@gmail.com

## ABSTRACT

**Background:** Inappropriate treatment of edentulousness using total prostheses may lead to not only impaired buccal function and increased alveolar bone loss, but also increased patient self-consciousness. Patient satisfaction also depends on technical and patient related variables. In dental institutions, majority of the dentures are fabricated by dental students. The Oral Impact on Daily Performance (OIDP) scale assesses the impact of oral health on an individual's daily life.

**Objectives:** To assessing the oral health related quality of life before and after wearing complete dentures fabricated by dental undergraduate students in a dental college in Kothamangalam.

**Methodology:** The study was a longitudinal questionnaire based survey. The target population was the patients visiting the Department of Prosthodontics in a dental college in Kothamangalam, Kerala over a period of two months for complete denture placement. Only first time denture wearers were included in the study. Oral Impact on Daily Performance Scale was used for assessing the OHRQoL. The assessment was made before and 6 months after wearing the dentures.

**Results:** Among the 56 participants, 29 were males. It was observed that there was a significant reduction in difficulty of performing all the eight daily performances six month after wearing dentures in relation to before wearing dentures. No significant difference was found in relation to gender and age group.

**Conclusion:** The study revealed that six months after wearing the dentures fabricated by students, there was a significant improvement in the OHRQoL of the study participants, with no significant difference in relation to gender and age group of the respondents.

**Key words:** OHRQoL, edentulousness, Oral impact on daily performances.

J Odontol Res 2014;2(2)11-7.

## INTRODUCTION

Teeth, be it natural or artificial are of paramount importance for human health. There are several studies to prove that tooth loss affects dietary intake, mastication and the nutritional status of individuals.<sup>1</sup> Dental awareness and the access to preventive dental care have contributed significantly to a decrease in the edentulous population. Despite the decreasing rate of tooth loss, the demand for removable prosthodontic treatment remains high.<sup>2</sup>

In the preamble of its constitution, WHO states that 'health is a state of complete physical, mental and social well being and not merely the absence of disease and infirmity'. In dentistry, this new perspective on health suggests that the ultimate goal of dental care is not merely the absence of caries or periodontal disease or oral cancer but also the mental and social well being of the patient. The concept of oral health-related quality of life (OHRQoL) captures the aim of this new perspective.<sup>3</sup> There is an increasing recognition that oral disorders can have a significant impact on physical, social and psychological well-being. This has resulted in a greater clinical focus on the quality of life improvement as a major, if not a primary outcome of dental care.<sup>4</sup> The emphasis on quality of life is consistent with the concept that the health is a resource and not simply the absence of disease.<sup>5</sup>

As per the reports of the WHO Global Oral Health Data Bank and WHO Oral Health Country/Area Profile Programme, 2000, the prevalence of edentulousness among 65-74 year old Indian population is about 19.6%.<sup>6</sup> Inappropriate treatment of edentulousness using total prostheses may lead to not only impaired buccal function and increased alveolar bone loss, but also increased patient self-consciousness. Patient satisfaction also depends on technical and patient related variables. Researchers have argued that the evaluation of treatment success should be established by each individual patient, as opposed to traditional clinical evaluation method. Despite the fact that patient wellbeing is always the main aim of the treatment approach adopted, clinical practice adopts predetermined criteria for treatment assessment, and these criteria do not consider the requirements and attitudes of individual patients.<sup>7</sup>

Numerous scales of measurements have been employed for measuring the Oral Health Related Quality of Life. The Oral Impact on Daily Performance (OIDP) scale assesses the impact of oral health on an individual's daily life. This instrument is advantageous for use in population surveys, not only in terms of it being easier to use while measuring individual behaviors rather than feeling states, but also because it is brief.<sup>1</sup>

Dental curriculum is one such curriculum that permits the students to treat their patients before completing the academic course. Students start treating edentulous patients and fabricate complete dentures for them when they enter the final year BDS. Although guided by the faculty members, the clinical and lab work done by students definitely need a quality control inspections.

Hence, this study was undertaken with an objective to compare the oral health related quality of life of edentulous patients before and after wearing complete dentures fabricated by students of Final year BDS.

## METHODOLOGY

The study was a longitudinal questionnaire based survey. The target population was the patients visiting the Department of Prosthodontics of Indira Gandhi Institute of Dental Sciences, Nellikuzhy, Kothamangalam, Kerala over a period of two months for complete denture placement. Only first time denture wearers were included in the study. All the dentures were fabricated by dental undergraduate students of Final Year. Oral Impact on Daily Performance Scale was used for assessing the OHRQoL.

A pre-fabricated, validated questionnaire was divided into two parts. The first part consisted of demographic data which included age, gender, visit (before or after denture wearing). The second part contained eight questions based on the Oral Impact on Daily Performance scale. Oral Impact on Daily Performances was obtained by adding scores for eight frequency items. "during the past 6 months how often did you have problems with your mouth and teeth which caused you any difficulties with,

1) eating, 2) speaking and pronouncing clearly, 3) cleaning teeth, 4) sleeping and relaxing, 5) smiling without embarrassment, 6) maintain emotional state, 7) enjoying contact with people and 8) carrying out major social work. The scale used was in the range: (0) 'never affected', (1) 'less than once a month', (2) 'once or twice a month', (3) 'once or twice a week', (4) '3-4 times a week', (5) 'every or nearly every day'. For analysis, dummy variables were constructed yielding categories 0 = never affected (including the original category 0) and 1 = affected less than once a month or more often (including original categories 1-5). Simple count scores (SC) were created by adding the 8 dummy variables. Additive scores (ADD) were created by adding the 8 ODP items as assessed originally. The questionnaire was translated into the local language Malayalam. The translated Malayalam version of the questionnaire was tested for content validity and reliability prior to the start of the study (Cronbach's  $\alpha$  value = 0.91).

The questionnaire was distributed by the faculty members of Department of Prosthodontics and Department of Public Health Dentistry. The questionnaire was distributed before denture delivery as well as 6 months after wearing the dentures. The respondents filled the questionnaire on their own and were asked to return the questionnaire immediately.

Necessary ethical clearance for the study was obtained from the ethical committee of the institution. The patients were briefed about the study and informed consent was obtained from all the participants prior to the administration of questionnaire. Patients who were not willing to participate in the study were excluded.

The final study sample was 56. All returned questionnaires were coded and analyzed. Results were expressed as a number and percentage of respondents for each question and were analyzed using the SPSS Version 17 software. Chi-square test was performed to compare the response in relation to gender, marital status and occupation. The level of significance was set at  $p = 0.05$ .

## RESULTS

### Respondent's Profile

Table I shows the respondent's profile. It was observed that about 51% of the respondents ( $n=29$ ) were males and the rest females ( $n=27$ ). Majority of the respondents belonged to the age group of 51-70 years ( $n=45$ ). Five patients were aged below 50 years and six above 71 years.

**TABLE I: RESPONDENT'S PROFILE**

GENDER	
MALE	29 (51.8%)
FEMALE	27(48.2%)
AGE GROUP	
<50 YEARS	5 (8.9%)
51-60 YEARS	22 (39.3%)
61-70 YEARS	23 (41.1%)
71-80 YEARS	6 (10.7%)

### Impact on Daily Performances

Table II shows the comparison of the impact on daily performances before wearing dentures and 6 months after wearing dentures as assessed by the Simple Count Scores (SCC). It was observed that there was a significant reduction in difficulty of performing all the eight daily performances six month after wearing dentures in relation to before wearing dentures.

Table III shows percentage distribution and mean frequency scores for eight oral impact on daily performance additive scores and oral impact on daily performance simple count scores. All the study subjects reported difficulty in eating and enjoying food and difficulty in carrying out major social role.

About 98% admitted they they had difficulty in enjoying contact with people. Six months after wearing dentures the study participants reported a significant reduction in difficulty in performing all the functions.

Table IV shows the results on inferential statistics in relation to age group and gender on the response as assessed by Chi square test. No significant difference in response was observed among the subjects of different age group and gender in relation to the parameters assessed.

**TABLE II: IMPACT ON DAILY PERFORMANCES BEFORE WEARING DENTURES AND 6 MONTHS AFTER WEARING DENTURES AS ASSESSED BY SIMPLE COUNT SCORES**

Q. No.	DAILY PERFORMANCES	BEFORE TREATMENT		AFTER TREATMENT		SIG.
		YES	NO	YES	NO	
1.	Difficulty in eating and enjoying food	56	0	44	12	$\chi^2 = 13.44$ $p < 0.01$
2.	Difficulty in speaking and pronouncing clearly	54	2	26	30	$\chi^2 = 34.30$ $p < 0.01$
3.	Difficulty in cleaning teeth	5	51	0	56	$\chi^2 = 5.23$ $p = 0.02$
4.	Difficulty in sleeping or relaxing	2	54	0	56	$\chi^2 = 2.03$ $p = 0.04$
5.	Difficulty in smiling, laughing and showing teeth without embarrassment	54	2	4	52	$\chi^2 = 89.40$ $p < 0.01$
6.	Difficulty in maintaining usual emotional state without being irritable	21	35	1	55	$\chi^2 = 22.62$ $p < 0.01$
7.	Difficulty in carrying out major work or social role	56	0	3	53	$\chi^2 = 100.61$ $p < 0.01$
8.	Difficulty in enjoying contact with people	55	1	2	54	$\chi^2 = 100.35$ $p < 0.01$

**TABLE III: PERCENTAGE DISTRIBUTION AND MEAN FREQUENCY SCORES FOR EIGHT ORAL IMPACT ON DAILY PERFORMANCE ADDITIVE SCORES AND ORAL IMPACT ON DAILY PERFORMANCE SIMPLE COUNT SCORES**

ORAL IMPACT ON DAILY PERFORMANCE PARAMETERS	PERCENTAGE AFFECTED		MEAN SCORE $\pm$ STANDARD DEVIATION	
	BEFORE	AFTER	BEFORE	AFTER
Difficulty in eating and enjoying food	100%	78.6%	1.00 $\pm$ 0.00	0.79 $\pm$ 0.05
Difficulty in speaking and pronouncing clearly	96.4%	48.2%	0.96 $\pm$ 0.02	0.46 $\pm$ 0.06
Difficulty in cleaning teeth	8.92%	0%	0.09 $\pm$ 0.03	0
Difficulty in sleeping or relaxing	3.6%	0%	0.04 $\pm$ 0.02	0
Difficulty in smiling, laughing and showing teeth without embarrassment	96.4%	7.1%	0.96 $\pm$ 0.02	0.07 $\pm$ 0.03
Difficulty in maintaining usual emotional state without being irritable	37.5%	1.7%	0.38 $\pm$ 0.06	0.02 $\pm$ 0.02
Difficulty in carrying out major work or social role	100%	5.3%	1.00 $\pm$ 0.00	0.05 $\pm$ 0.03
Difficulty in enjoying contact with people	98.2%	3.6%	0.98 $\pm$ 0.02	0.04 $\pm$ 0.03

**TABLE IV : TABLE SHOWING THE COMPARISON IN RELATION TO AGE GROUP AND GENDER ON THE RESPONSE AS ASSESSED BY CHI SQUARE TEST.**

ORAL IMPACT ON DAILY PERFORMANCE PARAMETERS	BEFORE		AFTER	
	GENDER	AGE GROUP	GENDER	AGE GROUP
Difficulty in eating and enjoying food	391.50 p = 1.00	$\chi^2 = 0.00$ p = 1.00	357.50 p = 0.43	$\chi^2 = 6.03$ p = 0.110
Difficulty in speaking, pronunciation	390.50 p = 0.959	$\chi^2 = 4.01$ p = 0.260	376.50 p = 0.776	$\chi^2 = 3.94$ p = 0.268
Difficulty in cleaning teeth	380.50 p = 0.703	$\chi^2 = 5.31$ p = 0.15	391.50 p = 1.00	$\chi^2 = 0.00$ p = 1.00
Difficulty in sleeping or relaxing	390.50 p = 0.959	$\chi^2 = 3.15$ p = 0.369	391.50 p = 1.00	$\chi^2 = 0.00$ p = 1.00
Difficulty in smiling, laughing and showing teeth without embarrassment	362.50 p = 0.139	$\chi^2 = 3.15$ p = 0.369	389.50 p = 0.941	$\chi^2 = 2.52$ p = 0.472
Difficulty in maintaining usual emotional state without being irritable	311.00 p = 0.116	$\chi^2 = 0.09$ p = 0.993	378.00 p = 0.335	$\chi^2 = 8.33$ p = 0.04
Difficulty in carrying out major work or social role	391.50 p = 1.00	$\chi^2 = 0.00$ p = 1.00	378.00 p = 0.599	$\chi^2 = 4.83$ p = 0.185
Difficulty in enjoying contact with people	377.00 p = 0.300	$\chi^2 = 1.55$ p = 0.672	364.50 p = 0.168	$\chi^2 = 3.95$ p = 0.266
OIDP SCC	335.00 p = 0.291	$\chi^2 = 0.22$ p = 0.975	361.50 p = 0.603	$\chi^2 = 6.13$ p = 0.105

## DISCUSSION

Although many industrialized countries have experienced a dramatic reduction in the prevalence of edentulousness and partial tooth loss, the proportion of edentulous individuals in aging societies worldwide continues to be significantly high. The main causes of tooth loss include the sequelae of caries and periodontal disease, but other factors have also been implicated. Tooth loss has been associated with several sociodemographic, behavioral, or medical factors. Once teeth are missing, food choices and nutritional changes could contribute to medical problems that might affect an individual's general well-being. Tooth loss can also have a negative impact on emotions and quality of life. Substitution of missing teeth with prosthesis is infrequent in developing countries, even though a high proportion of individuals may require some sort of prosthetic replacement<sup>8</sup>. Not many studies are conducted in Kerala state to assess the oral health quality of life of edentulous patients wearing complete dentures.

A variety of OHRQoL measures have been used, ranging from ad hoc, non-validated questionnaires to comprehensive measures based on conceptual models and validated for use in particular populations.<sup>9</sup> Generally, they measure the extent to which oral conditions disrupt normal social role functioning and lead to major changes in behaviours, such as changes in ability to work or attend school, or undertake parental or household duties.<sup>10</sup> Thus Oral Impact on Daily Performances questionnaire was used to assess the OHRQoL in this study.

The study revealed that among the eight daily performances assessed, before wearing the dentures, all the patients opined that they had difficulty in eating and enjoying food and difficulty in carrying out major social role. About 98.2% felt that the edentulousness made it difficult for them to enjoy communicate/socialize with people. Moreover, about 96.4% of the respondents had difficulty in smiling, laughing and showing teeth without embarrassment and difficulty in speaking and pronouncing clearly. Thus the study highlighted that over 96% of the study participants reported difficulty in six of the eight daily performances assessed. A

highly significant reduction in the difficulty in performing these six performances was reported six months after complete denture wearing. One important observation is that despite significant reduction reported in all parameters recorded, the reduction in difficulty in eating and enjoying food and difficulty in speaking was comparatively less than the other parameters. The observation could be due to an inherent drawback of prosthesis as compared with the natural dentition. However, none of the performances showed a significant difference in relation to age group or gender. This could be due to the fact that all the questions were based on daily performances.

Although studies,<sup>2,11,12</sup> systematic reviews and meta analysis<sup>9</sup> have revealed the impact of tooth loss on OHRQoL of older population, and studies have reported an improvement in OHRQoL after wearing conventional dentures,<sup>13-15</sup> longitudinal studies conducted comparing OHRQoL before and after wearing conventional dentures using Oral Impact on Daily Performance were sparse, with no studies reported on assessment of dentures fabricated by students. Although dental institutions throughout the country provide dental treatment at attractive and cheaper rates, the service is not well utilized by majority of the population. One important reason for this observation is due to the fact that majority of the treatment is done by students. Moreover, after the delivery of dentures the follow up of the patients is usually done for a week. Hence long term follow-up is a mandatory for assessing the quality of treatment done. Therefore, this study was undertaken with the above mentioned objective.

Moreover, with a simple scale such as Oral Impact on Daily performances, used in the study, the measurement of the Quality of Life becomes easier. Similar studies can be recommended as a measure of quality of service provided by the institution and can throw a light on the patient's satisfaction and quality of education.

## CONCLUSION

The study reveals that edentulousness had a significant impact on all the eight daily performances

assessed using the oral impact on daily performances scale. Six months after wearing the dentures fabricated by dental under graduate students, there was a significant improvement in the OHRQoL of the participants, with no significant difference in relation to gender and age group of the respondents.

