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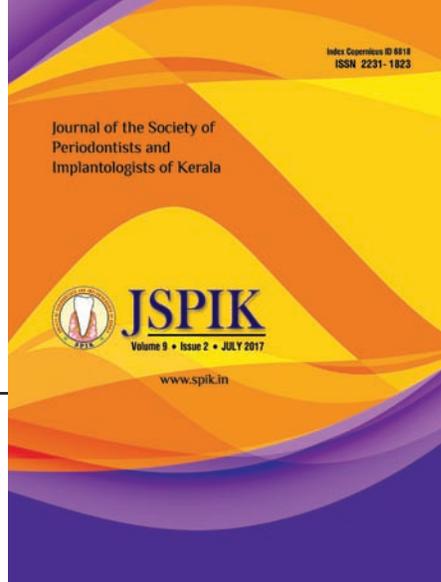
Journal of the Society of  
Periodontists and  
Implantologists of Kerala



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## Contents

President's Message	64
Editor Speak	65
Secretary's Message	66
<b>Awareness of risk factors for periodontal disease among people attending Dental College</b>	<b>67</b>
Johnson Prakash D'lima, Jose Paul, Senny Thomas, Deepak Thomas, Binitta Paul, Rifat Salma	
<b>Etiological and predisposing factors associated with gingival recession in a hospital population- a cross sectional study</b>	<b>72</b>
Ambili R, Seba Abraham, Shabna S.M	
<b>Management of furcation defects with root resection and osseous reconstructive surgery using platelet rich fibrin, osseomold and <math>\beta</math>TCP</b>	<b>78</b>
Swathi Adapa, Amitha Ramesh, Biju Thomas	
<b>Cilnidipine-induced Gingival Enlargement: A Review</b>	<b>81</b>
Renjana S, Majo Ambooken, Jayan Jacob Mathew, Karthika Menon, Arif P, Arun Kumar CB	
<b>Ethics in human research</b>	<b>86</b>
Arsha Rajendran1, Suchithra A2	
<b>A Complete Outlook On Gingival Biotype - A Review Report</b>	<b>91</b>
Subair K, Melwin Mathew, Agee Antony, Ashitha Mohandas, Anupama Varma, Nidhin George	
<b>Periodontal status of mandibular second molar following surgical removal of impacted mandibular third molar</b>	<b>95</b>
Ajith PS, Ajith Kumar K.C.	
<b>Root Biomodification: The Current Scenario.</b>	<b>99</b>
Greeshma Sivadas T, Bindu R Nayar	
<b>Periodontal flap:basics revisited</b>	<b>108</b>
Manikandan G.R., Ajithkumar.K.C	



## President's message

Warm greetings from the President...

It's a real honour to be the President of this Society, and thank you dear members for bestowing such an honour on me...

As you are all aware SPIK is almost on a transition, this year... We are re scheduling our calendar of events, pattern of events, putting emphasis on "Spreading Periodontics in Kerala and Strengthening Periodontists In Kerala" ...I envisage the pivotal role our young members with the guidance of seniors blending their experience and expertise, in the years to come.

We had kick started the year with the No Tobacco Day Campaign.. and the Secretary's office is busy charting the events to follow...

I seek your blessings, wholehearted co operation, active interactions... and of course, creative criticism too.

Your valuable suggestions will never be on a deaf note...

Let's work together towards excellence...

**Dr Anto Joseph Puthanangady**

President SPIK



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## Editorial

A New beginning ....

Welcome to the July issue of JSPIK !

As I take over as editor of JSPIK my main goal is to regularize publishing the issues ie 3 issues per year on schedule with quality papers. We at SPIK are already planning 2 future editions viz Nov and March. JSPIK has always had a range of topics in Periodontology, Lasers, Implants and Piezosurgery and I believe this issue continues that tradition. My job as an editor is to make our journal as useful and informative to you as possible. Learning is a part of our professional obligation and should not be a passive routine of attending a few continuing education courses. Also let me request all of you to send interesting articles to JSPIK, so that we can widen our knowledge base and manage clinical problems more effectively by learning from others.

If you have an article to publish I would be delighted to hear from you.

**Dr Plato Palathingal**  
Editor  
editorspik@gmail.com



## Secretary's Message

Dear Members,

Greetings from JSPIK.

The Dental Council Of India has recently revised the list of instruments and equipments for the Periodontics post graduate clinic. Complying to the new list is mandatory for obtaining approval for starting or renewal of MDS course in an institute . Better late than never, as the amendment was expected to happen much earlier. The existing list had a lot of errors like the Newmans probe and the magnifying glass, which were unheard off in the periodontal or dental armamentarium across the Globe. Faculties, managements and Inspectors alike were having nightmares I arranging and approving such instruments kept during inspection visits. It took almost a decade for DCI to look into the irregularities and in appropriateness in the list and correct it. The new list even though a welcome change , will pose some problems temporarily for managements and departments in finding funds to procure the new entries in the list . It is even more difficult in the present times when MDS seats are staying vacant and faculties are facing the heat for not being able to 'attract' students to occupy their pg seats. It's a shame that we have reached upto this stage . What's the future of Dentistry in India and what's the fate of Periodontists who have passed their degree and are staying jobless.

The problem is deep rooted and warrants something more than a cosmetic solution. In the wake of these issues the DCIs belated recognition of the broader reach and scope of periodontics is a welcome move. The new list has a separate set of gadgets for implant clinic, apart from instruments for GBR and advanced bone surgery. Learning new things , new treatment strategies and techniques and adding them in your repertoire is the only way in which you can come out of this crisis. So lets begin crisis management and the instrument list revision be a catalyst for the change.

Perio is thrilling!

**Dr. Baiju R.M.**  
Secretary, SPIK

# Awareness of risk factors for periodontal disease among people attending Dental College

Johnson Prakash D'lima<sup>1</sup>, Jose Paul<sup>2</sup>, Senny Thomas<sup>3</sup>, Deepak Thomas<sup>4</sup>, Binitta Paul<sup>4</sup>, Rifat Salma<sup>5</sup>

## ABSTRACT

**Background:** Risk factors when present increases the possibility that an individual will develop the disease. Therefore it is essential that patients are aware about risk elements of periodontal disease to maintain oral hygiene and have regular visits to the dentist.

**Aim of the study:** The aim of this study was to assess the level of awareness of patients about the risk elements for periodontal disease

**Materials and methods:** This study used a predesigned questionnaire to evaluate the awareness of the risk factors for periodontal diseases such as tobacco smoking, diabetes, pathologic bacteria, microbial tooth deposits, genetic factors, age, gender, socioeconomic status, stress, HIV, osteoporosis, infrequent dental visits, previous history of periodontal disease and bleeding from gums.

**Result:** The results showed that out of 151 subjects 70.04 % were aware about the risk factors for periodontal disease and only 27.55% subjects were not aware, 2.39% did not respond to the questions.

**Conclusion:** Though majority of subjects in this study were aware of the risk factors, about 30% were not aware of the risk factors for periodontal disease. The population should be educated about the detrimental effect of risk factors on the periodontium so that the probability of developing the disease can be reduced.

**Key words:** periodontal disease, risk factors,

## Introduction

Over the past three decades the understanding of the etiology and pathogenesis of periodontal diseases have grown greatly. There are different factors that contribute to the development of periodontal disease such as the microbial challenge, host immune-inflammatory factors, genetic and environmental factors. Thus periodontitis is termed as a multifactorial diseases. Host associated factors have played an important role in the pathobiology of periodontitis and the risk of developing this disease varies greatly from individual to another.<sup>1</sup>

Risk is the probability that an individual will

develop a specific disease in a given period. Risk assessment is defined by numerous components,<sup>2,3</sup> such as risk factors, risk determinants, risk indicators and risk predictors.

Risk factors (tobacco smoking, diabetes, pathogenic bacteria, microbial tooth deposits) which may be environmental, behavioral, or biologic factors that, when present, increase the likelihood that an individual will develop the disease these factors are identified through longitudinal studies.

Risk determinant (genetic factors, age, gender, socioeconomic status, stress) are those risk factors that cannot be modified.

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Risk indicators (HIV/AIDS, osteoporosis, infrequent dental visits) are factors that have been identified in cross-sectional studies but not confirmed through longitudinal studies.

Risk predictors/markers (previous history of periodontal disease, bleeding on probing) are elements that increased risk for disease, do not cause the disease.

Periodontal diseases can affect the quality of life of patients by affecting the function of the dentition and the dental appearance. It can also lead to the loss of teeth in susceptible patients.

Identifying the risk elements and undertaking measures that can reduce the risk can help in maintaining oral health and prevent the onset of periodontal diseases. Therefore awareness about these elements among the patients will permit the patient to identify or foresee probable risk of developing the disease. The aim of this study was to assess the level of awareness of patients about the risk elements for periodontal disease.

## Materials and methods

This study was a questionnaire based survey undertaken among out patients in the department of Oral Medicine, Annoor Dental College and Hospital, Muvattupuzha, Kerala. 151 subjects, who were willing to participate in the study were enrolled after obtaining verbal consent. A briefing was given about the nature of the study and procedure for answering the questions was explained.

This study used a self-developed, predesigned questionnaire consisting of 13 questions to evaluate the awareness of the risk factors for periodontal diseases such as tobacco smoking, diabetes, pathologic bacteria, microbial tooth deposits, genetic factors, age, gender, socioeconomic status, stress, HIV, osteoporosis, infrequent dental visits, previous history of periodontal disease and bleeding from gums. The subjects had to answer in yes or no for all the questions. After the completion of the questionnaire the data was collected, reviewed, organized and analyzed.