## REFERENCES

1. Ariga P, Bridgitte A, Rangarajan V, Philip JM. Edentulousness, denture wear and needs of the elderly in rural south India. *Iranian J Publ Health* 2012;41(7):40-3.
2. Prabhu GKR, Prabhu R, Rai R, Ilango T, Easwaran MA, Shakir IA. The Quality of Oral Rehabilitation in the Partially edentulous south Indian population: A cross sectional study. *J Clinical and Diagnostic Research* 2011;5(7):1478-80.
3. Mehta A, Kaur G. Oral health-related quality of life—the concept, its assessment and relevance in dental research and education *Indian Journal of Dentistry* 2011;2(2):26-9
4. Bianco A, Fortunato L, Nobile CGA, Pavia M. Prevalence and determinants of oral impacts on daily performance: results from a survey among school children in Italy. *Eur J Pub Health*. 2009;20(5):595-600.
5. Priya H, Sequeira PS, Acharya S, Kumar M. Oral health related quality of life among dental students in a private dental institution in India. *Journal of International Society of Preventive and Community Dentistry* 2011;1(2):65-70.
6. Petersen PE. WHO Global Oral Health Data Bank and WHO Oral Health Country/Area Profile Programme, 2000 assessed online on 02/05/2013.
7. Zani SR, Rivaldo EG, Luis CF, Frasca, Caye LF. Oral health impact profile and prosthetic condition in edentulous patients rehabilitated with implant-supported overdentures and fixed prostheses. *J Oral Sci* 2009;51:535-43.
8. Khalifa N, Allen PF, Abu-bakr NH, Rahman MEA. Factors associated with tooth loss and prosthodontic status among Sudanese adults. *J Oral Sci* 2012;54:303-12.
9. Gerritsen AE, Allen PF, Witter DJ, Bronkhorst EM, Creugers NHJ. Tooth loss and oral health related quality of life: a systematic review and meta-analysis *Health and Quality of Life Outcomes* 2010, 8:126-37.
10. Gherunpong S, Tsakos G, Sheiham A. The prevalence and severity of oral impacts on daily performances in Thai primary school children. *Health and Quality of Life Outcomes* 2004;2:57-64.
11. Jain M, Kaira LS, Sikka G, Singh SK, Gupta A, Sharma R, Sawla L, Mathur A. How Do Age and Tooth Loss Affect Oral Health Impacts and Quality of Life? A Study Comparing Two State Samples of Gujarat and Rajasthan. *Journal of Dentistry, Tehran University of Medical Sciences*. 2012; 9(2):135-44.
12. Montero J, Macedo C, López-Valverde A, Bravo M. Validation of the oral health impact profile (OHIP-20sp) for Spanish edentulous patients. *Med Oral Patol Oral Cir Bucal*. 2012;17(3):e469-76.
13. Heydecke, G., Tedesco, L. A., Kowalski, C. and Inglehart, M. R. (2004), Complete dentures and oral health-related quality of life – do coping styles matter?. *Community Dentistry and Oral Epidemiology*, 32: 297–306.
14. John MT, Slade GD, Szentpetery A, Setz JM. Oral health-related quality of life in patients treated with fixed, removable, and complete dentures 1 month and 6 to 12 months after treatment.. *Int J Prosthodont* 2004;17(5)503-11.
15. Kende D, Szabo G, Marada G, Szentpetery A. Impact of prosthetic care on oral health related quality of life. *Fogorv SZ* 2008;101(2):49-57.

## REVIEW ARTICLES

# GO GREEN PERIODONTICS

### ABSTRACT

There are many ways to treat and manage periodontal diseases, one among them is the natural remedy of using herbs in prevention and treatment of periodontal diseases. Various herbal products and their extracts such as aloe vera, neem, turmeric, green tea, etc., have been used as herbal remedies for the treatment of periodontal diseases. Our paper provides a review of potent herbal remedies being used worldwide for the treatment and prevention of periodontal diseases.

**Key words:** Herbal remedies, Periodontal diseases, Non-surgical therapy

J Odontol Res 2014;2(2):18-24.

### Authors:

Sugumari Elavarasu <sup>1</sup>

Arthiie Thangavelu <sup>2</sup>

Jayashakthi Saravanan <sup>3</sup>

Mohammed Shereef <sup>4</sup>

<sup>1</sup> Professor and H.O.D.

Department of Periodontology and Oral Implantology,  
J.K.K.N. Dental College and Hospital,  
Komarapalayam, Tamilnadu

<sup>2</sup> Senior Lecturer

Department of Periodontology and Oral Implantology,  
J.K.K.N. Dental College and Hospital,  
Komarapalayam, Tamilnadu.

<sup>3</sup> Post-graduate

Department of Periodontology and Oral Implantology,  
J.K.K.N. Dental College and Hospital,  
Komarapalayam, Tamilnadu.

<sup>4</sup> Reader

Department of Periodontology and Oral Implantology,  
J.K.K.N. Dental College and Hospital,  
Komarapalayam, Tamilnadu.

Address for correspondence:

Dr. Sugumari Elavarasu,  
136, Sambu Enclave,  
Salem main road,  
Komarapalayam - 638183,  
Tamilnadu.

Email: drsugu@gmail.com

## INTRODUCTION

Periodontitis is an inflammatory disorder which is caused by microorganisms such as *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans* and many other organisms which results in the destruction of supporting periodontal tissues resulting in bone loss and loosening of teeth. The prime aim of the periodontal therapy is to restore the lost, form, function, esthetics and comfort. The treatment of periodontitis mainly involves the non-surgical and surgical periodontal therapy. The non-surgical periodontal therapy mainly involves scaling and root planing with antibiotic prophylaxis which can alter the progression of periodontal disease and reduce the bacterial count.<sup>1</sup>

As the periodontal diseases are associated with bacterial infections, antibacterial treatment seems to be an appropriate method of improving the condition of the inflamed tissues. As the antibiotics are systemically administered, the drug is distributed throughout the body, which is not required and can lead to toxicity.<sup>2</sup> To minimize these problems associated with systemic antibiotics, the local drug delivery system was introduced which can deliver the drugs for a constant and prolonged time period locally. The antibiotics are delivered locally in the form of fibers, strips and compacts, films, microparticles, gels and nanoparticles. In the recent days because of the increasing antibiotic resistance, herbal forms of medicines were developed to treat the periodontal disease. During the last decade, extracts or oils of medicinal plants with antimicrobial and anti-inflammatory activity have been used for prevention of various oral infections. More recently herbosomes – herbal medicinal system for treating periodontal disease has been reviewed by Nimbekar et al in 2012.<sup>3</sup> Herbosomes are recently introduced herbal formulations that are better absorbed and as a result produce better bioavailability and actions than the conventional botanical extracts.

Herbal drugs in management of periodontal disease:

### **Acacia Catechu wild:**

Widely used in Ayurveda for many diseases and mainly for skin diseases. *A. catechu* commonly known as Black khair and commercially used to

obtain Kattha in North India. The bark of this plant has strong antioxidant, astringent, anti-inflammatory, anti-bacterial and antifungal properties. *A. catechu* is used as mouthwash for mouth, gum and throat disease like gingivitis, stomatitis.<sup>4</sup>

### **Aloe Vera Miller:**

Aloe vera is *Aloe barbadensis* Miller. The species is frequently used in herbal medicine and cosmetics. Traditionally, Aloe was used topically to heal wounds, skin diseases and orally as a laxative. It is also used in conditions including diabetes, asthma, epilepsy and osteoarthritis.<sup>5</sup>

Aloe vera is a perennial plant belonging to the *Aloeaceae* family. Aloe vera has anti-inflammatory properties, antiulcer activity and an astringent effect and may have the ability to reduce scars and enhance wound healing. The aloe vera plant contains anthraquinone glycosides, polysaccharides, aloeresins, glucomannans, and bsitosterol. Polysaccharides, especially the acetylated mannans from aloe vera, plays a key role in immunomodulation.

Aloe vera is used in plaque control to reduce gingivitis and periodontitis.<sup>6</sup>

Villalobos et al observed a significant reduction in plaque and gingivitis after 30-days use of mouthrinse containing aloe vera with tooth brushing.<sup>7</sup> Okyar et al reported that treatment with aloe vera increased antioxidant enzymes and reduced lipid peroxidation.<sup>8</sup>

### **Azadirachata indica (Neem)**

Neem tree (*A. indica*) was described as early as in 1830 by De Jussieu.<sup>9</sup> It belongs to *Meliaceae* family. Every part of the tree has been used in traditional medicine for household remedy.<sup>10,11</sup> Bioactive compounds in neem includes nimbidin, nimbolide, gedunin, and mahmoodin. Nimbidin has anti-inflammatory, anti-arthritic, antipyretic, hypoglycemic, and anti-bacterial property.<sup>12,13</sup> It is active against *Klebsiella*, *Staphylococcus* and *Serratia* species. It is also active against *Streptococcus mutans* and *Streptococcus faecalis*.

Chatterjee et al<sup>14</sup> reported antigingivitis and

antiplaque effect of neem mouth rinse on plaque induced gingivitis and found that *A. indica*-based mouth rinse is equally efficacious with fewer side effects as compared to chlorhexidine and may be used as an adjunct therapy in treating plaque induced gingivitis. In addition it can be used in the form of gel and strips as local drug delivery.

### **Curcuma Longa (Turmeric)**

Turmeric (haldi), a rhizome of *Curcuma longa*, is a flavourful yellow-orange spice. Its plant is 3 feet in height and has lance-shaped leaves and spikes of yellow flowers that grow in a fleshy rhizome or in underground stem. An orange pulp inside the rhizome constitutes the source of turmeric medicinal powder. Components of turmeric are commonly named curcuminoids, which includes curcumin, demethoxycurcumin and bisdemethoxycurcumin.<sup>15</sup>

The active constituent of turmeric is known as curcumin. It has a wide range of therapeutic actions such as antioxidant, anti-inflammatory, hepatoprotective, antimicrobial, anti-platelet aggregation and antimutagenic.<sup>16</sup>

As a topical application - Applying a paste made from 1 tsp of turmeric with ½ tsp of salt and ½ tsp of mustard oil provides relief from gingivitis and periodontitis. It is recommended to rub the teeth and gums with this paste twice daily.<sup>17</sup>

A study by Waghmare et al.<sup>18</sup> concluded that turmeric mouthwash can be effectively used as an adjunct to mechanical plaque control methods in prevention of plaque and gingivitis. The effect of turmeric observed may be because of its anti-inflammatory action. There was a reduction in total microbial count with the use of turmeric as mouth wash. Behal et al.<sup>19</sup> used turmeric gel as an adjunct to scaling and root planing and found a significant reduction in the trypsin-like enzyme activity of "red complex" microorganisms. Suhag et al.<sup>20</sup> used turmeric as subgingival irrigant and found a better resolution of inflammation than chlorhexidine and saline irrigation.

### **Matricaria Chamomile (Camomile)**

Chamomile or camomile is a common name for sev-

eral daisy-like plants of the family Asteraceae. Chamomile flowers are also used as anti-inflammatory.<sup>21</sup>

Saderi et al in 2005 conducted a study to evaluate the antimicrobial effects of Chamomile extract and essential oil on clinically isolated *Porphyromonas gingivalis* from Periodontitis and they found that they had antibacterial activity against *P.gingivalis*, suggesting the potential use of Chamomile in natural mouthwash to control of *P.gingivalis* induced periodontitis.<sup>22</sup>

Pourabbas et al.<sup>23</sup> studied the effect of German Chamomile(GC) mouthwash on dental plaque and gingival inflammation. They reported that GC mouthwash resulted in the reduction in the plaque and gingival index scores, which were significantly better than the control rinse. The anti-inflammatory effect of GC mouth rinse is because of the salicylic acid in the form of a methyl ester. They further reviewed that the other constituents which are found in whole plant chamomile extract are flavonoids, including apigenin, chamazulene and  $\alpha$ -bisabolol. The flavones act as anti-inflammatory agents due to interfering with the arachidonic acid pathway. The GC extract also promotes wound healing by decreasing the inflammatory responses and accelerating granulation and regeneration of the tissues on topical application.

### **Eucalyptus Extract<sup>24</sup>**

Eucalyptus is a native to Australia and is a widely planted genus. *Eucalyptus globulus* is a representative of *Eucalyptus* species. Its leaf is used for medicinal purposes and as a food source. They possess antibacterial activity against various bacteria, including oral bacteria. 60% ethanol from the *E.globulus* leaf exerts antibacterial activity against periodontopathic bacteria like *porphyromonas gingivalis* and *prevotella intermedia*.

Macrocarpals, are polyphenols which are unique to eucalyptus and are major components of ethanol extracts of *E.globulus* leaf exerts antibacterial and antiviral activities, antagonism of thromboxane A2 and leukotriene D4. Macrocarpals A, B, C, D, H, I, and J and eucalypton were isolated in the mid-

1990s. Macrocarpals A, B, and C inhibit the activity of virulence factors of *P.gingivalis*, including Arg- and Lys-specific cysteine proteinases, as well as adhesion of the organism to saliva-coated hydroxyapatite beads. So these are considered as the primary antibacterial agents against cariogenic and periodontopathic bacteria.

A study done by Nagata et al.<sup>25</sup> found that Eucalyptus extract may improve the condition of the oral health. This study revealed that subjects who chewed eucalyptus containing chewing gum found relief from the disease symptoms such as less gingival bleeding, improved pocket depth and reduced plaque accumulation.

#### **Green tea:**

Green tea is extracted from the leaves of *Camellia sinensis*, which is shrub-like, plant.<sup>26</sup> Tea is reported to contain nearly 4000 bioactive compounds of which one third is contributed by polyphenols.<sup>27</sup> Polyphenols found in tea are mostly flavonoids and catechins. The catechins are thought to be responsible for the health benefits that have traditionally been attributed to tea, especially green tea. Major catechins are epicatechin gallate (ECG), epicatechin (EC), epigallocatechin (EGC) and epigallocatechin gallate (EGCG). The most active and abundant catechin in green tea is epigallocatechin-3-gallate (EGCG).<sup>28</sup>

Green tea catechin inhibit the growth of *P.gingivalis*, *Prevotella intermedia* and *Prevotella nigrescens* and adherence of *P.gingivalis* on to human buccal epithelial cells.<sup>29</sup> EGCG, ECG and galocatechin gallate, which are major tea polyphenols, inhibit production of toxic end metabolites of *P.gingivalis*.

A study showed that green tea catechin, EGCG and ECG inhibit the activity of *P.gingivalis*-derived collagenase. The combined use of mechanical treatment and the application of green tea catechin using a slow-release local delivery system was effective in improving the periodontal status.<sup>30</sup> Nakagawa et al reported that EGCG inhibited osteoclast formation in a co-culture of primary osteoclastic cells and bone marrow cells, and it induced apoptotic cell death of

osteoclast in a dose-dependent manner suggesting the role of green tea in the prevention of bone resorption.<sup>31</sup> EGCG prevents alveolar bone resorption by inhibiting the expression of MMP-9 in osteoblasts and formation of osteoclast. Hattarki et al.<sup>32</sup> conducted a split mouth study, in which green tea catechin was used as local drug delivery and they found that the catechin reduced all the clinical parameters and microbiological analysis, it significantly reduced the red complex organisms in the study group suggesting the bactericidal and anti-inflammatory activity of green tea catechin.

Oxidative stress plays an important role in the pathogenesis of periodontal disease as well as many other disorders, and it is believed that antioxidants can defend against inflammatory diseases.<sup>33</sup> Antimicrobial polyphenols in green tea can improve bad breath by suppressing the periodontopathic bacteria from producing methyl mercaptan, an important volatile sulphur compound which is the main source for halitosis.<sup>34</sup>

#### **Propolis:**

Propolis, also called as bee glue, is a natural resinous substance collected by honey bees (*Apis mellifera* L.) from plant buds and bark exudates and mixed with other substances. Its chemical constituents comprises of approximately 55% resinous compounds and balsam, 30% beeswax, 10% ethereal and aromatic oils, and 5% bee pollen. Bioflavonols are the key contributors to propolis properties. Propolis was found to be rich in vitamins A, B1, B2, B3, biotin and 14 of the 15 minerals that the human body requires for normal function.<sup>35</sup>

Flavonoids are compounds which have antibacterial, antifungal, antiviral, antioxidant, and anti-inflammatory properties. Propolis has been found to be very effective against gram positive and gram negative bacteria, yeast and virus.<sup>36</sup>

Murray investigated the effectiveness of a propolis containing mouthrinse in the inhibition of plaque formation concluded that propolis containing mouthrinse was marginally better than negative control.<sup>37</sup>

### **Tea tree oil:**

Tea tree oil is derived from the paper bark tea tree, which is part of the family Myrtaceae. Tea tree oil is the essential oil containing many components like monoterpene and sesquiterpene hydrocarbons and their alcohols. Tea tree oil is now used around the world in many cosmetic, medicinal and dental products (e.g., natural toothpastes). The main components of tea tree oil are also found in other common essential oils.<sup>38</sup>

Tea tree oil shares a similar range of antimicrobial activity with chlorhexidine (CHX), although their mechanisms of action differ. They both have antibacterial, antiviral and antifungal properties. Tea tree oil has the potential to be a therapeutic agent in chronic gingivitis and periodontitis. Mouthwashes containing tea tree oil reduce gingival inflammation. It also helps in controlling halitosis and plaque formation.<sup>39</sup>

### **Tulsi:**

Botanical name is *Ocimum sanctum*. It possess many medicinal properties such as expectorant, analgesic, anti-cancer, anti-asthmatic, antiemetic, anti-diabetic, hepato-protective, hypotensive, hypolipidemic and antistress agents.<sup>24</sup>

Dried, powdered tulsi leaves can be mixed with mustard oil to make a paste and used as tooth paste.<sup>40</sup> Its anti-inflammatory property helps in treating gingivitis and periodontitis.<sup>41</sup>

### **Bloodroot:**

Because of its natural alkaloids, bloodroot can impair the growth of bacteria responsible for periodontal disease. Bloodroot is included in oral health products such as toothpaste and mouthwashes, as it can reduce the inflammation and prevent bacteria from deepening the periodontal pockets.<sup>1</sup>

### **Lotus leaf:**

Traditionally, in Chinese medicine the lotus leaf has been used for treating gingival inflammation. An extract of lotus leaves have demonstrated significant antibacterial activity against some of the periodontopathogens. Quercetin in a lotus leaves

extract may be responsible for antibacterial activity.<sup>42</sup>

### **Fruit extracts in the management of periodontal disease:**

Craneberry juice components have the ability to reverse and inhibit the coaggregation of oral bacteria responsible for plaque formation and periodontitis.<sup>43</sup> Blackberry extract concentrations exhibit antimicrobial properties against important periodontal pathogens as well as *Streptococcus mutans*. It has the potential to be used as an antibacterial topical agent for the prevention and control of periodontitis as well as dental caries. Incorporation of blackberry extract in oral-release devices, such as chewing gum, is a long-term goal.<sup>44</sup>

### **CONCLUSION:**

In the future, herbs will be a major source of new chemicals and raw materials for the pharmaceutical industry. It is important to correlate the ancient literature of traditional plants with the etiology of periodontal disease so that the active ingredients of these herbs can be used in the management of periodontal disease. The interest in herbal products globally in the recent years is because of its low cost, ease of availability and safety. The herb–drug interactions has to be considered which is a potential hazard and can lead to deleterious effects. These herbal remedies hold a promising future in periodontal therapy.