Table 1: The questionnaire and the response

Sl. No.	Questions	Yes (%)	No (%)	No response (%)
1	Are you aware that deposits on the teeth and gums are related to gum disease?	82.1	16.6	1.3
2	Gum disease can occur with any age group?	82.8	16.6	0.7
3	Gum disease are more often seen in males than in females?	39.7	58.9	1.3
4	Are you aware that decreased awareness of gum disease and decreased frequency of dental visit may lead to gum disease?	93.4	6.0	0.7
5	Are you aware that irregular visits to the dentist may cause gum disease	85.4	13.9	0.7
6	Is it known to you that previous history of gum disease can indicate that you can develop gum disease in future also	69.5	29.8	0.7
7	Are you aware that the use of tobacco especially smoking can be a reason for gum disease	83.4	16.6	0.0
8	Is it known to you that subjects with diabetes are prone to gum disease and need to be extra careful about the gum health	67.5	29.1	3.3
9	Is it known to you that if an immediate family member has or had gum disease it is likely that you might develop gum disease	36.4	59.6	4.0
10	Is it known to you that stress can cause gum disease	37.1	57.6	5.3
11	A compromised immune system may lead to gum disease	74.2	21.9	4.0
12	Weakening of bones may be related to gum disease	66.9	27.2	6.0
13	Bleeding from gums can be an indication for gum disease	92.1	4.6	3.3

### Statistical Analysis

Data were analyzed using SPSS version 22.0.0.0. Descriptive statistics and frequency distributions were used to assess the data.

### Results

In this study, a total of 151 subjects were enrolled, out of which, 75 (49.7%) were males and 76 (50.3%) were females. Table 1 shows the questions asked and the corresponding responses.

### Discussion

The aim of the study was to evaluate the level of awareness about the risk elements of periodontal disease among the patients attending the OPD of a dental college. Numerous studies indicate that gum disease is a likely precursor to a variety of serious systemic conditions. Therefore it is essential that patients should be educated about the maintenance of oral hygiene and to have regular visits to the dentist for check ups. The prevention and management of dental health conditions, by and large, requires considerable self-knowledge about factors that affect the oral hygiene status, practices and maintenances.<sup>4</sup>

There have been several studies worldwide on oral health knowledge of patients.<sup>5,6</sup> Over the past three decades, there has been an extraordinary growth in the knowledge regarding risk factors responsible for periodontal diseases. A number of studies indicate that the nicotine found in tobacco products triggers the overproduction of cytokines which are involved in the process of gingival inflammation. Diabetes causes abnormalities in blood vessels and high levels of interleukins, a group of cytokines which increases the chance of gum diseases. This lack of oral hygiene encourages bacterial build-up and bio film plaque

formation, and can also increase certain species of pathogenic bacteria associated with more severe forms of gum diseases.<sup>7</sup>

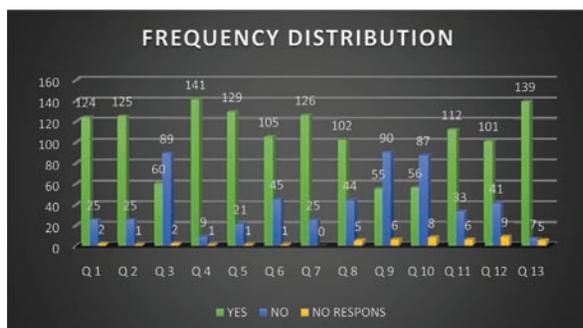
Risk is the probability that an event may occur in the future. In a population it may be expressed as the proportion/or percentage expected to experience the condition/disease. In an individual, it is the likelihood that the person will develop the disease or have it progress to a measurable outcome.

Good oral health practice has been found to be the key factor in periodontal disease prevention,<sup>8</sup> thus knowledge about the risk elements can help in motivation of good oral hygiene practices and prevention of periodontal diseases.

In the present study it was seen that 70.04% of the total study population was aware about the risk elements of periodontal diseases, 27.55% population were not aware and 2.39% did not respond to the questions. The no response could be due to lack of understanding the items in the questionnaire by the respondents.

Out of the questions asked, infrequent dental visits and bleeding from gums got the maximum positive response with 93.4% and 92.1% respectively which the subjects assumed to be the main risk elements for periodontal diseases. Questions regarding genetic factors and stress got the least positive responses with 36.4% and 37.1% respectively.

Awareness on smoking (83.4%), diabetes (67.5%) and microbial deposits and pathogenic bacteria (82.1%) is comparatively less. These elements have been proved as the potential risk factors for periodontal diseases.<sup>9,10</sup> The population should be educated about the detrimental effect of risk factors on the periodontium so that the probability of developing the disease can



be reduced. Risk factors are part of the causal chain, or they expose the host to the causal chain. However, a risk factor is not necessarily a cause.

In a study by Malik AR et al.,<sup>11</sup> level of awareness of patients about dental diseases and their prevention was assessed. The results showed that more than 83% of the participating patients were able to correctly identify the most important cause of gum diseases out of which, 30 percent of patients showed a correlation between smoking and the severity of periodontal pathology, 19 percent correlated with diabetes, 19 percent with abnormal environmental factors while 17% knew the way of their prevention. Majority of the patients (63%) showed no knowledge of prevention. It was concluded that patients awareness about dental diseases and their prevention was not up to mark and various corrective measures were needed for prevention.

Lung et al.<sup>12</sup> investigated patients' knowledge of the effects of smoking on periodontal health and only 6% of respondents knew specifically of the link between smoking and periodontal disease. It was concluded that there was lack of awareness of the relationship between smoking and periodontal diseases among the patients.

Health care providers have a very important role in educating the patients about the risk for periodontal diseases. In a study by Karouski et al.,<sup>13</sup> it was found that respondents with good knowledge on periodontal disease were among those with frequent dental visits. However, this study also showed that there was also high proportion of regular dental attendees who were not aware of the periodontal disease risk.

In a randomized control trial study by Asimakopoulou et al.,<sup>14</sup> the effects of a routine periodontal assessment consultation versus a routine consultation individualized risk assessment communication intervention on patient thoughts and emotions about periodontal disease were compared. It was seen that patients motivated with risk assessment had positive influence on the psychological variables and they adhered to the periodontal instructions better than the control group.

American Academy of Periodontology has developed a self-assessment tool, a web based tool on the American Academy of Periodontology website

which can be used for assessing the role of individual periodontal risk. This can be used to educate patients, raise awareness and assist in decision-making. This tool has 13 brief straight forward questions that can be answered easily. The items include the person's age (three response options: <40; 40–65; >65 years) and their flossing behavior (daily, weekly, seldom). Other items have simple response choices of yes or no, whereas several items in addition to the yes/no option also include the option of don't know (any of your family members had gum disease, are your teeth loose, do you currently have any of the following health conditions, i.e. heart disease, osteoporosis, osteopenia, high stress or diabetes) or the option of don't remember (seen a dentist in the last 2 years, ever been told that you have gum problems, gum infection or gum inflammation). The answers are combined using proprietary algorithm and categorized as low risk, medium risk or high risk. The website informs users that by using the answers to the questions, the self-assessment tool will help them to see if they are at risk for having or developing periodontal (gum) disease<sup>15</sup>. Among the general public, use of a risk assessment instrument may help identify the 20% of patients in need of intervention to prevent or minimize development of more advanced periodontal disease<sup>16</sup>.

## Conclusion

Though majority of subjects in this study were aware of the risk factors, about 30 percent were not aware of the risk factors for periodontal disease. The population should be educated about the detrimental effect of risk factors on the periodontium so that the probability of developing the disease can be reduced.

The practice of risk assessment provides dental care professionals the opportunity to improve dental and medical outcomes in the general population and in specific population groups by focusing on early identification and proactive targeted interventions. The limitations of this study is the small sample size and hence the result cannot be extrapolated to general populations' level of awareness. Future research to explore the awareness of the health providers on the relationship of periodontal disease and its risk and the importance of advising their patients on having good oral health is very much needed.

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# Etiological and predisposing factors associated with gingival recession in a hospital population- a cross sectional study

Ambili R<sup>1</sup>, Seba Abraham<sup>2</sup>, Shabna S.M<sup>3</sup>

## ABSTRACT

**Back ground and Objective:** Gingival recession (GR), an intriguing condition with multiple etiologies is a common manifestation in most populations. Correction of etiological factors is one of the important aspects in the management of gingival recession. The present study is aimed at assessing the etiological and predisposing risk factors among a hospital population of Vattappara, Trivandrum, Kerala

**Materials and Methods:** In this study, 374 patients were examined of which 100 subjects with gingival recession, aged above 12 years were included. Subjects were interviewed using a structural questionnaire, and full mouth clinical examination was done

**Results:** GR is found to be an age associated disease with female predilection. Among the various etiological factors leading to recession, the combined effect of periodontal diseases and trauma from occlusion (TFO) appeared to be the most frequent precipitating etiological factor (42%). Trauma from tooth brushing was found to be the second common reason for recession (22%). Significant association was noted between GR and smoking.

**Conclusion:** Being a multifactorial disease, identification of various etiological factors associated with recession and their correction before surgical management is necessary for better treatment outcome. The role of TFO in the pathogenesis of GR is not fully established yet. The present study reveals that TFO also plays a significant role along with periodontal disease in causing recession. So elimination of TFO is an essential component in the management of GR

**Keyword:** Gingival Recession, Trauma from occlusion, Periodontal disease

## Introduction

Gingival recession, the most common and undesirable condition of the gingiva is described as “the exposure of the root surface by an apical shift in the position of the gingiva”<sup>1</sup>. Gingival recession increases in both prevalence and severity with age<sup>2,3</sup>. For a patient, gingival recession usually creates an aesthetic problem, especially when such problem affects the anterior teeth, and anxiety about tooth loss due to progressing destruction. It may also be associated with dentin hypersensitivity, and/or root caries, abrasion and/or cervical wear, erosion because of exposure

of the root surface to the oral environment and an increase in accumulation of dental plaque.<sup>4</sup>