### **REFERENCES**

1. Reddy PD, Sathyanarayana T, Swarnalatha, Purushothaman M. Local drug delivery of herbs in treatment of periodontitis. *JITPS*. 2010;1:245-51.
2. Kumar P, Ansari SH, Ali J. Herbal remedies for the treatment of periodontal diseases- a patent review. *Recent Pat Drug Deliv Formul*. 2009;3:221-8.
3. Nimbekar T, Wanjari B, Bais Y. Herbosomes – herbal medicinal system for the management of periodontal disease. *Int J of Biomed & Adv Res*. 2012;3:468-72

4. Negi BS, Dave BP. In vitro antimicrobial activity of *Acacia catechu* and its phytochemical analysis. *Indian J Microbiol* 2010;50:369-74.
5. Vogler BK, Ernst E. Aloe vera: a systematic review of its clinical effectiveness. *Br J Gen Pract* 1999;49:823-8.
6. Reynolds T, Dweck AC. Aloe vera leaf gel: A review update. *J Ethnopharmacol* 1999;68:3-37.
7. Villalobos OJ, Salazar CR, Sa´nchez GR. Effect of a mouthwash made of Aloe vera on plaque and gingival inflammation (in Spanish). *Acta Odontol Venez* 2001;39:16-24.
8. Okyar A, Can A, Akev N, Baktir G, Su˘tlu˘pınar N. Effect of Aloe vera leaves on blood glucose level in type I and type II diabetic rat models. *Phytother Res* 2001;15:157-161
9. Chatterjee A, Pakrashi SC. *The Treatise on Indian Medicinal Plants, Volume 2.* Publications & Information Directorate, 1992. 1994;3:76.
10. Chopra RN, Nayer SL, Chopra IC. *Glossary of Indian Medicinal plants.* New Delhi: CSIR; 1956.
11. Drabu S, Khatri S, Babu S. *Neem: Healer of All Ailments.* *Res J Pharm Biol Chem Sci.*2012;3:120–6.
12. Biswas K, Chattopadhyay I, Banerjee RK, Bandyopadhyay U. Biological activities and medicinal properties of neem (*Azadirachta indica*) *Cur Scien.* 2002;8:1336–45.
13. Marsh PD. Host defences and microbial homeostasis: role of microbial interactions. *J Dent Res.*1989;68:1567–75.
14. Chatterjee A, Saluja M, Singh N, Kandwal A. To evaluate the antigingivitis and antipalque effect of an *Azadirachta indica* (neem) mouthrinse on plaque induced gingivitis: A double-blind, randomized, controlled trial. *J Indian Soc Periodontol.* 2011;15:398-401.
15. Monika Nagpal and Shaveta Sood. Role of curcumin in systemic and oral health: An overview. *J Nat Sci Biol Med* 2013;4:3-7.
16. Chaturvedi TP. Uses of turmeric in dentistry: an update. *Indian J Dent Res.* 2009;20:107-9.
17. Cikrikci S, Mozioglu E, Yilmaz H. Biological activity of curcuminoids isolated from *Curcuma longa*. *Rec Nat Prod* 2008;2:19-24.
18. Waghmare PF, Chaudhari AU, Karhadkar VM, Jamkhande AS. Comparative evaluation of turmeric and chlorhexidine gluconate mouthwash in prevention of plaque formation and gingivitis: A clinical and microbiological study. *J Contemp Dent Pract.* 2011;1:221-4.
19. Behal R, Mali MA, Gilda SS, Paradkar AR. Evaluation of local drug delivery system containing 2% whole turmeric gel used as an adjunct to scaling and root planning in chronic periodontitis: A clinical and microbiological study. *J Indian Soc Periodontol.* 2011;15:35–8.
20. Suhag A, Dixit J, Dhan P. Role of curcumin as a subgingival irrigant: a pilot study. *Perio* 2007;4:115-21.
21. Amsterdam JD, Li Y, Soeller I, Rockwell K, Mao JJ, Shults J. A randomized, double-blind, placebo-controlled trial of oral matricaria recutita (chamomile) extract therapy of generalized anxiety disorder. *J Clin Psychopharmacol* 2009;29:378-82.
22. Saderi H, Owlia P, Hosseini A, Semiyari H. Antimicrobial effects of Chamomile extract and essential oil on clinically isolated *Porphyromonas gingivalis* from Periodontitis. *Acta Hort.* 680, ISHS 2005.
23. Pourabbas R, Delazar A, Chitsaz MT. The effect of German Chamomile mouthwash on dental plaque and gingival inflammation. *IJPR* 2005;2:105-9.
24. Agrawal N, Gupta R, Gupta I, Mehrotra V, Roopa DA. *Herbcraft: A boon to the periodontal therapy.* *Int J Dent Health Sci* 2014;1:47-62.
25. Nagata H, Inagaki Y, Tanaka M, et al. Effect of eucalyptus extract chewing gum on

periodontal health: a double-masked, randomized trial. *J Periodontol*. 2008;79:1378-1385.

26. Cabrera C, Artacho R, Giménez R. Beneficial Effects of Green Tea--A Review. *J Am Coll Nutr* 2006;25:79-99.
27. Mahmood T, Akhtar N, Khan BA. The morphology, characteristics, and medicinal properties of *Camellia sinensis*' tea. *J Med Plants Res*. 2010;4:2028-33.
28. Arab H, Maroofian A, Golestani S, Shafae H, Sohrabi K, Forouzanfar A. Review of the therapeutic effects of *Camellia sinensis* (green tea) on oral and periodontal health. *J Med Plants Res*. 2011;5:5465-69.
29. Sakanaka S, Aizawa M, Kim M, Yamamoto T. Inhibitory effects of green tea polyphenols on growth and cellular adherence of an oral bacterium, *Porphyromonas gingivalis*. *Biosci. Biotech. Biochem*. 1996;60:745-49.
30. Hirasawa M, Takada K, Makimura M, Otake S. Improvement of periodontal status by green tea catechin using a local delivery system: A clinical pilot study. *J Periodont Res* 2002;37:433-8.
31. Nakagawa H, Wachi M, Woo JT, Kato M, Kasai S, Takahashi F, et al. Fenton reaction is primarily involved in a mechanism of (-)-epigallocatechin-3-gallate to induce osteoclastic cell death. *Biochem Biophys Res Commun* 2002;292:94-101.
32. Hattarki SA, Pushpa SP, Bhat K. Evaluation of the efficacy of green tea catechins as an adjunct to scaling and root planing in the management of chronic periodontitis using PCR analysis: A clinical and microbiological study. *J Indian Soc Periodontol*. 2013;17:204-9.
33. Coimbra S, Castro E, Rocha-Pereira P, Rebelo I, Rocha S, Santos-Silva A. The effect of green tea in oxidative stress. *Clin Nutr*. 2006;25:790-6.
34. Ui M, Yasuda H, Shibata M, Maruyama T, Horita H, Hara T, Yasuda T. Effect of tea catechins for halitosis and their application in chewing gum. *Nippon Shokuhin Kogyo Gakkaishi*, 1991;38:1098-1102.
35. Gebaraa EC, Pustiglioni AN, de Lima LA, Mayer MP. Propolis extract as an adjuvant to periodontal treatment. *Oral Health Prev Dent* 2003;1:29-35.
36. Kosalec SL, Pepeljnjak S, Bakmaz M. Flavonoid analysis and antimicrobial activity of commercially available propolis products. *Acta Pharma* 2005;55:423-30.
37. Murray MC, Worthington HV, Blinkhom AS. A study to investigate the effect of a propolis-containing mouthrinse on the inhibition of de novo plaque formation. *J Clin Periodontol* 1997;24:796-8.
38. Walsh LJ, Longstaff J. The antimicrobial effects of an essential oil on selected oral pathogens. *Periodontology* 1987;8:11-15.
39. Soukoulis S, Hirsch R. The effects of a tea tree oil-containing gel on plaque and chronic gingivitis. *Aust Dent J*. 2004. *Aust Dent J*. 2004;49:78-83.
40. P Prakash, Neelu Gupta. Therapeutic uses of *ocimum sanctum* linn (tulsi) with a note on eugenol and its pharmacological action: A short review. *Indian J Physiol Pharmacol*. 2005;49:125-31.
41. Sen P. Therapeutic potential of Tulsi: from experience to facts. *Drugs News and views* 1993;1:15-21.
42. Li M, Xu Z. Quercetin in a lotus leaf extract may be responsible for antibacterial activity. *Arch Pharm Res*. 2008;31:640-4.
43. Weiss EI, Lev-Dor R, Kashamn Y, Goldhar J, Sharon N, Ofek I. Inhibiting interspecies coaggregation of plaque bacteria with a cranberry juice constituent. *J Am Dent Assoc* 1998;129:1719-23.
44. González OA, Escamilla C, Danaher RJ, Dai J, Ebersole JL, Mumper RJ, Miller CS. Antibacterial effects of blackberry extract target periodontopathogens. *J Periodont Res* 2013;48:80-86.

# OBSTRUCTIVE SLEEP APNEA (OSA) - AN OVER VIEW

## Authors:

Sanu Tom Abraham <sup>1</sup>  
Meenu Merry C Paul <sup>2</sup>

<sup>1</sup> Professor and Head  
Dept. of Orthodontics  
Indira Gandhi Institute of Dental  
Sciences, Kothamangalam.  
Kerala 686691

<sup>2</sup> Professor and Head,  
Dept. of Prosthodontics  
Indira Gandhi Institute of Dental  
Sciences, Kothamangalam,  
Kerala 686691

Corresponding Author:  
Dr. Sanu Tom Abraham  
Professor and Head  
Dept. of Orthodontics  
Indira Gandhi Institute of Dental  
Sciences, Kothamangalam.  
Kerala

## ABSTRACT

Sleep apnea is a condition that develops from the obstruction of the upper airway during sleep and necessitates awakening to resume breathing. This article gives an overview of the types, clinical features, etiology, various diagnostic methods and management of Obstructive sleep apnea including mandibular advancement device and surgical techniques.

**Key Words:** Sleep apnea syndromes; Snoring; Orthodontic appliances; Diagnosis; Therapy.

J Odontol Res 2014;2(2):25-9.

## INTRODUCTION

Obstructive sleep apnea (OSA) is a syndrome characterized by repetitive episodes of upper air way obstruction, that occurs during sleep, usually associated with a reduction in blood oxygen saturation<sup>1</sup>(Fig 1). People with sleep apnea literally stop breathing repeatedly during their sleep, often a minute or longer and as many as hundreds of times in a single night.

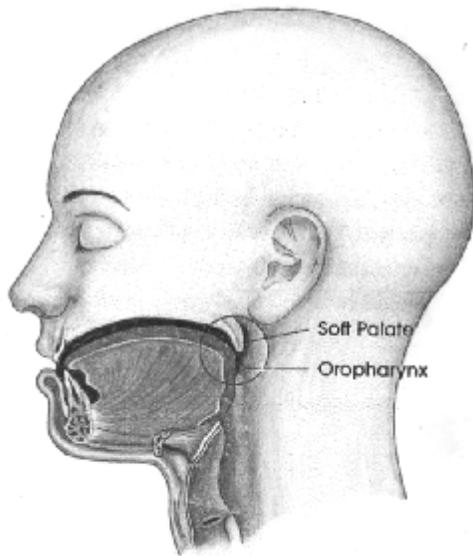


Figure 1

Types of apnea - The different types of apnea are obstructive, central and mixed .

Obstructive sleep apnea occurs due to obstruction caused by collapse of soft tissue structures in the oropharynx or hypopharynx. This includes the base of the tongue, soft palate with uvula, tonsils, epiglottis, pyriform sinuses . Central sleep apnea occurs when the brain fails to send appropriate signals to the breathing muscle to initiate respiration.

Mixed apnea starts as unobstructed apnea which is quickly followed by thoraco abdominal movements with upper air way obstruction

### Causes of Obstructive sleep apnea<sup>1,2</sup>

- Nose –deviated septum, enlarged turbinates, polyps

- Nasopharynx-enlarged adenoids
- Pharynx-enlarged tonsils, uvula, soft palate, base of tongue, and tongue base falling into pharyngeal airway
- Laryngopharyngeal reflex changes with severe posterior commissural swelling

### The common predisposing factors<sup>1,2,3</sup>

- Obesity
- Age with increase in age the muscle masses in the airway is replaced with fat leaving the airway narrow and soft
- Sex males more affected than female
- Retro positioned maxilla and mandible
- Habitual snoring
- Enlarged tonsils and adenoids (main cause of OSA in children)
- Drugs, alcohol, sedatives, anesthetics, sleeping pills, and narcotics increase the degree of relaxation of airway and interfere with brain arousability
- Smoking causes inflammation, swelling and narrowing of upper airway<sup>7</sup>
- Hypothyroidism, acromegaly, amyloidosis, vocal cord paralysis.

- Nasal paralysis

### Systemic Complications

- Systemic Hypertension
- Type 2 Diabetes Mellitus
- Myocardial Infarction
- Cerebrovascular accident(Stroke)
- Pulmonary Hypertension
- Arrhythmia

### Clinical symptoms of OSA<sup>1,2</sup>

- Excessive day time sleepness
- Loud snoring
- Morning headache
- Unrefreshing sleep

- Dry mouth upon awakening
- High Blood pressure
- Over weight
- Irritability and depression
- Difficulty in concentrating
- Frequent nocturnal urination
- Rapid weight gain

#### **The radiographic characteristics of OSA**<sup>5</sup>

- Mandibular retrognathia
- Retropositioned tongue
- High mandibular plane angle
- Short chin neck angle
- Class II skeletal relation
- Nasal airway obstruction
- Oropharyngeal abnormalities .
- Children with apnea are found to have longer hyoid mandibular plane distance.

#### **Diagnostic techniques**

The upper airway should be evaluated in all patients, particularly in non obese adults, for features associated with the presence of OSA such as narrowing of the lateral airway walls, enlarged tonsils, retrognathia, micrognathia, soft palate edema ,high arched palate ,enlarged uvula or tonsillar hypertrophy. An elongated soft palate that rest on the base of tongue is other case of air way obstruction some times seen in patients with OSA.<sup>5</sup>

#### • **Polysomnography**<sup>6</sup>

Overnight Polysomnography (PSG) is considered the gold standard of sleep apnea. Sleep polysomnography features electro cardiography, brainwave, electroencephalography (EEG) measurements, motor activity extremity measurements, diaphragmatic, chest movements, eye movements, pulse oximetry for oxygen desaturation measurements and inhalation exhalation oronasal flow characteristics. However PSG does not provide data for patients who have mild OSA.

#### • Oxymetry

Overnight oximetry which measures a patients oxygen saturation throughout the night.

#### • Multiple sleep latency test (MSLT)<sup>6</sup>

Measure the speed of falling asleep. MSLT is also performed to assess the level of day time sleep. A mean sleep latency of less than five minutes is considered abnormal (the average adult require 10 or more minutes to fall asleep during the day). The MSLT may be useful to measure the degree of excessive day time sleepiness and to rule out other type of sleep disorders.

#### **Investigations**

1. Radiographs like lateral neck films can better demonstrate adenotonsillar hypertrophy and other air way lesion.<sup>7</sup>

2. Computed Tomography (CT) scans provide tomographic images often used to diagnose pharyngeal obstruction. The drawback include the radiation exposure, expense and that is a non dynamic study .

3. MRI non invasive with high contrast resolution and allow scanning in multiple planes , allowing whole air way to visualize at one time. Reduction in the air space up to 50% considered as normal. MRI is the best non- invasive modality for evaluation and follow up of patients with OSA.<sup>7</sup>

4. Flexible fibro optics provides a dynamic examination of the upper air way.<sup>11</sup> Rigid bronchoscopy and laryngoscopy under general anesthesia which spontaneous respiration may be necessary in children where the site of obstruction cannot be discriminated by physical examination or radiographic studies.

#### **Treatment**

Treatment of snoring and OSA are directed at the upper air way and include nasal Continuous Positive Air way Pressure (CPAP) ie, sleeping with oxygen mask and the tank besides, various oral appliances and surgical management.

## Oral Devices

- Mandibular advancing devices<sup>4,5,7,8,9</sup> -advances the mandible and increase the air way by creating space between soft palate and the posterior nasopharynx.



Mandibular advancement device

- Tongue retraction device - the tongue is kept in an anterior position, the airway remains patent during sleep.<sup>1,2,4,5,6</sup>

The adverse effects of wearing an oral appliance includes TMD and tooth discomfort, pain, increased salivation, periodontal problem etc.

## Stimulants

If the patient is sleepy, he can be treated with stimulants and he becomes more active.

## Surgical Correction

1. Tracheotomy 1:- Surgical hole in the neck that opened during night and plugged for normal breathing during day.

Problem : raw unconditioned air inhalation<sup>8</sup>

2. Uvulopalatopharyngoplasty or UPPP<sup>10,11</sup>, is the oldest and most invasive surgical treatment for snoring<sup>9</sup>. It was first performed in 1982 by a Japanese surgeon named S. Fujita<sup>10</sup>. The reconstruction of the throat by resecting the posterior margins of soft palate and redundant mucosa on lateral pharyngeal wall. In this procedure, the surgeon resects (removes) the patient's tonsils, part of the soft palate, and the uvula. The procedure works by enlarging the airway and removing some of the soft tissue that vibrates when the patient snores. It is not effective in

treating snoring caused by obstructions at the base of the tongue.

## Drawbacks of UPPP

Lengthy recovery period.

Result in major complications, including severe bleeding due to removal of the tonsils as well as airway obstruction.

The results may not be permanent; between 50% and 70% of patients who have been treated with UPPP report that short-term improvements in snoring do not last longer than a year.

Expensive procedure.