Recessions represent a complex pathology, with multiple etiologies, sometimes difficult to identify. The exact etiology of gingival recession is not fully understood. Several factors may play a role in gingival recession development which can be categorised into 4 groups<sup>5</sup>

- Physiologic factors
  - Aging
- Pathologic factors

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- Excessive or inadequate teeth brushing
- Plaque induced inflammatory periodontal disease,
- Traumatic occlusion and deleterious habits
- Anatomic factors
  - Malocclusion
  - Thin bony plates
  - Aberrant frenal attachment
  - Fenestration & dehiscence
  - Inadequate width of attached gingiva <sup>6</sup>
- Iatrogenic factors
  - Improper restorations
  - Prolonged orthodontic treatment
  - Clasps in prosthetic dentures<sup>7</sup>

Studies have reported that gingival inflammation and a “thin gingival biotype” are significant predictors for gingival recession<sup>8</sup>. In addition to the above mentioned factors, various aggravating factors like smoking and diabetes mellitus can predispose the individual to gingival recession. Tissue trauma caused by vigorous tooth brushing is considered to be a dominating causative factor for the development of recessions<sup>9</sup>. However, studies have shown that bacterial plaque initiated periodontal tissue destruction is of equal importance in the etiology of gingival recession<sup>10</sup>.

The role of trauma from occlusion (TFO) in the pathogenesis of gingival recession is a controversial area. Excessive functional stress may initiate inflammatory changes in the periodontium and thus enhance destructive bacterial processes<sup>11,12</sup>. There are reports supporting contributory role of TFO in initiating and enhancing the inflammatory changes in the periodontium<sup>13,14</sup>. In the epithelial and connective tissues deep to the receding margin, morphological changes were seen which apparently lead to cleft formation and recession. These appeared to be associated with mononuclear cell infiltration of the connective tissue. In case of gingival recession due to trauma from occlusion there will be thinning of the labial plate of alveolar process. Consequently thinning and breakdown of connective tissue occurs and leads to proliferation of the epithelium into the site of connective tissue destruction. Proliferation of the epithelial cells into the connective tissue brings

about a subsidence of the epithelial surface, which is manifest clinically as recession. But at the same time many studies deny its role in recession pathology<sup>15,16</sup>. Still higher prevalence of recession is noticed in patients with TFO in clinical scenario.

Management of GR requires thorough patient assessment, identification of etiological factors, and recording and monitoring of the extent and severity of the condition. Treatment should be directed at prevention of further progression and the control of symptoms of disease. Correction of etiological factors is one of the important factors in the management of gingival recession. The present study is aimed at assessing the etiological and predisposing risk factors in a hospital population of Trivandrum, Kerala

## Materials and Methods

### Subjects

Study subjects were randomly selected from the outpatient clinic of PMS Dental College, Vattappara, Trivandrum, Kerala who sought for various dental treatments. Among 374 patients examined, 100 patients with gingival recession with male: female ratio-3:2, aged above 12 years were included. All patients with gingival recession were selected irrespective of their systemic status and smoking.

### Inclusion criteria

- Patients diagnosed with generalized or localized gingival recession irrespective of their systemic status and habits.
- Those willing to participate in the study.

### Exclusion criteria

- Psychiatric problems
- Presence of life threatening conditions like malignant tumor or radiotherapy either current or in previous six months
- Bleeding disorders
- Pregnant and lactating females
- Immunocompromised patients
- Patients undergoing orthodontic appliance therapy

### Procedure

All participants were informed about the

procedure and after obtaining informed consent, clinical examination was done. The clinical examination was based on a porforma and data taken include age, sex, medical status, habits, oral hygiene status, type of recession (isolated or multiple), extent of recession based on Millers classification, presence of cervical abrasion, attrition and associated etiological factors and predisposing factors. Detailed gingival examination was done in isolated cases; bone level assessment was done by taking IOPA radiographs and bone sounding. While doing clinical examination gingival changes were noticed in patients with improper tooth brushing

Occlusal analysis was done to assess trauma from occlusion. Occlusal interferences, tooth mobility and other clinical signs of TFO were noted. Radiographic assessment was done to appreciate the bony changes and widening of periodontal ligament.

### Results and Observations

The present study evaluated the prevalence of various etiological and predisposing factors associated with gingival recession among 100 patients examined.

Table 1- Demographic details of subjects

No. of patients	100
Mean age	38.8±8 years
Male :Female	3:2

60% of the subjects with recession were males and 40% females

Table 2 - Medical status

Systemically healthy	58%
Diabetic	20%
Hypertensive	10%
Both hypertensive and diabetic	12%
Thyroid disorder	10%
Asthmatic	15%

Table 3- Oral hygiene status

Good	4%
Fair	40%
Poor	56%

56% of the patients were with poor oral hygiene status, 40% fair and 4% poor

The descriptive statistics of the patients selected for the study is shown in Table 1.

The study showed that 75% of participants had class I gingival recession, 17% had class II, 5% had class III and 3% class IV, according to the Miller's classification). 92 % of the subjects reported with multiple recession whereas 8% was with isolated cases

56% of the patients with recession showed cervical abrasion and attrition was present in 52%

Among the various etiological factors leading to recession, the combined effect of periodontal diseases and trauma from occlusion (TFO) appeared to be the most frequent precipitating aetiological factors (42%). Interestingly, periodontal diseases and TFO alone causes gingival recession in 18% and 6% of the patients respectively. The second common reason for recession was trauma from tooth brushing (22%). 6% of the subjects showed trauma from tooth brushing and periodontal diseases as etiological factors. Other

Table 4 - Habits

Smoking	52%
Pan chewing	30%

52% of the patients with recession were smokers

Table 5 - Type and extent of recession

Multiple recession	92%
Isolated recession	8%
Class 1	75%
Class II	17%
Class III	5%
Class IV	3%

Table 6 - Etiological and predisposing factors

Etiological factors	No. of patients
Periodontal Diseases	18%
TFO	6%
TFO + Periodontal Diseases	42%
Trauma From Tooth Brushing	22%
Trauma From Tooth Brushing + Periodontal Diseases	6 %
Frenum Pull	4%
Inadequate width of attached Gingiva	2%

predisposing factors like frenum pull in 4% and inadequate width of attached gingiva in 2% were also noticed.

### Discussion

In the current study, evaluating various etiological factors leading to recession, most interesting observation was the role of trauma from occlusion along with plaque induced inflammatory periodontal diseases in the causation of gingival recession in 42% of the patients. A harmonious relationship between occlusion and periodontium is today considered mandatory to maintain a healthy dentition. Stillman in 1921 was the first to associate occlusal trauma in the development of gingival cleft which was known by his name as ‘Stillman’s cleft’<sup>13</sup>. Surprisingly, the relationship between occlusal trauma and gingival cleft has remained unclear till the reports published by Solnit which revealed that gingival clefts apparently underwent spontaneous repair following occlusal analysis and subsequent adjustment<sup>14</sup>.

According to Solnit, gingival clefts in the upper jaw are due to working side interferences and in the lower jaw due to the balancing side contacts. Contrary to this, it was Glickman in 1965 who introduced the novel concept of zone of irritation and zone of co-destruction in trauma from occlusion and explained that marginal gingiva or zone of irritation is unaffected by traumatic occlusion<sup>15</sup>. Emslie found no evidence to support the role of occlusal trauma in the formation of gingival clefts<sup>16</sup>. Trot and Love observed trauma from occlusion in only 10 % of the cases with recession while Gorman found recession in 20 % of the cases<sup>17,18</sup>

In this study, what we could observe is that

in conjunction with plaque induced inflammatory periodontal diseases, traumatic occlusion also plays an important role in the causation of gingival recession. Even though, the combined effect of TFO and plaque induced inflammatory periodontal diseases results in recession in majority of the study subjects, periodontal diseases and TFO alone causes gingival recession in 18% and 6% of the patients, respectively. Loe et al have also emphasized the role of poor oral hygiene, dental plaque and calculus in gingival recession.<sup>10</sup>

Second dominating etiological factor which accounts for recession was trauma from vigorous tooth brushing which was observed in 22% of the subjects. This is in accordance with various previous studies<sup>9</sup>. We could observe increase in prevalence of gingival recession with increase in age as observed in various other studies<sup>2,3</sup>

As mentioned above male to female ratio among the randomly selected sample was 3:2 (60% males and 40% females). This finding is in agreement with various other study reports.<sup>19-26</sup> Gender differences regarding the prevalence of gingival recession could be attributed to the facts that females are more concerned about oral hygiene and they visit their dentists more frequently than males.

The present study reveals that multiple recessions are more common than isolated recession and establishes the strong association between dental plaque induced inflammatory diseases and gingival recession. Among the study subjects, 56% of the patients were with poor oral hygiene status, 40% fair and 4% poor. Previous studies have reported that gingival recession is seen both in populations with high and poor standards of oral hygiene 27.56% of the patients with recession show cervical abrasion (abfraction) which can be correlated with trauma from tooth brushing and trauma from occlusion and 52% attrition which again may indicate traumatic occlusion. This supports the fact that greater percentage of the patients who were included in this study were having occlusal problems. These findings are supported by various previous studies which have shown that recession often causes increased susceptibility for abfraction, attrition poor esthetics and dentin hypersensitivity.<sup>28,29</sup>

52% of the patients with recession were smokers. Cigarette smoking was another important