## 3. Laser-assisted uvulopalatoplasty (LAUP)<sup>12</sup>

LAUP was developed in the late 1980s by Dr. Yves-Victor Kamami, a French surgeon. Laser-assisted uvulopalatoplasty, or LAUP, is an out-patient surgical treatment for snoring in which a carbon dioxide laser is used to vaporize part of the uvula, a small triangular piece of tissue that hangs from the soft palate above the back of the tongue. LAUP is typically performed as a series of three to five separate treatments. Additional treatment sessions, if needed, are spaced four to eight weeks apart.

## 4. Somnoplasty<sup>13</sup>

Somnoplasty, or radio frequency volumetric tissue reduction (RFVTR) is a newer technique. The surgeon uses a thin needle connected to a source of radio frequency signals to shrink the tissues in the soft palate, throat, or tongue. The needle is inserted beneath the surface layer of cells and heated to a temperature between 158°F (70°C) and 176°F (80°C). The upper layer of cells is unaffected, but the heated tissue is destroyed and gradually reabsorbed by the body over the next four to six weeks. Somnoplasty stiffens the remaining layers of tissue as well as reducing the total volume of tissue. Some patients require a second treatment, but most find that their snoring is significantly improved after only one. The procedure takes about 30 minutes and is performed under local anesthesia.

Somnoplasty appears to have a higher success rate (about 85%) than LAUP and is considerably less

painful. Most patients report two to three days of mild swelling after somnoplasty compared to two weeks of considerable discomfort for LAUP.

### Conclusion

Obstructive sleep apnea is a syndrome characterized by repeated episodes of airway obstruction during sleep. Among the various treatment modalities, surgery is indicated only if there is no response to drugs or CPAP (Continuous Positive Airway Pressure).

### REFERENCES

- Bernstein AK, Reidy RM. The effects of mandibular repositioning on obstructive sleep apnea. *J Craniomandibular Prac* 1988;6:179-81.
- Bonham PE, Currier GF, Orr WC, Othman J, Nanda RS. The effect of a modified functional appliance on obstructive sleep apnea. *Am J Orthod Dentofacial Orthop* 1988;94:384-92.
- Calderelli DD, Cartwright RD, Lilie JK. Obstructive sleep apnea: variations in surgical management. *Laryngoscope* 1985;95:1070-3.
- Clark GT, Arand D, Chung E, Tong D. Effect of anterior mandibular positioning on obstructive sleep apnea. *Am Rev Respir Dis* 1993;147:624-9.
- Eveloff SE, Rosenberg CL, Carlisle CC, Millman RP. Efficacy of a Herbst mandibular advancement device in obstructive sleep apnea. *Am J Respir Crit Care Med* 1994;149:905-9.
- George PT. A modified functional appliance for treatment of obstructive sleep apnea. *J Clin Orthod* 1987;21:171-5.
- Importance of cigarette smoking and obesity. *Chest* 1988;93:678-83.
- Guilleminault C, Simmons FB, Motta J, et al. Obstructive sleep apnea syndrome and tracheostomy: long-term follow-up experience. *Arch InternMed* 1981;141:985-8.
- Keenan SP, Burt H, Ryan CF, Cleetham JA. Long-term survival of patients with obstructive sleep apnea treated with uvulopalatopharyngoplasty or nasal CPAP. *Chest* 1994;105(1):155-9.
- Fujita S, Conway W, Zorick F, Roth T. Surgical correction of anatomic abnormalities in obstructive sleep apnea syndrome: uvulopalatopharyngoplasty. *Otolaryngol Head Neck Surg* 1981;89:923-34.
- Remmers JE, deGroot WJ, Sauerland EK, Anch AM. Pathogenesis of upper airway occlusion during sleep. *J Appl Physiol* 1978;44:931-8.
- Walker RP, Gopaldaswami C, Totten MC, Grigg-Damberger M. Laser assisted uvulopalatoplasty for snoring and obstructive sleep apnea: Results in 170 patients. *The Laryngoscope*. 1995;105(9):938-43.
- Sandhu GS, Vatts A, Bhinney D, Kotecha B, Croft PB. Somnoplasty for simple snoring - a pilot study. *Clinical Otolaryngology & Allied Sciences*. 2003;28(5):425-29.

## REVIEW ARTICLE

# AUTOIMMUNITY - A BRIEF INSIGHT

### ABSTRACT

Autoimmunity is characterized by the reaction of cells (auto reactive T-lymphocytes) or products (autoantibodies) of the immune system against the organism's own antigens (autoantigen). It may be part of the physiological immune response (natural autoimmunity) or pathologically induced, which may eventually lead to development of clinical abnormalities (autoimmune disease). Different mechanisms are involved in the induction and progression of autoimmunity. These include genetic or acquired defects in immune tolerance or immune regulatory pathways, molecular mimicry to viral or bacterial protein, an impaired clearance of apoptotic cell material.

**Key words:** Autoimmunity, Immunity

### Authors:

Jithin Jose<sup>1</sup>,  
Ambika K<sup>2</sup>,  
Niveditha Baiju<sup>3</sup>, Pramod  
Mathews<sup>4</sup>, Skariah KS<sup>5</sup>

<sup>1</sup> Senior lecturer, Dept of Oral Pathology & Microbiology, Indira Gandhi Institute of Dental Sciences, Kothamangalam.

<sup>2</sup> Former Principal, Indira Gandhi Institute of Dental Sciences, Kothamangalam.

<sup>3</sup> Professor & HOD, Dept of Oral Pathology & Microbiology, Indira Gandhi Institute of Dental Sciences, Kothamangalam.

<sup>4</sup> Professor, Dept of Oral Pathology & Microbiology, Indira Gandhi Institute of Dental Sciences, Kothamangalam.

<sup>5</sup> Reader, Dept of Oral Pathology & Microbiology, Indira Gandhi Institute of Dental Sciences, Kothamangalam.

Corresponding Author:  
Jithin Jose, Senior lecturer, Indira Gandhi Institute of Dental Science, Kothamangalam.  
E-mail: jitinjos@gmail.com

J Odontol Res 2014;2(2):30-5.

## INTRODUCTION

Immunology is the science that deals with body's response to antigenic challenge (Latin Immunitas, freedom from). Immunity is of different types it can be innate (native) or acquired (adaptive) immunity. Immunity is a very broad scientific discipline involving concept of recognition, specificity and memory. Immunological mechanism are involved in the protection of the body against infectious agent but they can also damage host organism called as autoimmunity.<sup>1</sup> Autoimmunity is the mechanism where an organism fails to recognize its own constituent parts (down to the sub-molecular levels) as "self", which results in an immune response against its own cells and tissues.<sup>2</sup>

Autoimmunity is characterized by the reaction of cells (auto reactive T-lymphocytes) or products (autoantibodies) of the immune system against the organism's own antigens (autoantigen). It may be part of the physiological immune response (natural autoimmunity) or pathologically induced, which may eventually lead to development of clinical abnormalities (autoimmune disease).<sup>3</sup> Different mechanisms, which are not mutually exclusive, may be involved in the induction and progression of pathologically autoimmunity these include genetic or acquired defects in immune tolerance or immune regulatory pathways, molecular mimicry to viral or bacterial protein, an impaired clearance of apoptotic cell material.<sup>4</sup>

### Association of autoimmunity with disease

Disease of autoimmune origin usually exhibit the following features:<sup>1</sup>

- An elevated level of Immunoglobulins
- Demonstrable autoantibodies
- Accumulation of lymphocytes and plasma cells at the sites of lesion.
- The occurrence of more than one type of autoimmune lesion in an individual.
- A genetic predisposition towards autoimmunity
- Higher incidence among females
- Chronicity, usually non reversible.

### Classification of autoimmune diseases:

The Autoimmune diseases are classified based on site of involvement and nature of lesion as localized (or organ specific) and systemic (or non-organ specific)<sup>5</sup>

Localized (Organ specific) autoimmune diseases:

- Autoimmune diseases of the thyroid gland
- Hashimoto's disease (Lymphadenoid goiter)
- Thyrotoxicosis (Grave's disease)
- Addison's disease
- Autoimmune orchitis
- Myasthenia gravis
- Autoimmune diseases of the eye
- Pernicious anaemia
- Autoimmune disease of nervous the system
- Autoimmune disease of the skin

### Systemic (non-organ specific) autoimmune diseases:

- Systemic lupus erythematosus
- Rheumatoid arthritis
- Polyarteritis nodosa
- Sjogren's syndrome

### The Autoimmune diseases is classified based on the various organ systems as follows:<sup>6</sup>

- |                       |   |
|-----------------------|---|
| A) Blood:             | Hemolytic anaemia,<br>Leucocytopenia,<br>Thrombocytopenia.                                |
| B) GIT:               | Pernicious anaemia,<br>Crohn's disease  |
| C) Endocrine:         | Thyroid- Hashimoto's<br>thyroiditis<br>Pancreas- IDDM Type 1                              |
| D) Connective tissue: | Lupus erythematosus,<br>Systemic scleroderma,<br>Dermatomycositis,<br>Erythema multiforme |
| E) CVS:               | Polyarthritis nodosa,<br>Wegner's granulomatousis,  |

- Temporal arteritis  
Endocarditis and  
Myocarditis
- F) Locomotion: Rheumatoid arthritis,  
Psoriatic arthritis,  
Mysthena gravis
- G) Skin and Mucosa: Pphemphigoid-Bullous,  
Benign cicatrical; Behcet's  
syndrome, Desquamative  
gingivitis, Recurrent  
apthae, Lichen planus
- F) Salivary: Sjogren's syndrome
- G) Nervous: Polyneuritis and Multiple  
sclerosis

### Mechanisms of autoimmune diseases :

Cells or tissues may undergo antigenic alteration as a result of physical, chemical, or biological influences, such altered or neoantigens may elicit an immune response. Neoantigens can arise in a variety of ways. Physical agents such as irradiation may cause antigenic alteration. Several chemicals, including drugs may combine with cells and tissues and alter their antigenic nature. The various mechanisms of autoimmune diseases is listed are as follows

#### 1. By pass of helper T-cell tolerance

Tolerance of CD4+ helper T cell is critical to the prevention of autoimmunity.

Therefore, tolerance may be broken if the helper T cells is bypassed or substituted.<sup>7</sup>

#### 2. Emergance of sequestered antigen

The induction of tolerance requires interaction between the antigen and the immune system. Thus any self-antigen that is completely sequestered during development is likely to he viewed as foreign if introduced into circulation, and an immune response will develop.<sup>8</sup>

#### 3. Imbalance of suppressor helper T-cell function

A loss of suppressor T cell function will contribute to autoimmunity and conversely, excessive T-cell help may drive B cells to extremely high levels of autoantibody production.<sup>7</sup>

#### 4. Microbial agents in autoimmunity

A variety of microbes, including bacteria, mycoplasmas and viruses have been implicated in triggering autoimmunity. Microbes may trigger autoimmune reactions in several ways. First, viral antigens and autoantigens may become associated to form immunogenic units and bypass T-cell tolerance. Second, some viruses (EBV) are nonspecific, polyclonal B-cell mitogens and may thus induce formation of autoantibodies. Third, viral infection may result in loss of suppressor T-cell function.<sup>8</sup>

#### 5. Molecular mimicry

Several infectious agents cross react with human tissues and their haptenic determinants. The infecting microorganisms may trigger an antibody response by presenting the cross reacting haptenic determinants in association with their own carrier to which helper T cell are not tolerant. The antibody so formed may then damage the tissue that shares cross reacting determinants.<sup>7</sup>

#### 6. Polyclonal lymphocyte activation

Several microorganisms and their products are capable of causing polyclonal (i.e antigen nonspecific) activation of B cells.<sup>8</sup>

### Environmental triggers in autoimmunity

Autoimmune disorders may result from multiple interactions of genes and environmental factors. Even if one inherit a genetic predisposition, the autoimmune disease will not occur unless there is an environmental trigger. There are several suspects in the search for triggers such as viruses, bacteria, diet, toxins, radiation, metal, estrogen, chronic infections etc. Genetics accounts for about half of the risk of developing an autoimmune disease. The other half is the agent in the environment which triggers the process. In an individual with a susceptible genotype, exposure to environmental factors can act to initiate an autoimmune process.<sup>9</sup>



### Genetic factors in autoimmunity

The different genes can increase susceptibility to autoimmune diseases. Established genetic risk factors include genes encoding histocompatibility molecules, complement proteins, immunoglobulins, peptide transporter proteins, and genes controlling the production of sex hormones. Each factor may independently enhance the immunogenicity of autoantigens, either by increasing their processing and presentation of B lymphocytes and macrophages or by increasing the chance for recognition by autoreactive T and B lymphocytes.<sup>10</sup>

### Nutrition and autoimmunity:

Nutritional deficiencies can alter the immune response. Example, protein–energy malnutrition is widespread in developing countries and results in the functional impairment of T-cells, phagocytic cells and secretory immunoglobulinA antibody response, as well as reduced levels of several complement components. Other impairments of immune function have been reported for moderate deficiencies of trace minerals (such as zinc) and vitamins (particularly A and D).<sup>11</sup>

### Apoptosis and autoimmunity

Apoptosis Greek word means “falling of leaves from trees and defined scientifically as programmed cell death. Apoptosis is essential to regulate and maintain tissue growth and maintain homeostasis. Dying cells undergo morphological modifications including chromatin condensation, nuclear fragmentation and generation of apoptotic bodies. Furthermore, they express so called “eat-me” signals on the cell surface that allow macrophage recognition and phagocytosis. Clearance of apoptotic cells is fundamentally important, since otherwise apoptotic cells tend to become secondary necrotic, release intracellular contents, and provoke inflammation and autoimmunity. Within the immune system alone, it has been estimated that more than 109 cells undergo apoptosis daily and these are cleared rapidly by neighboring tissue cells or professional phagocytes, normally without inciting an inflammatory reaction. Indeed, the most significant difference between phagocytosis of pathogens and the uptake of apoptotic cells has been traditionally considered

the immune response. A pro-inflammatory reaction is often induced after phagocytosis whereas the secretion of anti-inflammatory cytokines follows the engulfment of apoptotic cells.<sup>12</sup>

It is found that autoantigens are found within apoptotic bodies and that apoptotic cells are critical in the presentation of antigens, activation of innate immunity and regulation of macrophage cytokine secretion.

### Recent advances:

#### Proteomic approach to autoimmune disorders<sup>13</sup>

Proteomics is the study of structural and functional endowment of cells, tissues or organs. This science brings together powerful tools-physical separation techniques like 2-D electrophoresis and mass spectroscopy. It also includes various monoclonal antibodies and other probes coupled with which analysis is done by systems biology approach using modern software. Various statistical, probabilistic, humanistic and artificial neural network algorithms and at the same time incorporating elements of fractional theories are used to study the interactions of multitude of proteins in the cell. This allows separation of large background high concentration proteins inside the cell from pathobiologically and aetiologically relevant protein molecules present in nano, femto or even atto molar concentrations. Pattern recognition algorithm in modern proteomic techniques will help in understanding aetiopathogenesis of disease, discovering diagnostically and prognostically important biomarkers and molecular targets for future discovery. These techniques will have important applications in autoimmune disorders and other disorders which are difficult to manage.

Proteomic technologies hold the potential to revolutionize clinical care by providing tools for the discovery of biomarker for diagnosis, prediction of disease course, guiding therapeutic selection and monitoring response to therapy. Nevertheless tremendous work remains to develop refine validate and apply proteomics technologies to identify biomarker in autoimmune disease. To highlight several proteomics technologies and their application to autoimmune disease includes the following.<sup>14</sup>

1. 2-DE and MS for autoantigen and biomarker discovery
2. Autoantigen microarrays to characterize autoantibody response
3. Antibody array technologies to profile cytokines and other biomolecules
4. Reverse phase protein array (RPPA) studies to analyze phosphoproteins
5. Flow cytometric analysis of phosphoproteins

#### **Induction of immune tolerance by dendritic cells: Implication for preventive and therapeutic immunotherapy of autoimmune disease**<sup>15</sup>

Dendritic cells (DC) have a key role in controlling the immune response, by determining the outcome of antigen presentation to T cells. Through costimulatory molecules and other factors, DC is involved in the maintenance of peripheral tolerance through modulation of the immune response. This modulation occurs both consecutively, and in inflammation, in order to prevent autoimmunity and to control established immune responses. Dendritic cell control of immune responses may be mediated through cytokine or cell- contact dependent mechanisms. This understanding reaches a level at which DC- based therapies are helpful for the induction of immune regulation in autoimmunity.

#### **Haemopoietic stem cell transplantation for autoimmune disease**<sup>16</sup>

Transplantation of haematopoietic stem cells capable of self renewing and reconstituting all types of blood cell can treat numerous lethal diseases, including leukaemias and lymphomas. It may now be applicable for the treatment of autoimmune diseases and severe immune-mediated disorders, such as therapy-resistant rheumatoid arthritis and multiple sclerosis. Studies in animal models show that the transfer of haematopoietic stem cells can reverse autoimmunity, and several mechanistic pathways may explain this phenomenon. The outcome of ongoing clinical trials, as well as of studies in patients and animal models, will help to determine the role that stem-cell transplantation can play in the treatment of autoimmune diseases.

#### **The Use of Microarrays to Study Autoimmunity**<sup>17</sup>

Microarray technology provides an unprecedented and uniquely comprehensive probe into the coordinated workings of entire biological pathways and genomic-level processes. In general terms, microarrays refer to a variety of platforms in which high-density assays are performed in parallel on a solid support. The multiple sclerosis, systemic lupus erythematosus, and Sjogren's syndrome illustrate the potential for gaining new insights into the pathophysiology of these complex autoimmune disorders on a global, molecular scale. These new insights are likely to significantly improve our understanding of disease processes, diagnosis, identification of new therapeutic targets, and identification of patients most likely to benefit from specific and tailored therapies.

#### **CONCLUSION:**

Autoimmunity is the mechanism where an organism fails to recognize its own constituent parts (down to the sub-molecular levels) as "self", which results in an immune response against its own cells and tissues. Any disease that results from such an aberrant immune response is termed an autoimmune disease. Autoimmune diseases generally have varied systemic manifestations. The disease process may affect any organ system in the body and create physical, psychological, social and economical disability in the patient. This is an attempt to review the available literature on autoimmunity.

#### **REFERENCES**

- 1) Ananthanarayanan R and CK Jayaram Paniker's text book of microbiology, edited by CK Jayaram Paniker 7th edition. Orient longmann: 70-79.
- 2) De Lisa Fair-weather, Autoimmune disease mechanisms, Encyclopedia of life sciences, John Wiley and son's ltd. 2007: 1-6.
- 3) Kasper, Braunwald, Sanci, Houser, Longo, Jameson. Harrison's Principles of Internal Medicine: 16th edition, Vol. 2. McGraw hill Medical 2003: 471-477.

- 4) Environmental health criteria 236 Principals and assessing methods of autoimmunity associated with exposure to chemicals, World health organization, National institute for public health and environment, Bilthoven, Netherland.P.1-70.
- 5) R Dennis MC Gonagle, Michael F Mcdermott, A proposed classification of immunological diseases Research in translation PLOS Medicine August 2006 vol3; Issue 8: P1243-1248.
- 6) Xv11th National conference oral and maxillofacial pathology, Immune defeciciencies: 37-38.
- 7) Robbins and Cotran pathologic basis of disease 5th edition; Kumar, Abbas, Fausto, Aster Saunders Elseiver, Philadelphia. USA: 120-136.
- 8) Robbins and Cotran pathologic basis of disease 7th edition; Kumar, Abbas, Fausto, Aster Saunders; Elseiver, Philadelphia.USA: 171-189.
- 9) Dennis A Carson, Genetic factors in the etiology and pathogenesis of autoimmunity. The FASEB Journal Vol. 6; July 1992: 2800-2805.
- 10) Davidson A, Autoimmune diseases. N Eng Med 2001: 340-345.
- 11) Carlo Selmi, Koichi Tsuneyama, Nutrition, geoepidemiology, and autoimmunity. Autoimmunity reviews 9; 2010: A267-A270.
- 12) Tana Lleo, Carlo Selmi, Pietro Invernizzi, Mauro Podda, M. Eric Gershwin. The consequences of apoptosis in autoimmunity Journal of Autoimmunity 2008; 31: 257-262.
- 13) Vandhana D Pradhan, Neha R Deshpande and K Ghosh; Proteomic approach to autoimmune disorders: A review; Indian journal of biotechnology, jan 2010; 9: 13-17.
- 14) Wolfgang Hueber and William Robinson, Proteomic biomarkers for autoimmune disease review. Proteomics 2006; 6: 4100-4105.
- 15) Angus. G. Thompson and Ranjey Thomas, Induction of Immune tolerance by dendritic cells Implications for preventive and therapeutic immunotherapy of autoimmune disease. Immunology and cell biology 1997; 75: 503-507.
- 16) Megan Sykes and Boris Nikolic, Treatment of severe autoimmune disease by stem cell transplantation NATURE Vol. 435, 2; June 2005: 620-627.
- 17) Kathy L Moser, Patrick M Gaffney, Martha E. Grandits, Eshrat S. Emamian , Daniella B Machedo, Emily C Baechler, Nelson L Rhodus and Timothy W Behrens, The use of Microarrays to study Autoimmunity Journal of Investigative dermatology. vol. 9, No.1; Jan 2004: 18-22.

REVIEW ARTICLE

# A REVIEW OF MAXILLOFACIAL PROSTHESIS MATERIALS

Authors:

Shilpa Joseph<sup>1</sup>  
Pius AV<sup>2</sup>  
Seema George<sup>3</sup>  
Cinil Mathew<sup>1</sup>

**ABSTRACT**

A facial prosthesis restores normal anatomy and appearance, protects the tissues of a defect, and provides great psychological benefits to the patient. Materials for facial prostheses over the years include latex, polymethacrylates, polyvinylchlorides, chlorinated polyethylene, polyurethanes, silphenylene and silicone elastomers. Selection of a material for a facial restoration more often is dependent on the individual experiences and preferences of the clinician.

**Key words:** maxillofacial, prosthesis, methacrylate, silicone

<sup>1</sup>Senior Lecturer, Department of Prosthodontics, Indira Gandhi Institute of Dental Sciences Nellikuzhy, Kothamangalam, Kerala

<sup>2</sup>Professor, Department of Prosthodontics, Indira Gandhi Institute of Dental Sciences Nellikuzhy, Kothamangalam, Kerala

<sup>3</sup>Reader, Department of Prosthodontics, Indira Gandhi Institute of Dental Sciences Nellikuzhy, Kothamangalam, Kerala

Address for correspondence:  
Dr. Shilpa Joseph  
Department of Prosthodontics,  
Indira Gandhi Institute of Dental Sciences  
Nellikuzhy P.O., Kothamangalam, Kerala  
Ph. 9446631581  
Email : shilpajozz@gmail.com

J Odontol Res 2014;2(2):36-44.

## INTRODUCTION

Maxillofacial prosthetics is defined as that branch of prosthodontics concerned with restoration and replacement of both of stomatognathic and associated facial structures by artificial substitutes that may or may not be removed (GPT 8). Prostheses are used to restore function and/or appearance in patients who have suffered injuries or deformities, which can be caused by congenital defects, trauma and neoplasm.

In German, prostheses are called Epitheses, originating from Greek word "epithema" which means "to put something on top" in order to conceal an abnormality. Somato-prosthesis, facial prosthesis or epithesis are general terms found in literature.

### History of maxillofacial prosthesis materials.

Excavations of the Egyptian tombs (1613-2494 BC) have provided evidences of artificial eyes, ears and noses. Eyes made from precious stones, earthenware, enamelled bronze, copper, and gold were found within eye sockets of Egyptian mummies.

Chinese had used natural waxes and resins to fabricate nasal and auricular prostheses<sup>2</sup>.

Ambroise Pare (1510-1590) can be considered as the father of facial prostheses. His work is considered to be the foundation stone of modern anaplastology. He described nasal prostheses made of silver, auricular prostheses made of papiermache or leather, and ocular prostheses retained by a metal band passing around the patient's head<sup>3,4</sup>.

In the 19th century, metals such as gold and silver, as well as ceramic materials and wood were used to create prostheses<sup>3</sup>. Between 1800 and 1900, William Morton (1819), Kingsley (1880) and Claude Martin (1889) all attempted to replace nasal defects by using ceramic material<sup>5</sup>.

Upham (1901) reported the fabrication of nasal and auricular prostheses from vulcanite rubber. This material was, at that time, widely used for intraoral prostheses<sup>4</sup>.

During World War I, a material based on gelatin and glycerine, called elastine, was used to fabricate

facial prostheses for patients injured in the war. Because of water absorption, this material lasted only for seven or eight days, and the patients themselves were taught to make their own prostheses<sup>3</sup>.

Prevulcanized latex was introduced as material for maxillofacial prostheses between World War I and World War II. This material was lightweight and easy to process. However, in the early 1940s, acrylic resin replaced vulcanized rubber, due to better processing and physical properties<sup>3</sup>.

As an attempt towards more flexible materials, polyvinylchloride was used for a period starting from the mid-1940s<sup>3</sup>. Barnhart, in 1960, introduced a special silicone rubber for construction of facial prostheses; this was the major revolution in the history of maxillofacial prostheses<sup>6</sup>. From 1970 to 1990, different authors described many types of maxillofacial elastomers. Gonzalez described polyurethane for maxillofacial prostheses<sup>7</sup>. Lontz described the use of modified polysiloxane elastomers<sup>8</sup>. Lewis and Castleberry used phenylene compound to fabricate facial prostheses<sup>9</sup>. By the 1990s polyphosphazenes, a class of metallo-organic polymers has also been investigated for their suitability for facial prostheses by Lawrence Gettleman<sup>10</sup>.

The currently available facial prosthetic materials are divided into methacrylate or acrylic resins, polyurethane elastomers, and silicone elastomers. Today most maxillofacial prostheses are made of medical grade silicone elastomer (silicone rubber)<sup>3,4</sup>.

Ideal properties of a maxillofacial prosthesis material

Lewis et al.<sup>9</sup> classified three categories of ideal properties of these materials:

1. Processing characteristics that include low viscosity extended working time, capability of intrinsic and extrinsic coloration, low processing temperature, and ease of molding using reusable molds.
2. Mechanical or performance characteristics such as high tensile strength, high percent elongation and elastic modulus, high tear strength, sufficient hardness, dimensional stability, proper surface tension, coefficient of friction, and resistance to chemicals

and ultraviolet light.

3. Patient accommodation properties that guarantee a product that is nontoxic, non-allergenic, non-carcinogenic, easily cleansable, lightweight and compatible with adhesives and that has a reasonable cost.

Materials used for maxillofacial prosthesis

Methacrylates (acrylic resins)

Acrylic resin is translucent and easy to color both intrinsically and extrinsically. It is also easy to process and is relatively hard, but durable<sup>11</sup>. Acrylic resins are used for fabrication of prosthetic eyes in ocular or orbital prostheses, and for frameworks, as a base material or clip carrier material in silicone maxillofacial prostheses<sup>12</sup>. Heat-polymerized acrylic is more tissue-friendly, containing no unpolymerized tertiary amines, and therefore it is preferred over autopolymerized acrylic. A-211 is a new fleshtone (self cure) premium acrylic polymer, mixed 3 to 1 with AC-198 Fleshtone Monomer (self cure). This final product can also be tinted to various additional colors simply by adding oil paints to the monomer.

In case of repetitive surgery, the acrylic prosthesis can be temporarily lined with soft tissue liners. Acrylic is used particularly in those cases in which little movement of the tissue bed takes place during function. It has good strength and can be fabricated with a feather margin. It has a good life of about 2 year.

Its main disadvantages are rigidity, duplicate prosthesis is not possible because of destruction of the mold during processing and water sorption which results in increased weight<sup>13</sup>.

#### Acrylic Co-polymers

Oils or other plasticizers can be added to produce copolymers, which are used as flexible polymethacrylates in maxillofacial prosthodontics<sup>14</sup>. Polymethyl methacrylate can be plasticized with butylacrylate and methyl methacrylamide, to be used as synthetic latex (acrylic latex). However, because of the time-consuming fabrication and the

short durability of the material (3-4 months) this material is not suitable for facial prostheses<sup>12</sup>.

Acrylic co-polymers are soft and elastic but have not received wide acceptance. They possess poor edge strength and poor durability. They are subjected to degradation when exposed to sunlight. Processing coloration is difficult. Completed restoration often become tacky, predisposing to dust collection and staining<sup>13</sup>. Incorporation of high molecular weight acrylic polymers with molecular blocks of polymer like polyether urethane, hydrocarbon, fluorocarbon or silicone can eliminate the shortcomings of traditional acrylic copolymers and contain camphoroquinone as a photoinitiator<sup>36</sup>.

#### Thermoplastic materials

Thermoplastic materials for dental prostheses, Valplast (Valplast Int. Corp. - USA) and Flexiplast (Bredent - Germany), were first introduced to dentistry in the 1950s. Both materials were similar grades of Polyamides (nylon plastics). Thermoplastic resins tend to have predictable long-term performance. They are stable and resist thermal polymer unzipping. They also exhibit high creep resistance and high fatigue endurance as well as excellent wear characteristics and solvent resistance. A significant percentage of the population is allergic to free monomer and these materials offer a new safe treatment alternative for these individuals. In addition, thermoplastic materials have almost no porosity, which reduces biologic material build up, odors, and stains and exhibit higher dimension and color stability.<sup>32</sup>

Thermoplastic resins are used for a broad variety of applications from removable flexible partial dentures, preformed partial denture clasps, fiber-reinforced fixed partial dentures, temporary crowns and bridges, provisional crowns and bridges, obturators and speech therapy appliances, orthodontic retainers and brackets, impression tray and border molding materials, occlusal splints, sleep apnea appliances, and implant abutments.<sup>33</sup>

#### Polyvinylchloride and co-polymers:

Polyvinyl chloride is produced by polymerization of the monomer vinyl chloride (VCM). Polyvinyl chlo-

ride is a rigid plastic that is clear, tasteless, and odorless, with a glass transition temperature higher than room temperature<sup>37</sup>. For maxillofacial application plasticizers are added to produce an elastomer at room temperature.

It is processed at 150°C and metal mold are generally used<sup>37</sup>. A wide variation in properties can be obtained by altering the proportion of the reactant and catalyst. These properties include increased flexibility and adaptability to both intrinsic and extrinsic colouration. Recently a copolymer of 5% to 20% vinyl acetate, with the remaining percentage being vinyl chloride has been introduced. The copolymer is more flexible, but less chemically resistant than poly vinyl chloride<sup>38</sup>.

The disadvantages of this material is the early loss of plasticisers, resulting in colour loss, increased permeability, easy tearing of the prosthetic edges and absorption of body secretion. These factors can result in rapid degradation of the physical properties of the material<sup>13</sup>.

#### **Chlorinated polyethylene**

Lewis and Castleberry reported similarity of this material to polyvinyl chloride in both chemical composition and physical properties<sup>13</sup>. Chlorinated polyethylene has some advantages compared to silicone elastomer: it is possible to repair, reline or recondition - factors which may extend the lifetime of the prosthesis. It is also much less expensive than silicone rubber, has greater edge strength and does not support fungus growth. The fabrication of CPE prostheses requires high temperatures and metal molds, which complicates the fabrication process<sup>11,15</sup>. The coloration has to be done with oil-soluble dyes by using a laminating technique, with layers of pigmented and unpigmented material<sup>16</sup>.

According to Gettleman et al.<sup>15</sup>, chlorinated polyethylene is suitable for making thin feather edges of the prosthesis, or to simulate cartilage while silicone elastomer is more suitable for fabricating soft facial prostheses. More recent studies have shown that aging, due to exposure to ultraviolet radiation, sebum and perspiration, leads to considerable changes in the physical properties of chlorinated

polyethylene, probably due to cross-linking reactions within the material<sup>17</sup>.

#### **Polyurethane**

Polyurethane consists of a hard segment of an extended di-isocyanate and a soft segment of polyols, and the polymerization process is performed at room temperature with an organo tin catalyst. The proportion of these segments determines the softness of the end-product Turner & Castlebury reported the development of an aliphatic polyurethane prepolymer-isophorone.. The elastomer type of polyurethane has been used as material in maxillofacial prostheses<sup>18</sup>. The type of polyurethane usually used in maxillofacial surgery is Epithane-3, formally marketed as Dermathane by MIP Industries<sup>9,19</sup>.

This material allows prostheses to be lifelike in appearance<sup>19</sup>. In general, the tear energy necessary for breaking PU elastomers is higher than the other commercially available maxillofacial materials<sup>20</sup>. Furthermore, polyurethanes do not injure the tissues, are hypoallergenic and have a longer longevity (9-18 months) when properly cured and handled. Thus PU elastomers can be used with success in the fabrication of facial prostheses if the casting procedure is done accurately and carefully<sup>18</sup>.

The iso-cyanate component is toxic and it is very sensitive to moisture during the fabricating process. The presence of moisture can lead to bubbles and incomplete curing of the material<sup>21</sup>. Cured polyurethane contains isocyanate in a bound and nontoxic form, but it is possible that remnants of the free, toxic isocyanate component may also be present in cured material. The polyurethane composition used in maxillofacial prosthetics has been found to be toxic to human tissue cells<sup>22</sup>.

#### **Silicone elastomers**

Silicones are a general category of synthetic polymers whose backbone is made of repeating silicon to oxygen bonds. In addition to their links to oxygen to form the polymeric chain, the silicon atoms are also bonded to organic groups, typically methyl groups. The simultaneous presence of "organic" groups

attached to an “inorganic” backbone gives silicones a combination of unique properties, making possible their use as fluids, emulsions, compounds, resins, and elastomers in numerous applications and diverse fields.

Medical use of silicone elastomer began in 1953 and it was first used for external prostheses in 1960 by Barnhart<sup>23</sup>. A great variety of maxillofacial silicone products has been developed since the 1960s. It is still the most commonly used material for fabricating the surface of, or entire, facial prostheses<sup>3,4</sup>.

Silicones are classified into 4 groups according to their applications<sup>13</sup>:

Class I: - Implant grade, which requires the material to undergo extensive testing and must meet FDA requirements.

Class II: - Medical grade, which is approved for external use. This material is used for fabrication of maxillofacial prosthesis.

Class III: - Clean grade

Class IV: - Industrial grade, commonly used for industrial applications.

The two major groups of poly-dimethylsiloxane silicone elastomers used for fabrication of maxillofacial prostheses are:

1) Room-temperature vulcanizing (RTV) silicones – these include a filler of diatomaceous earth particles and are composed of two main parts; a catalyst (stannous octate) and a cross linking agent, ortho-alkyl silicate. This group includes a variety of materials namely Silastic 382 and 399. They are inert, colour stable viscous polymers. MDX4-4210 is also widely used in the manufacture of maxillofacial prostheses<sup>10</sup>. These materials are translucent so they can be blended with suitable earth pigments to replicate the patient’s basic skin colour, with higher colour stability. The material is biologically inert and processed easily. Furthermore, it can retain physical and mechanical properties at a wide range of temperatures. The main disadvantage of these materials is poor edge strength<sup>13</sup>.