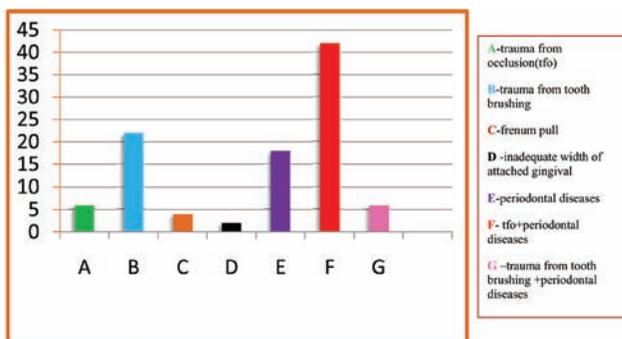


Fig 1: Graphical representation of Gingival recession of the sample by etiological factors

predisposing factor in the studied population, which was significantly associated with gingival recession similar to periodontal disease. This finding is in line with several previous studies.<sup>20, 30, 31</sup>

Frenum attachment showed a less significant association with gingival recession in this study, contrary to the previous findings that suggested frenum attachments is as etiologic factors for gingival recession<sup>32</sup>. The finding may be due to the small sample not yielding statistical significance.

Gingival recession due to inadequate width of attached gingiva was observed in only 2% of the study subjects. Lang & Loe stated that 2 mm or more of keratinized gingiva (which corresponds to 1 mm or more of attached gingiva) is necessary to maintain gingival health<sup>33</sup>. Contrary to this, studies have shown that periodontal health can be maintained even in absence of attached gingiva<sup>34, 35</sup>.

In many surgical treatments along with careful surgical technique, correction of etiological factors like TFO also plays an important role. Further studies are needed including more samples to establish this strategy.

## Conclusion

Recessions represent a complex pathology, with multiple etiologies, sometimes difficult to identify. Identification of various etiological factors associated with the recession and its correction before surgical management is necessary for better treatment outcomes. The role of trauma from occlusion in the pathogenesis of gingival recession is not fully established yet. The present study reveals that trauma from occlusion also plays a significant role along with inflammatory component in causing recession. So elimination of trauma from occlusion is essential in periodontal therapy in the management of gingival recession.

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# Management of furcation defects with root resection and osseous reconstructive surgery using platelet rich fibrin, osseomold and $\beta$ TCP

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## ABSTRACT

Furcation involvements are one of the most challenging clinical problems in periodontics. Root resection is one of the treatment options for preserving molars with furcation involvement. It has been reported that molars with bone support of more than 50% of the remaining roots at the time of root resection had a significantly higher survival rate compared with that of molars with less than 50% bone support. This case evaluate whether the survival rate of resected molars can be increased by increasing the bone support to the remaining tooth structure by bone regeneration with PRF and bone graft.

**Key words:** Furcation, Root resection, PRF, Bone Graft

## Introduction

Furcation involvements are one of the most challenging clinical problems in periodontics. Root resection is one of the treatment options for preserving molars with furcation involvement. Root resection is indicated in multirouted teeth with grade II to IV furcation involvements. It is preferable, to have endodontic therapy completed before resection of root. It is distressing for both patient and clinician to perform a vital root resection.(unfavourable events - perforation, inability to instrument canal and fracture of root).

Hamp et al. examined 87 root resection cases five years after surgery and reported very good results regarding the periodontal conditions.<sup>1</sup>

On the other hand, Langer et al. investigated 100 root resections 10 years after surgery and reported a total failure rate of 38%.<sup>2</sup>

It has been reported that molars with bone support of more than 50% of the remaining roots at the time of root resection had a significantly higher survival rate compared with that of molars with less

than 50% bone support.<sup>3</sup>

This case evaluate the survival rate of resected molars by bone regeneration with PRF and bone graft.

## Case report

A 35 years old male has reported to the department of periodontics with the chief complaint of food impaction in the upper left back tooth region since a year. On clinical examination following findings were observed with respect to 26 - grade I mobility, 10 mm probing depth, grade I recession and grade II furcation involvement (Fig. 1). On radiographic examination there was complete bone loss localised to disto buccal root of 26 (Fig. 2). First phase I therapy scaling and root planning was performed and then root canal therapy was done with respect to 26. One week after phase I therapy surgery was performed. First sulcular incisions were given on buccal and palatal aspects of 26 extending upto 25 and 27. Full thickness flap was raised and the area was debrided. After complete debridement root apex was seen, there was bone loss till the apex of the disto buccal root. Disto buccal root was resected using a surgical bur with irrigation and the root piece is

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extracted. Occlusal adjustment therapy was done. 5 ml of patients intravenous blood was drawn & collected into 10ml sterile test tubes without an anticoagulant and centrifuged immediately for 12 min at 2700 rpm. PRF is obtained. PRF was easily separated from red corpuscles base [preserving a small red blood cell (RBC) layer] using a sterile tweezers and scissors. PRF is mixed with the bone graft (osseomold and  $\beta$  TCP). The mix (PRF, BONE GRAFT and  $\beta$  TCP) was packed in the surgical area, repositioned the flap and sutured with 4.0 VICRYL sutures. Periodontal pack was placed. post operatively analgesic- anti inflammatory drug and 0.2 % chlorhexidine mouth wash was prescribed. After one week sutures were removed, the healing process was uneventful. Clinical and radiographic examination done after 6 months. Radiograph after 6

months showed radio opacity which was indicative of new bone formation (fig. 3 and 4).