2) Heat-temperature vulcanizing (HTV) is used

when higher tear strength is required. Tear strength is determined by the type and nature of the cross linking in the catalyst. Different heat vulcanized silicone elastomers exist and include: Silastic 370, 372, 373, 4-4514, and 4-4515. They are highly viscous white/opaque materials with a dichloro benzyl peroxide/platinum salt catalyst. Different amounts of silica fillers are added according to the degree of hardness, tensile and tear strength that is required. The material has thermal and colour stability but it lacks flexibility and restricts movement. It has poor aesthetic output because the material is opaque and many consider it to have an artificial or lifeless appearance. A new generation of (HTV) are Q7-4635, Q7-4650, Q7-4735, SE-4534U and these have shown improved mechanical properties compared to MDX4-4210 and MDX4-4514 RTV Silicone<sup>10</sup>. Lontz et al reported a new type of HTV silicone, poly di methyl siloxane (PDM). It was developed by the Veteran’s Administration.

Room temperature vulcanizing (RTV) silicones have been preferred because of their easy fabricating process. Stone molds can be used, and even if the polymerization reaction occurs at room temperature, the process can be accelerated at higher temperatures<sup>9</sup>. Heat temperature vulcanizing (HTV) silicones are generally stronger, tougher and stiffer, but the fabrication is more complicated as the material requires a milling machine and metal molds during fabrication<sup>9</sup>.

One non-desired property is that silicone rubber is unmodifiable, which means that the whole prosthesis has to be remade due to possible changes of the underlying tissue, which may occur due to the results of healing, radiation therapy or further surgery. Silica or other fillers are added to increase the tensile strength, but the fillers may give rise to a loss of translucency. Other main disadvantages of silicone elastomers are low tear and edge strength, relatively low elongation, problems with color stability<sup>11,14</sup> and the potential to support bacterial or fungal growth<sup>3,4</sup>.

#### **Recent advances in Silicone elastomers**

MDX 4–4210

It is a low temperature, vulcanizing silicone polymer provided as a two component kit. The polymerization reaction is addition reaction with no by product. It is very colour stable. It has a high tear strength compared to RTV silicones. Unusually thin edges can be designed in prosthesis without the risk of damage during wear & removal. Accelerated aging tests have shown that the elastomer is very colour stable<sup>13</sup>. According to Moore it has improved edge strength and superior coloration<sup>34</sup>.

### **Sil Phenylenes**

They are arylene silicone polymer. It is synthesized & formulated as a pourable, viscous, RTV liquid. It is transparent and reinforced with silica fillers. It is available as a three component kit base elastomer, tetrapropoxysilane (cross linking agent) and organotin catalyst. It has an unusual combination of high-tensile strength & low modulus (relative to other conventional RTV silicones)<sup>13</sup>.

### **Silicone Block Copolymers**

It has been introduced to improve some of the weaknesses of silicone elastomers, such as decreased tear strength, low percent elongation and its susceptibility to bacterial growth<sup>13</sup>.

### **Polyphosphazenes**

Fluroelastomer has been developed for use as a resilient denture liner, and has the potential to be used as a maxillofacial prosthetic material<sup>13</sup>.

### **Cosmesil**

It was described by Woofaardt<sup>35</sup>. It is a RTV silicone showing a high degree of tear resistance<sup>13</sup>.

### **Foaming silicones**

Silastic 386 is a form of RTV silicone. The gas forms bubbles within the vulcanizing silicone. After the silicon is processed, the gas is eventually released; leaving a spongy material. Formation of bubbles within the mass can cause the volume to increase by as much as seven fold. Purpose of the foam silicon is to reduce the weight of the prosthesis.

### **Platinum Silicones**

A-2000 is the latest in the development of elastomers

specifically formulated for prosthetics. This is the first generation of 1:1 mixture RTV silicone reacting well with thixotropic agents. The clinicians can control the viscosity of this silicone while working with the uncured material. A-2002 Platinum Silicone Elastomer is a new, low durometer, 10:1 by weight platinum, optically clear silicone elastomer<sup>38</sup>. This low viscosity silicone is pourable and reacts with thixotropic agents. A-RTV-40 is a new, a low durometer, shore A 40, 10:1 by weight, platinum, translucent silicone elastomer. This low viscosity silicone is pourable and reacts with thixotropic agents.

### **TinSil Silicone Elastomer**

TinSil Silicone Elastomer [FX-108T, FX-308T] are the new condensation cure, RTV, low viscosity, translucent, low durometer, tin silicone elastomer, which has proven to be a very economical and versatile material with enhanced properties and physical characteristics.

### **Liquid Silicone Rubber (LSR) Systems**

Liquid Silicone Rubber (LSR) Systems are two part 100% solids, pure dimethyl silicone elastomers, engineered for optimum performance in liquid injection molding (LIM) processes where high clarity, high strength molded parts. Liquid Silicone Rubber (LSR) is a pump able, colorless, translucent paste. When A and B components are mixed together in equal portions by weight, the paste will cure to a tough, optically clear elastomer via platinum catalyzed addition-cure chemistry.

### **Coloring agents and pigments**

A maxillofacial prosthesis is characterized and colored with dry pigments, pigment suspensions, dyes or pastes to match the color of adjacent facial structures. The prosthesis should also possess a certain translucency to obtain a life like appearance. Rayon flock, thread or yarn, can be added to achieve a realistic skin appearance and texture.

Usually the combination of intrinsic and extrinsic coloring makes the color of a pigmented prosthesis match that of human skin. Intrinsic coloration plays an important part in this process since it sets the basic color and translucency. Intrinsic coloring is

less vulnerable to environmental conditions and handling than extrinsic coloring. Extrinsic coloration may be applied on the surface of a cured pigmented prosthesis which originally does not exhibit an acceptable appearance match<sup>24</sup>.

Pigments and dyes play a key role in pigmentation and coloration of maxillofacial prosthetic elastomers. A color pigment acts as solid filler, which does not bond to the silicone. It is a finely divided colored substance that does not dissolve, but remains dispersed, when mixed or ground in a liquid vehicle. Dyes dissolve in liquid and give their color effect by staining the material<sup>25</sup>. Inorganic pigments are usually metal oxides while organic pigments are carbon hydrogen derivatives of animal, vegetable or synthetic origin.

#### **Adhesives for retention of prosthesis**

Medical products that involve adhesion to the skin or adhesives that attach to human skin are known as pressure-sensitive adhesives (PSA), defined as viscoelastic materials, which in their dry state at room temperature can adhere strongly to a wide variety of substrates by application of slight pressure<sup>26</sup> for a short period of time without activation by water, heat, or solvent<sup>27</sup>.

Nowadays, PSA for skin contact applications are mostly made of acrylic polymers because they are less irritating to skin<sup>28</sup>. Silicone adhesives (Holister) are a form of RTV silicone dissolved in solvent. Once applied, the solvent evaporates & a tacky surface forms that form bond with another surface. Despite their low adhesive strength, they have good resistance to moisture & weathering with low water sorption. Acrylic resin emulsions (Epithane-3, ProSAide) are composed of acrylic resin dispersed in water solvent when evaporated, leaves a rubber-like substance. Other materials include synthetic rubber, vinyl acetate, reclaimed rubber, vinyl chloride, styrene, & methacrylic. Factor II inc. A-4717 Silicone Elastomer is a two part, clear to translucent, pourable silicone system that cures at room temperature and forms a permanent high tack gel. Polymerization occurs without formation of heat RTV room temperature Vulcanizing. When used cor-

rectly it will self-attach to a silicone prosthesis as a permanent adhesive.

Adhesives has the advantages of easy application and removal from the prostheses<sup>29</sup>. A major limitation is achieving optimal adhesion of the prostheses for long periods of time. Another disadvantage of this method of retention is the interaction of the adhesive material with the patient's skin - perspiration, movement, sensitivity/allergy to the adhesive material. Furthermore, there is the issue of cleaning and removal of the adhesive material from the prostheses and the skin on a daily bases, which increases the possibility of tearing the prosthetic margin during maintenance<sup>30</sup>. Another critical problem relating to adhesive retained prostheses, and in fact prostheses in general, is colour fade. In addition to these problems, there are also concerns with alteration to the material consistency and properties with an increase in potential damage to the prosthesis<sup>29</sup>.

#### **Conclusion**

Materials presently used for maxillo-facial prosthetics are improved and adequate but not ideal. It is highly desirable that the prosthesis be durable and has the capability of being used without significant compromise of esthetics and physical properties for at least one year<sup>31</sup>.

The current materials used demonstrate poor long-term durability, and a prosthesis may become torn or lose its color within a short period of time. This overall deterioration has been attributed to certain environmental factors such as (1) exposure to the ultraviolet of natural sunlight, (2) wetting and drying of the elastomer, (3) surface abrasion resulting from the application and removal of cosmetics (adhesives and their solvents), and (4) secretions (sebaceous, nasal, and salivary)<sup>31,32</sup>.

#### **REFERENCES**

1. Roberts, A. C. Silicones for facial prostheses. *Dent Pract Dent Rec.*1971b ;21: 276-84.
2. Bulbullian AH. Facial prostheses. Philadelphia: WB Saunders Co.1945; p. 27.

3. Heller HL, McKinstry. Facial materials. In: McKinstry RE, editor. *Fundamentals of facial prosthetics*. Arlington: ABI Professional Publications.1995; p.79-97.
4. Beumer J, Reisberg DJ, Marunick MT, Powers J, Kiat-amnuay S, van Oort R, Zhao Y, Wu G, Eversole LR, Cherrick HM, Roumanas E, Pedroche D, Baba T, de Cubber J, Moy PK, Noorda WD, van Dijk G. Rehabilitation of facial defects. In: Beumer J, Marunick MT, Esposito SJ editors. *Maxillofacial rehabilitation: prosthodontics and surgical management of cancer-related, acquired, and congenital defects of the head and neck*. 3rd edition. Chicago: Quintessence Publishing Co. 2011; p. 255-314.
5. Beder, O. E. *Fundamentals for Maxillofacial Prosthetics*. Springfield, Illinois: Charles C Thomas Publisher. 1974.
6. Barnhart, G. W. A new material and technic in the art of somato-prosthesis. *J Dent Res*.1960; 39:836-44.
7. Gonzalez, J. B. Polyurethane elastomers for facial prostheses. *J Prosthet Dent*.1978;39:179-87.
8. Lontz, J. F. 1990. State-of-the-art materials used for maxillofacial prosthetic reconstruction. *Dent Clin North Am*.34, 307-25.
9. Lewis, D. H. & Castleberry, D. J. An assessment of recent advances in external maxillofacial materials. *J Prosthet Dent*.1980;43:426-32.
10. Beumer J, Ma T, Marunick M, et al. Restoration of facial defects: etiology, disability, and rehabilitation. In: Beumer J, Curtis TA, Marunick MT, editors. *Maxillofacial rehabilitation: prosthodontic and surgical considerations*. St Louis: Ishiyaku EuroAmerica. 1996; pp. 377—453.
11. Lemon JC, Kiat-amnuay S, Gettleman L, Martin JW, Chambers MS. Facial prosthetic rehabilitation: preprosthetic surgical techniques and biomaterials. *Curr Opin Otolaryngol Head Ne*. 2005;13:255-262.
12. Lontz JF. State of the art of materials used for maxillofacial prosthetic reconstruction. *Dent Clin North Am*. 1990;34:307-325.
13. Maller, U. S., Karthik, K. & Maller, S. V. Maxillofacial Prosthetic Materials-Past and Present Trends. *JIADS*.2010;1:25. 36.
14. Huber H, Studer SP. Materials and techniques in maxillofacial prosthodontic rehabilitation. *Oral Maxillofac Surg Clin North Am* .2002;4:73-93.
15. Gettleman L, Goist KC, Vargo JM, Guerra LR, Mendez AT, Larson HD. Processing and clinical testing of a thermoplastic material for maxillofacial prosthetics. In: Kawahara H, editor. *Oral implantology and biomaterials*. Progress in biomedical engineering series, vol 7. Amsterdam: Elsevier. 1989; p.7-13.
16. Gettleman L. Chlorinated polyethylene and polyphosphazene. In: Gettleman L, Khan Z, Sectos J, editors. *Proceedings of a conference on materials research in maxillofacial prosthetics*. Transactions of the Academy of Dental Materials 1992;5:158-174.
17. Eleni PN, Krokida MK, Polyzois GL, Gettleman L. Material properties of a maxillofacial chlorinated polyethylene elastomer stored in simulated skin secretions. *Int J Biomed Mater Res Part B: Appl Biomater*. 2009;91B:964-974.
18. Gonzalez, J. B. Polyurethane elastomers for facial prostheses. *J Prosthet Dent*.1978; 39, 179-87.
19. Chu CC, Fischer TE. Evaluation of sunlight stability of polyurethane elastomers for maxillofacial use I. *J Biomed Mater Res* .1978; 12:347-359.
20. Goldberg AJ, Craig RG, Filisko FE. Tear energy of elastomers for maxillofacial applications. *J Oral Rehabil*. 1980; 7:445-451.

21. Chalian VA. Treating the patient with facial defects. In: Laney WR, editor. *Maxillofacial prosthetics*. Littleton, Massachusetts: PSG Publishing Co. 1979; p. 279-308.
22. Huber H, Studer SP. Materials and techniques in maxillofacial prosthodontic rehabilitation. *Oral Maxillofac Surg Clin North Am*. 2002;4:73-93.
23. Begum Z, Kola MZ, Joshi P. Analysis of the properties of commercially available silicone elastomers for maxillofacial prostheses. *Int J Contemporary Dent*. 2011;2:1-5.
24. Seelaus R, Troppmann RJ. Facial Prosthesis Fabrication: Coloration Techniques, Chapter 17 in Taylor TD ed. *Clinical Maxillofacial Prosthetics*, Quintessence Publishing Co., Inc.: Chicago, IL. 2000; 245-264
25. McLaren K. The colour science of dyes and pigments. 2nd ed. Bristol: Adam Hilger Ltd. 1986; p. 1-20.
26. Karwoski AC, Plaut RH. Experiments on peeling adhesive tapes from human forearms. *Skin Res. Technol*. 2004;10:271–277. Lei CH, Ouzineb K, Dupont O, Keddie JL. Probing particle structure in waterborne pressure-sensitive adhesives with atomic force microscopy. *J. Colloid. Interface Sci*. 2007;307:56–63.
27. Kenney JF, Haddock TH, Sun RL, Parreira HC. Medical-grade acrylic adhesives for skin contact. *J. Appl. Polym. Sci*. 1992; 45:355–361.
28. Chen, M. S., Udagama, A. & Drane, J. B. Evaluation of facial prostheses for head and neck cancer patients. *J Prosthet Dent*. 1981; 46:538-44.
29. Kiat-Amnuay, S., Gettleman, L., Khan, Z. & Goldsmith, L. J. Effect of adhesive retention on maxillofacial prostheses. Part I: skin dressings and solvent removers. *J Prosthet Dent*. 2000;84:335-40.
30. Beatty, M.W., Mahanna, G.K., Dick, K. and Jia, W. Color changes in dry-pigmented maxillofacial elastomer resulting from ultraviolet light exposure. *J. Prosthet. Dent*. 1995;74: 493–498.
31. Haug, S.P., Andres, C.J., Munoz, C.A. and Bernal, G. Effects of environmental factors on maxillofacial elastomers: Part IV – optical properties. *J. Prosthet. Dent*. 1992;68: 820–823.
32. Meda Negrutiu et al. Thermoplastic Resins for Flexible Framework Removable Partial Dentures. *TMJ* 2005; 55(3):295-99.
33. Pusz A, Szymiczek M, Michalik K. Aging process influence on mechanical properties of polyamide-glass composites applied in dentistry. *JAMME* Jan 2010;38:49-55.
34. Moore DJ, Glaser ZR, Tabacoo MJ, Linebaugh MG. Evaluation of polymeric materials for maxillofacial prosthetics. *J Prosthet Dent* .1977;38:319-26.
35. Wolfaardt JF, Chandler HD, Smith BA. Mechanical properties of a new facial prosthetic material. *J Prosthet Dent*. 1985;53: 228-34.
36. Shifman A. Clinical application of visible light-cured resin in maxillofacial prosthetics, Part II: Tray material. *J Prosthet Dent*. 1990;64:695-9.
37. Mahajan H, Gupta K. Maxillofacial Prosthetic Materials: A Literature Review. *J Orofac Res*. 2012; 2(2):87-90.
38. Vidyasankari, et al. Evolution in Maxillo-Facial Prosthetic Materials-Review. *Sebha Medical Journal* 2010;9(2):12-18.
39. Lontz JF. State of the art material used for maxillofacial prosthetic reconstruction. *Dent Clin North Am*. 1990;34:307-25.

**CASE REPORT**  
**PALATO- RADICULAR GROOVE**  
**AND LOCALIZED PERIODONTITIS:**  
**A rare case report**

**Authors:**

Sugumari Elavarasu <sup>1</sup>,  
Thangakumaran Suthanthiran <sup>2</sup>,  
Arthiie Thangavelu <sup>3</sup>,  
Saranya Selvaraj <sup>4</sup>

<sup>1</sup> Head of the Department,  
<sup>2</sup> Reader,  
<sup>3</sup> Senior lecturer,  
<sup>4</sup> PG student.

Department of Periodontics,  
JKK Nattaraja Dental College,  
Komarapalayam,  
Tamilnadu, India.

Address for correspondence:  
Dr. SugumariElavarasu  
drsugu@gmail.com

**ABSTRACT**

Periodontitis is an immuno inflammatory disorder caused mainly by microorganisms. Various tooth developmental anomalies occur in maxillary anterior tooth region. One such abnormality is palato-radicular groove, which is most commonly found in maxillary and mandibular anterior. Numerous studies correlate the relation between palato-radicular groove and localized periodontitis. This case report described the management of tooth with palate-radicular groove associated with localized periodontitis and dull intermittent pain. Groove and associated periodontitis was treated by open flap debridement along with sybograf placement and saucerization.

**Keywords:** Palato- radicular groove, Localized periodontitis, Saucerization, RVG

**J Odontol Res 2014;2(2):45-9.**

## INTRODUCTION:

Periodontitis is a multifactorial disease, of which dental plaque play a definite role<sup>1</sup>. Anatomical aberrations of dentition provide a favorable environment for dental plaque accumulation and subsequent periodontal destruction. One such abnormality is the palato - radicular groove (PRG), which is most commonly seen in maxillary incisor region<sup>2</sup>. Palato-radicular groove is defined as developmental, anomalous groove usually found on the palatal aspect of maxillary central and lateral incisors<sup>3</sup>. It is also termed as palato - gingival groove, disto lingual groove, radicular groove, and palatal groove.

Palato radicular groove was first identified in upper lateral incisor of a Chinese female<sup>4</sup>. Koracs called palatoradicular groove as a syndesmo-coronoradicular teeth<sup>5</sup>. Radiographically, the groove is seen as a radiolucent line simulating the root canal of the involved teeth hence is referred to as parapulpal line. But this is not evident in all cases. Etiology of palato radicular groove is still unknown. Black et al was the first to describe PRG as a malformation during tooth development<sup>6</sup>. Atkin et al revealed that there is no enough space during tooth development in the maxilla, results in folding in the area of HERS, and development of PRG<sup>7</sup>. Goon et al said that PRG developed as an attempt for root partition<sup>8</sup>. Ennes J.P et al found PRG formation is due to genetic changes<sup>9</sup>.

Prevalence of palato radicular is varied. In a recent study by Albaricci et al 2008 reported prevalence of PRG as 11.1% in maxillary lateral incisors. Among them 62.8% of the grooves were proximally located; 57.8% originated from lingual fossa<sup>10</sup>.

According to Kogon, a definite association was found between palato radicular groove and periodontal destruction<sup>11</sup>. Probing depths and attachment loss were significantly greater at sites adjacent to PRD than at control sites. Lee et al first reported the association between PRG and localized periodontitis<sup>12</sup>. Various treatment have been proposed to treat PRG-associated periodontal bone defects such as scaling and root planning, odontoplasty, amalgam restoration, and tooth extraction. Recently, principles of guided tissue

regeneration (GTR), with or without associated bone grafts, have also been successfully used, which resulted in a significant reduction in probing depths and gain in attachment levels.

This article presents the course of successful management of a periodontally compromised maxillary lateral incisor, anatomically complicated with the presence of a PRG.

## Case report

A 35-years-old female patient reported to outpatient department of JKK Nattraja dental college with the chief complaint of persistent dull pain and progressive spacing in the upper front teeth since few months and was referred to Department of Periodontology and Oral Implantology. On intra oral examination it was found that all the teeth in the maxillary right quadrant were intact, caries-free, with no mobility and non-tender on percussion. No relevant medical history was reported. The oral hygiene status of the patient was also satisfactory. Careful periodontal examination of the patient revealed a 10 mm pocket on the distal aspect of maxillary lateral incisor with no pus discharge. (Fig.1) On examination palato - radicular groove was noticed on the mid-palatal aspect of the maxillary right lateral incisor originating in the cingulum and extending apically on the root. The tooth was assessed for vitality using electric pulp tester and was found to be vital. Radiovisiograph (RVG) revealed no evidence of parapulpal line or peri-apical pathology. (Fig. 2)

Initially scaling and root planing followed by oral hygiene instructions was performed. After 4 weeks of phase 1 therapy, the inflammation in the marginal gingiva was subsided, but probing depth remains the same as noted in the preoperative phase (10 mm). The desired area was anesthetized by local infiltration using lignocaine hydrochloride injection (1:80.000). In the surgical phase of treatment a muco-periosteal flap was elevated up to the most apical extent of the groove. The flap elevation revealed a palato-gingival groove and deposition of calculus in the coronal portion of the root along the groove with localized bone loss on distal aspect.(Fig. 3) The groove was smoothed with a tapering fissure

bur.(Fig. 4) Thorough debridement was done to remove all the granulation tissue and a vertical defect was noted in the distal aspect, extending beyond the mid root portion of the root. (Fig. 5) Considering the architecture of the defect bone graft (sybografit - 200 - 300 microns of synthetic nano crystalline hydroxyapatite granules) was placed in the defect.(Fig.6) The flap was approximated and sutured with 3-0 non-resorbable silk suture material.(Fig. 7) Post-surgical instructions were given to the patient along with antibiotics (Amoxicillin-500 mg and Metronidazole-400 mg, both thrice daily) and 0.2% Chlorhexidine Gluconate rinses for 5 days. After 7 days the sutures were removed and the healing was found to be satisfactory. After 6 months the pocket depth was found to be 3 mm on the distal aspect of 12 and RVG showed adequate bone fill.(Fig. 8,9)

## DISCUSSION

The link between PRG and localized periodontitis depends on the extent and depth of the groove on the root. It usually presents as a perio-endo lesion or periodontal lesion. Because of funnel shaped morphology, it serves as plaque retentive area. This leads to attachment loss and pulpal necrosis. PRGs may be symptomatic or asymptomatic. Grooves limited to the cingulum usually do not cause damage to the periodontium. Hence these grooves are asymptomatic and intensive treatment is not required. Deep grooves associated with intrabony defect require both periodontal and endodontic management. Symptomatic patient may report with concurrent episode of pain and swelling on the palate adjacent to the groove.

Parapulpal line observed radiographically is not a pathognomonic feature because these lines are most often obscured by the radiolucent root canal. It is not seen in our case radiographically. Recently computerized tomography (CT) has been used in determining the extent of the groove. CT shows the 3D image of the groove and also its proximity with the root canal<sup>13</sup>.

Successful management of PRG with localized periodontitis involves two aspects: treating the groove and the resultant pathology (intrabony

defects, if present) Prognosis of the tooth with PRG depends on the depth, location and termination on the root.

Saucerization has been a successful method in removing shallow grooves in single rooted teeth. Once the unfavourable anatomical condition is eliminated the condition can be viewed as a pure periodontal defect. Various regenerative materials currently used to fill the intra bony defects are bone grafts, platelet rich plasma, and enamel matrix derivative. Anderegg and Metzler<sup>14</sup> have reported clinical success at 6 months for 10 cases treated with non-resorbable barrier. Jeng et al<sup>15</sup> reported a case similar to the one presented in this article. These authors treated successfully by radiculoplasty, bone graft with DFDBA, and placement of a non-absorbable membrane. Similarly in this case, bone defect was filled with syografit in the distal aspect and it shows adequate bone fill, reduced probing depth and improved gingival appearance.

## CONCLUSION

Presence of palato-radicular groove is not pathology always. Palato radicular groove become significant only when it possess associated symptoms like localized periodontitis. Different treatment modalities are offered to treat palato-radicular groove associated localized periodontitis and each treatment modality offers promising results. Treatment plan should be decided based on the groove morphology, bone defect morphology, tooth anatomy and patient compliance. Early detection through meticulous examination by the clinician is the pre-requisite in the management of PRG.



Fig 1: Pre-operative view showing 10 mm pocket depth



Fig 2: Pre-operative RVG



Fig 3: Palato radicular groove extend from the crown to the root apex



Fig 4: saucerization and degranulation done.



Fig 5: sybograft in place



Fig 6: coepak placed



Fig 7: Postoperative view showing 3mm pocket depth after 6 months



Fig 8: Postoperative RVG showing adequate bone fill after 6 months

**REFERENCES**

1. Jayaprakash S Gadagi, SugumariElavarasu, DivyaAnanda, ThamaraiselvanMurugan. Successful treatment of osseous lesion associated with palato radicular groove using local drug delivery and guided tissue regenretion. A report of two cases. *J Pharm Bioallied Sci.* Aug 2012; 4(Suppl 2): S157–S160.
2. Rajendran M, sivasankar K. Palato-radicular groove- hidden route to destruction - case report. *Ijcr.* 2013; 5(4): 85-92.
3. Glossary of periodontal terms, 3rd ed. Chicago: American Academy of Periodontology; 1992. p.22.
4. A. Sucheta, RashmiHeralgi, AshitG. Bharwani, DarshanMundinamane. Treatment of intrabony osseous lesion associated with palato - radicular groove. *Contemporary Clinical Dentistry* 2012; 3:2.
5. Bose BB, Sudarsan S. Palatogingival Groove – An Added Dimension in the Etiology of Localised Periodontitis. *International Journal of Dental Science and Research* 2013; 1:5-7.
6. Black GV. Operative dentistry: pathology of hard tissues. Chicago: medico-dental publishing, 1908.
7. Atkinson SR. The permanent maxillary lateral incisor. *Am J Orthodont* 1943; 29:685-88.
8. Goon WW, Carpenter WM, Brace NM, Ahlfeld RJ. Complex facial radicular groove in a maxillary lateral incisor. *J Endod* 1991; 17:244-48.
9. Ennes JP, Lara VS. Comparitive morphological analysis of the root developmental groove with the palate -gingival groove. *Oral disease* 2004; 10:378-82.
10. Albaricci MF, De Toledo, Zuza EP, Gomes DA, Rossetti EP, Prevalence and features of Palato radicular grooves: An in vitro study . *J Int Academy of Periodontology*; 2008; 10: 2-5.
11. Kogon SL. The prevalence, location and confirmation of palatoradicular grooves in maxillary incisors. *J Periodontal* 1986; 57:231-4.
12. Lee KW, Lee EC. Poon KY. Palatogingival grooves in maxillary incisors. *Br Dent J* 1968; 124:14-8.
13. Anuradha Singh, Rajinder Kumar Sharma, Satish Chandra Narula. Palato-radicular groove, diagnosis and management-a case report. *Indian Journal of Dentistry.* 2011, 52-55, Published by Elsevier.
14. Andergg CR, Metzler DG. Treatment of palatogingival groove with guided tissue regeneration. *J Periodontal* 1993; 64:72-4.
15. Jeng J, Lu H - K, Hou L. Treatment of an osseous lesion associated with a severe palato-radicular groove. *J Periodontal* 1992; 63:708-17.

## CASE REPORT

# ESTHETICS BY ROOT SUBMERGENCE TECHNIQUE - A NOVEL APPROACH

### Authors:

Narendra Kumar Gupta <sup>1</sup>  
Devendra Chaudhary <sup>2</sup>  
Nitika Sachan <sup>3</sup>  
Pradyumna Misra <sup>4</sup>

### ABSTRACT

The aesthetic around the teeth, pontics and implants is determined by the volume and symmetry of the natural gingival contour. Osseous reduction following extraction of teeth results in unaesthetic bony concavities in aesthetic zone. This article describes a simple and effective method of retaining root stumps in the concerned area following endodontic treatment to preserve alveolar bone heights and aesthetics.

**Key Words:** Root submergence technique, Alveolar bone height, preservation.

<sup>1</sup> Professor, Department Of Prosthodontics and Crown and Bridge, BBD College of Dental Sciences, BBD University, Lucknow.

<sup>2</sup> Professor Department of Conservative Dentistry and Endodontics, MM College of Dental Sciences, MM University, Mullana, Ambala, Haryana

<sup>3</sup> JR III, Department Of Prosthodontics, BBD College of Dental Sciences, BBD University, Lucknow.

<sup>4</sup> Professor Department of Conservative Dentistry and Endodontics, BBD College of Dental Sciences, BBD University, Lucknow.

Address for correspondence:  
Dr. Narendra Kumar Gupta  
Professor, Department of Prosthodontics,  
BBD College of Dental Science,  
BBDU, Lucknow.  
Email: drnkg19@gmail.com  
Contact no. 09936611100

J Odontol Res 2014;2(2):50-4.

## INTRODUCTION

The osseous reduction following extraction of the teeth is considered as an inevitable consequence resulting unaesthetic bony concavities especially in esthetic zone. The extraction of teeth eliminates the need for an alveolar process, and the bone is resorbed.<sup>1</sup> Roux suggested that the loss of alveolar bone occurring after tooth loss is an example of disuse atrophy. The only reliable method known to preserve alveolar bone is the maintenance of functioning healthy teeth. There is a gradual loss of the alveolar bone due to the pattern of bone remodelling.<sup>2</sup> In spite of the availability of newer treatment modalities like endodontic restoration and periodontic procedures for preservation of the remaining teeth, they are not feasible for the patients in severe stages where restoration might not be possible. The only reliable method of preserving the remaining bone is by maintaining the functional health of the teeth. Over the years, many studies showed that roots which are fractured and left behind during extractions are retained into the alveolar bone with no evidence of pathosis.<sup>3,4,5</sup> Use of retained roots to preserve alveolar bone in over-denture treatment has been a common practice through the vital or non vital root submergence concept. But use of retained roots to preserve alveolar height and esthetics in fixed prosthodontics has not received much attention. In fixed prosthodontics restoring esthetics in patient with severe bone loss has always been a challenge. Methods adopted in cases of inadequate bone in esthetic zone include use of gingival porcelain, surgical soft tissue or hard tissue regeneration using grafts or reconstruction using gum veneers. While all these methods have proved to be effective, a simpler and much more efficient method is retaining the root stumps in the concerned area following endodontic treatment to eliminate the source of infection.

Atwood and Coy found the mean reduction for the anterior maxillary bone to be about 1 mm per year and for the anterior mandible, 0.4 mm per year following the loss of teeth.<sup>6</sup> The only reliable method known to preserve alveolar bone is the maintenance of functioning healthy teeth.<sup>7</sup>

We report a case in which a endodontically treated root submergence was carried out to prevent the alveolar ridge reduction prior to fabrication of a fixed prosthesis in maxillary anterior region. This article suggests a strategy to provide a more predictable protocol for esthetic treatment of anterior tooth loss using the root submergence technique (RST). By maintaining the natural tooth root with the RST, a much greater amount of surrounding tissue may be preserved than with the conventional technique, which almost always leads to crestal bone resorption and thus reduction of the height of the interdental papillae and width of the edentulous ridge. RST instead maintains the natural attachment apparatus of the tooth in the pontic site, which in turn allows for complete preservation of the alveolar bone frame and assists in the creation of an esthetic result.

## Case report

A 25-year-old female reported to the Department of Prosthodontics with a chief complaint of unesthetic appearance due to missing front teeth. Patient had a history of trauma few months back, resulting in fracture and subsequent loss of tooth. On intra-oral examination it was found that 21 was missing. (Fig1A) Upon radiographic examination it was found that root of 21 was present without any sign of periapical pathology and 11 showed a periapical radiolucency suggestive of a pathology. (Fig 1B) She was referred to the Department of Conservative Dentistry and Endodontics for consultation regarding 11 and the retained root of 21 which required endodontic treatment procedures, and to assess the periapical status of remaining teeth. Treatment plan for the patient included crown in 11 and post and core placement followed by crown placement for 21.

Following root canal treatment, it was concluded that post and core treatment with respect to 21 would result in unfavourable crown to root ratio and poor prognosis of the prosthesis. Therefore, treatment plan was modified according to clinical situation and a fixed prosthesis was planned with 11 and 22 as

abutments. 22 showed unfavourable overjet precluding its use as an abutment unless sufficient clearance was generated; which was possible only through a intentional root canal treatment followed by post and core placement. Part of the treatment plan was to evaluate the possibility of more natural looking pontic appearance if residual ridge could be stabilised from further resorption by retaining the remaining root.<sup>7,8</sup>

Therefore, it was decided to cover the root with mucosa for healing to take place. For this purpose the root of 21 was reduced to one millimeter subosseous height after undergoing endodontic therapy (Fig 2A). After reduction the primary soft tissue closure was achieved over the site and sutures were placed (Fig 2B).

Following a period of one week, sutures were removed after ensuring adequate healing (Fig 2C). 22 was prepared to receive a custom cast post and core and 11 and 22 were prepared as an abutment to receive a fixed prosthesis (Fig 2D).

An interim prosthesis was given to the patient until next appointment in which final prosthesis cementation would be done (Fig 3A). With adequate bone height, a more natural looking prosthesis could be fabricated without black triangles near the pontic area or excessive use of unsupported gingival porcelain application. In this case very slight gingival porcelain in Pontic area was used to match the cervicoincisal height with adjacent tooth. (Fig 3B)

## DISCUSSION

Atwood<sup>6</sup> observed that the “Reduction of residual ridges needs to be recognized for what it is: a major unsolved oral disease which causes physical, psychological and economic problems for millions of people all over the world.” Both objective and subjective findings clearly indicate the significant benefits of tooth retention since, even the extraction of a patient’s few remaining teeth should be a serious decision.<sup>8</sup> Alveolar bone maintenance depends upon the presence of healthy roots and periodontal ligaments, which transmit functional and parafunctional forces to the surrounding bone. The loss of teeth and periodontal ligaments and their replacement by artificial substitutes inevitably changes the degree of

esthetics and also the pattern of force distribution.<sup>9</sup> Bjorn<sup>10</sup> was the first person to publish a report of root submersions. Masterson<sup>11</sup> in 1979 submerged 36 vital teeth in 10 patients and followed the vitality and position of the sectioned roots, the surface integrity of soft tissue coverage, and the osseous tissue character surrounding the roots of the sectioned teeth for 3 years. He concluded that the patients in general, felt as though they had some of their own teeth, which suggested more of an intact body image, and exhibited good proprioceptive, perceptive and psychologic response. Ortega Alejandra and Salgado Silva<sup>12</sup> in 1991 concluded that atrophy of the alveolar process can be avoided by intentionally preserving dental roots in patients with ideal periodontal and pulpal health conditions.

The concept of vital root retention was also proposed by Von Wowern and Winther<sup>13</sup> in 1981, based on the observation that bone resorption did not occur around retained teeth, but this was later abandoned due to soft tissue complications.

In 2007 Maurice Salama et al<sup>14</sup> suggested a strategy to provide a more predictable protocol for esthetic implant treatment for multiple-tooth defects using the root submergence technique (RST). RST maintains the natural attachment apparatus of the tooth in the pontic area, which in turn allows for complete preservation of the alveolar bone.

Patient had mild deep bite and was suggested for orthodontic treatment but she was not interested. Even then the final outcome of the treatment was up to mark and well accepted by the patient.

## CONCLUSION

It has long been recognised that whatever restorative materials are used for clinical crowns, and however masterfully the prosthesis is fabricated, it is the volume and symmetry of the natural gingival contours that determine esthetics around the teeth, pontics and implants alike.

For this purpose, maintenance of an abundance of natural soft tissue and underlying bone volumes and contours in the event of tooth loss are of a significant concern on long term esthetics, function and ease of hygiene maintenance. For these reasons different

**Fig 1**



Fig 1:  
 A-Pre-treatment intra oral view.  
 B- Pre-treatment radiograph showing retained root in 21 and periapical pathology in 11  
 C- Post endodontic treatment radiograph.

**Fig 2**



Fig 2  
 A- Reduction of remaining root to 1mm subosseous height.  
 B- Primary soft tissue closure was achieved over the root.  
 C- Post operative healing stage.  
 D- Tooth reduction in 11 and post and core followed by tooth reduction in 22.



Fig 3  
 A-Interim prosthesis.  
 B- Final prosthesis.



Fig 4  
 Pre and post treatment photographs of the patient.

strategies have been engaged to preserve the residual ridge crest and associated soft tissue. This approach allows the opportunity to achieve a more natural result with a minimally invasive approach. Preservation of tissue is more desirable than allowing ridge atrophy to occur and then be faced with the prospects of hard and soft tissue reconstruction. To paraphrase DeVan, "Our goal should be the perpetual preservation of what remains rather than the meticulous restoration of what is missing".<sup>15</sup> Another way of saying this is that the best dentistry is the least dentistry necessary to return the patient to acceptable function and esthetics.

It can be concluded that mucosal coverage of roots as a means of preserving the residual alveolar ridge is a sound clinical method for those patients where undue ridge resorption would unfavourably compromise the esthetics of fixed prosthesis. The undisturbed root attached to the alveolar bone by the periodontal ligament is the "perfect" implant.

## REFERENCES

1. Miller PA. Complete dentures supported by natural teeth. *J Prosthet Dent* 1958; 8: 924-28.
2. Atwood DA. Clinical, cephalometric, and densitometric study of reduction of residual ridges. *J Prosthet Dent* 1971; 26:280-99.
3. Y. Ravi Shankar, K. Srinivas, HemChand Surapaneni, S.V. Sudhakar Reddy. Prosthodontic treatment using vital and non vital submerged roots-two case reports. *Journal of Clinical and Diagnostic Research*, 2013 October [cited: 2014 Feb 7 ]; 7:2396-2399.
4. Zeev Ben-Ur / Colin Gorfil / Israel Aviv. Use of roots to establish favorable removable partial denture design: Case reports
5. Anil Sharma, Submergence of vital roots for the preservation of residual ridges: A clinical study. *Oral health and preventive dentistry*. 2012;10:259-65. *Quintessence international* volume 25,number 3,1994
6. Atwood D. Bone loss of edentulous alveolar ridges. *J Periodontol*. 1979 Apr;50:11-21.
7. Richardson A. The pattern of alveolar bone resorption following extraction of anterior teeth. *Dent Pract Dent Rec* 1965 Oct;16(2):77-80
8. DeFranco RJ. Overdentures. *Dent Clin North Am* 1977; 21:379.
9. Brewer AA, Morrow RM. *Overdentures*. St. Louis: CV Mosby Co.; 1975: IX, Foreword.
10. Bjorn H. Experimental studies on reattachment. *Dent Practit* 1961;11:451-4.
11. Masterson MP. Retention of vital submerged roots under complete dentures: report of 10 patients. *J Prosthet Dent* 1979;41:12-5.
12. Ortega Alejandro JJ, Salgado Silva NC. Preprosthetic surgery: preservation of the alveolar process using retained tooth roots. *Pract Odontol* 1991;12:13-5.
13. Von Wowern N, Winther S. Submergence of roots for alveolar ridge preservation. A failure (4-year follow-up study). *Int J Oral Surg* 1981;10:247-50.
14. Salama M, Ishikawa T, Salama H, Funato A, Garber D. Advantages of the root submergence technique for pontic site development in esthetic implant therapy. *Int J Periodontics Restorative Dent* 2007;27:521-7.
15. DeVan MM. The nature of the partial denture foundation: suggestions for its preservation. *J Prosthet Dent* 1952;2:210.

## CASE REPORT

# PROSTHODONTIC MANAGEMENT OF MANDIBULAR DEVIATION USING PALATAL RAMP APPLIANCE

Authors:

Binsu S<sup>1</sup>

Meenu Merry C Paul<sup>2</sup>

Pius AV<sup>3</sup>

Cinil Mathew<sup>4</sup>

<sup>1</sup> Reader

Dept. of Prosthodontics  
Indira Gandhi Institute of Dental Sciences  
Kothamngalam, Kerala

<sup>2</sup> Professor & HOD

Dept. of Prosthodontics  
Indira Gandhi Institute of Dental Sciences  
Kothamngalam, Kerala

<sup>3</sup> Professor

Dept. of Prosthodontics  
Indira Gandhi Institute of Dental Sciences  
Kothamngalam, Kerala

<sup>4</sup> Senior lecturer

Dept. of Prosthodontics  
Indira Gandhi Institute of Dental Sciences  
Kothamngalam, Kerala

Address for correspondence:

Dr. Binsu S.

Reader

Dept. of Prosthodontics  
Indira Gandhi Institute of Dental Sciences  
Kothamngalam, Kerala

### ABSTRACT

Segmental resection of the mandible commonly results in deviation of the mandible to the defective side. This loss of continuity of the mandible destroys the balance of the lower face and leads to decreased mandibular function by deviation of the residual segment toward the surgical site. Prosthetic methods advocated to reduce or eliminate mandibular deviation include intermaxillary fixation, removable mandibular guide flange, palatal ramp, implant-supported prosthesis with palatal guidance restorations which may be useful in reducing mandibular deviation and improving masticatory performance and efficiency. These methods and restorations would be combined with a well organized mandibular exercise regimen. This clinical report describes the rehabilitation following segmental mandibulectomy using palatal ramp prosthesis.

J Odontol Res 2014;2(2):55-8.

## INTRODUCTION

Segmental resection of the mandible results in special physiological and esthetic problems, especially if condylectomy has been performed. The most significant difficulty in esthetics is encountered with mandibular deviation towards the defective side when condylectomy has been performed<sup>1</sup>. The earlier that mandibular guidance therapy is initiated in the course of treatment, the more successful the patient's definitive occlusal relationship and masticatory efficiency. Any delays in the initiation of mandibular guidance appliance therapy, due to problems such as extensive tissue loss, radiation therapy, radical neck dissection, flap necrosis, and other post surgical morbidities, may result in an inability to achieve normal maxillomandibular relationships<sup>2,3</sup>. Intermaxillary fixation, mandibular-based guidance restorations, and palatal based guidance restorations will reduce or minimize this mandibular deviation.

A well organized mandibular exercise program should always accompany these methods. Any uncoordinated masticatory movements may result in dental or soft tissue trauma, including severe lip or tongue lacerations and hemorrhage<sup>4</sup>. So, monitoring the lesion, smoothing sharp teeth, using oral appliances, extracting problematic teeth, or inhibiting behaviors such as self-mutilation of lips, cheeks, and tongue are the best solutions for such soft tissue trauma. This article describes the fabrication of palatal ramp type guidance appliance for a patient following a segmental mandibulectomy.

### Case Report

A 9-year-old male patient was referred to the Department of Prosthodontics for rehabilitation following resection of the right mandible (Figure 1). The patient's history indicated that 3 years back, he was surgically treated for the Pindborg tumor on right mandibular molar region. TMJ examination revealed severe deviation of the mandible towards the resected site (Figure 2). Based on the clinical situation, a palatal ramp type guidance appliance was

planned (Figure 3). It was noted that the patient lacks motor control to bring the mandible into centric occlusion. Definitive impressions were made with addition of polysilicone (Coltene Whaledent, Switzerland). Definitive casts were poured with type IV dental stone (Kalrock, Kalabhai Karson Pvt. Ltd., Mumbai, India). Over the maxillary cast a simple retainer type of appliance was made. The retainer was checked for adaptation in oral cavity. After this auto polymerizing acrylic resin was added to this retention plate on the left side and as acrylic resin reached doughy stage, mandible was manipulated to the desired interocclusal relationship. This movement was repeated several times. The resin was manipulated to extend 7-10 mm superiorly. After this prosthesis was removed from the mouth and resin was allowed to polymerize. The appliance was finished, evaluated, and adjusted intraorally. It was noted that the patient was able to achieve a functional intercuspal position immediately after insertion of the prosthesis. The prosthesis was removed from the mouth. The prosthesis was repolished and inserted (Figure 4). The patient was given routine post insertion instructions and was motivated to make efforts to learn to adapt to the new prosthesis. Simple exercises were suggested to the patient that helped the patient learn to manipulate the mandible into the proper position.

## DISCUSSION

Successful rehabilitation of edentulous mandibulectomy patients is more difficult than that of a dentulous patient. Sharry<sup>5</sup> described the difficulties encountered as:

- Limited coverage and retention.

- Grossly impaired relation of the mandible to the maxilla.

- Limited movement of the mandible.

- Loss of facial structures and sensory and motor innervation complicates the control factors.

Mandibular treatment prosthesis is very helpful in reducing the unavoidable sequelae resulting from



Fig 1  
Extraoral view of patient showing marked mandibular deviation towards right side.



Fig 2  
Intraoral view showing mandibular deviation.



Fig 3  
Palatal ramp prosthesis.



Fig 4 &5  
Palatal ramp prosthesis in patient's mouth.



Fig 5  
Palatal ramp prosthesis in patient's mouth.



Fig 6  
Post insertion extraordinary view

extensive mandibular resection like muscular contraction, mutilation of occlusal plane, scar contracture, etc. Its success varies and depends upon the nature, size and site of the surgical defect, initiation of the guidance therapy, patient's expectation, cooperation and other factors. Modification to these principles are determined on an evidence basis and greatly influenced by unique residual tissue characteristics and dynamics and science of mandibular movement<sup>6</sup>. This flange engages the mandibular teeth during mandibular closure, thereby directing the mandible into an appropriate intercuspal position. Earlier the mandibular guidance therapy is initiated in the course of treatment, more successful the patient's definitive occlusal relationship. Mandibular guidance therapy begins when immediate post surgical sequelae have subsided, usually two weeks after surgery. Various other methods advocated to reduce or eliminate mandibular deviation include mandibular guidance therapy, intermaxillary fixation, resection guidance restorations, splinting, and fabrication of prosthesis similar to 'swing lock' removable partial dentures. For best results, these methods and restorations would be combined with a well-organized mandibular exercise regimen. An implant-supported fixed prosthesis can be an optional treatment modality for functional and esthetic rehabilitation. The use of resection guidance restoration is predicted on the basis of presence of maxillary and mandibular teeth, as teeth presence in both arches is important for effective guidance and reprogramming of mandibular movement. For the patient, this prosthesis provided comfort and sufficient function, and he was able to achieve functional intercuspal position immediately after the insertion of the prosthesis. A removable prosthesis is an equally effective alternative for most patients with mandibular defects, considering the poor prognosis, difficulty in decision making for use of implant, and economic feasibility.

### CONCLUSION

Certain basic principles of construction of conventional dentures should be modified for mandibular resection patients because of many restrictive physical factors. The philosophical approach to the treat-

ment and rehabilitation of such patients with resected mandibles is not in concentrating on what has been sacrificed in the eradication of the disease, but rather in taking full advantage of the remaining structures. This clinical report describes the prosthetic rehabilitation following segmental mandibulectomy with palatal ramp type guidance appliance and the patient expressed satisfaction with the esthetic outcome.

### REFERENCES

1. Beumer J 3rd, Curtis TA, Marunick MT. Maxillofacial rehabilitation: Prosthodontic and surgical consideration. St. Louis: Ishiyaku. EuroAmerica; 1996. p.184-8.
2. Sahin N, Hekimoglu C, Asian Y. The fabrication of cast metal guidance flange prostheses for a patient with segmental mandibulectomy: A clinical report. *J Prosthet Dent* 2005;93:217-20.
3. Ufuk H, Sadullah U, Ayhan G. Mandibular guidance prosthesis following resection procedures: Three case reports. *Eur J Prosthodont Rest Dent* 1992;1:69-72.
4. Oelgiesser D, Levin L, Barak S, Schwartz-Arad D. Rehabilitation of an irradiated mandible after mandibular resection using implant/tooth supported fixed prosthesis: A clinical report. *J Prosthet Dent* 2004;91 :310-4.
5. Sharry JJ. Extension of partial denture treatment. *Dent Clin North Am* 1962; 6: 821-35.
6. Beumer J, Curtis T, Firtell D editors. Maxillofacial rehabilitation. St. Louis: Mosby; 1979. p. 90-169.

## GUIDELINES FOR SUBMISSION OF MANUSCRIPTS

### About the Journal

**Journal of Odontological Research**, an official publication of Indira Gandhi Institute of Dental Sciences, Nellikuzhy P. O., Kothamangalam 686 691, Kerala, is a peer-reviewed journal published bi-annually in print format.

### Scope of the journal

The journal will cover studies related to dentistry and applied basic subjects.

### Submission of manuscripts

The manuscripts can be submitted under the categories of **Original Research, Review and Case reports. The guidelines and instructions for authors regarding the drafting and submitting the manuscripts are given below.** Kindly submit your valuable contributions as per the guidelines to the e-mail id [jorigids@gmail.com](mailto:jorigids@gmail.com).

### The Editorial Process

A manuscript will be reviewed for possible publication with the understanding that it is being submitted to Journal of Odontological Research alone at that point in time and has not been published anywhere, simultaneously submitted, or already accepted for publication elsewhere. The journal expects that authors would authorize one of them to correspond with the Journal for all matters related to the manuscript. All manuscripts received are duly acknowledged. On submission, editors review all submitted manuscripts initially for suitability for formal review. Manuscripts with insufficient originality, serious scientific or technical flaws, or lack of a sig-

nificant message are rejected before proceeding for formal peer-review.

Manuscripts that are found suitable for publication in Journal of Odontological Research are sent to two or more expert peer reviewers. The journal follows a double-blind review process, wherein the reviewers and authors are unaware of each other's identity. Every manuscript is also assigned to a member of the editorial team, who based on the comments from the reviewers takes a final decision on the manuscript. The comments and suggestions (acceptance/rejection/ amendments in manuscript) received from reviewers are conveyed to the corresponding author. If required, the author is requested to provide a point by point response to reviewers' comments and submit a revised version of the manuscript. This process is repeated till reviewers and editors are satisfied with the manuscript.

Manuscripts accepted for publication are copy edited for grammar, punctuation, print style, and format. Page proofs are sent to the corresponding author.

### Authorship Criteria

Each contributor should have participated sufficiently in the work to take public responsibility for appropriate portions of the content of the manuscript. The order of naming the contributors should be based on the relative contribution of the contributor towards the study and writing the manuscript. The journal prescribes a maximum number of authors for the manuscripts. **The maximum num-**

**ber of authors for original research articles is six and for case reports and reviews is four.**

### **Conflicts of Interest/ Competing Interests**

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

### **Submission of Manuscripts**

All manuscripts must be submitted on-line to the e-mail [jorigids@gmail.com](mailto:jorigids@gmail.com). Authors will have to pay for submission, processing or publication of articles. If you experience any problems, please contact the editorial office by e-mail. The submitted manuscripts that are not as per the "Instructions to Authors" would be returned to the authors for technical correction, before they undergo editorial/ peer-review. Generally, the manuscript should be submitted in the form of two separate files:

#### **[1] Title Page/First Page File/covering letter:**

This file should provide

1. The type of manuscript (original article, case report, review article, Letter to editor, Images, etc.) title of the manuscript, running title, names of all authors/ contributors (with their highest academic degrees, designation and affiliations) and name(s) of department(s) and/ or institution(s) to which the work should be credited, . All information which can reveal your identity should be here. Use text/rtf/doc files.
2. Source(s) of support in the form of grants, equipment, drugs, or all of these.
3. Acknowledgement, if any.
4. Conflicts of Interest of each author/ contributor. A statement of financial or other relationships that might lead to a conflict of interest, if that information is not included in the manuscript itself or in an authors' form.
5. The name, address, e-mail, and telephone number of the corresponding author, who is responsible for communicating with the other authors about revisions and final approval of the proofs, if that information is not included on the manuscript itself.

**[2] Blinded Article file:** The main text of the article, beginning from Abstract till References (including tables) should be in this file. The file must not contain any mention of the authors' names or initials or the institution at which the study was done or acknowledgements. Page headers/running title can include the title but not the authors' names. Manuscripts not in compliance with the Journal's blinding policy will be returned to the corresponding author. Use rtf/doc files. Do not zip the files. **Limit the file size to 1 MB.** Do not incorporate images in the file. The pages should be numbered consecutively, beginning with the first page of the blinded article file.

**[3] Images:** Submit good quality color images. **Each image should be less than 4 MB in size.** Size of the image can be reduced by decreasing the actual height and width of the images (keep up to 1800 x 1200 pixels or 5-6 inches). Images can be submitted as jpeg files. Do not zip the files. Legends for the figures/images should be included at the end of the article file.

**[4] The contributors' / copyright transfer form** (template provided below) has to be submitted in original with the signatures of all the contributors within two weeks of submission via courier, fax or email as a scanned image. High resolution images (up to 5 MB each) can be sent by email.

### **Preparation of Manuscripts**

Manuscripts must be prepared in accordance with "Uniform requirements for Manuscripts submitted to Biomedical Journals" developed by the International Committee of Medical Journal Editors (October 2008). The uniform requirements and specific requirement of Journal of Odontological Research are summarized below. Journal of Odontological Research accepts manuscripts written in English. For further details regarding the guidelines in drafting the manuscript for publication, log on to [www.igids.org](http://www.igids.org)