### Discussion

it has been reported that molars with bone support of more than 50% of the remaining roots at the time of root resection had a significantly higher survival rate compared with that of molars with less than 50% bone support.<sup>3</sup>

in a case report by Abdulaziz S .Calcium sulfate was used to fill the bony crypt of the amputated root. It was found that significantly more bone and cementum was found in the defects filled with calcium sulfate compared with unfilled controls.<sup>4</sup>

Calcium sulfate is biocompatible, bioresorbable, osteoconductive and an effective hemostatic.<sup>5</sup>



Fig. 1: clinical picture at the base line



Fig. 2: radiographic view at the base line



Fig. 3: clinical view 6 months after surgery



Fig. 4: radiographic view 6 months after surgery

In a case report by H Develioglu et al they have managed class III furcation problem in upper right first molar with root resection and the extraction defect was grafted with the Unilab Surgibone. Minimal bone regeneration was seen. They have conclude that the application of this biomaterial only in such cases is not a good alternative because of its limited effect on bone regeneration and the low resorption rates. However, A combination of PRF and xenograft maintained both the space for tissue regenerations and exerted an osteoconductive effect in the bony defect could be more effective. Added to this the use of blood clot that is the hosts own biological product is a better space filler and helps tissue wound healing.

In the present case on clinical and radiographic examination, severe bone loss was observed with respect to distobuccal root of 26. The disto buccal root was resected and extracted.

Blood was drawn & collected into 10ml sterile test tubes without an anticoagulant and centrifuged immediately for 12 min at 2700 rpm. PRF is obtained. The resultant product consisted of following 3 layers- topmost layer consisted of acellular platelet poor plasma (PPP), PRF clot in the middle and RBC's at the bottom.

The extraction socket was filled with mixture of bone graft and PRF. There were complications during healing period. 9 months after surgery radiographically, bone formation was observed.

PRF is easy to obtain, less costly, and a possibly very beneficial ingredient to add to the "regenerative mix." Regardless of the choice of graft material (autograft, allograft, xenograft or alloplast) or membrane selection (bioresorbable or nonresorbable). PRF is a concentrated suspension of growth factors found in platelets which are involved in wound healing and are known to be promoters of tissues regenerations.

The combination of PRF in platelet gel form along with bone graft may promoted wound healing, bone growth, maturation, graft stabilization and hemostasis, leading to an overall improvement in the handling properties of graft materials.

Veena Kalburgi et al have evaluated the effectiveness of autologous PRF along with the osseomold bone graft in treatment of two different cases of intrabony defects in chronic periodontitis subjects, and have Radiographically, observed significant bone formation in the intrabony defect.<sup>7</sup>

In this case patient's oral hygiene maintenance was good. Patient was adviced to use proxa brush in the interdental area.

Good post operative oral hygiene is important, especially in the area of root resection.

Periodontal problems around resected molars have tendency to recur and should be maintained through meticulous supportive periodontal treatment.

More studies with large population and long term follow-ups are required

## Conclusion

in conclusion, root amputation remains a viable treatment to retain a tooth when an implant is not feasible and also when patient is not willing for extraction. Additional grafting can be helpful for rapid bone regeneration.

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# Cilnidipine-induced Gingival Enlargement: A Review

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## ABSTRACT

Gingival hyperplasia is a common adverse effect reported with the use of L-type calcium channel blocker (CCB). Cilnidipine is a fourth generation dihydropyridine CCB approved for the treatment of essential hypertension with efficacy and safety that is comparable to amlodipine. It is a unique L-type calcium channel blocker with an inhibitory action on the sympathetic N-type calcium channels. It has a slow-onset but the long-lasting action. It was introduced in the market, with a claimed superiority over amlodipine. Due to this difference in side-effect profile, cilnidipine is often used to replace CCB in patients with high blood pressure. The overall objective of this article is to review the recently introduced, yet widely prescribed CCB - cilnidipine and its potential effects on gingival hyperplasia.

**Key words:** Gingival hyperplasia, calcium channel blocker, cilnidipine, hypertension.

## Introduction

Over the years, many classes of antihypertensive agents have been in clinical use,<sup>1</sup> and Calcium channel blockers (CCBs) are among the most commonly used antihypertensive medications presently available in the market.<sup>2</sup> Despite the popularity and wide acceptance of the calcium channel blockers (CCBs) by the medical community, their oral impact is rarely recognized or discussed. CCBs have been frequently regarded as an etiologic factor for a common oral condition seen among patients seeking dental care: drug-induced gingival enlargement or overgrowth. This enlargement can be localized to a site, or generalized, and can range from mild to extremely severe, affecting patient's appearance and function. Treatment options for these patients include cessation of the offending drug and substitution with another group of antihypertensive medication to prevent recurrence of the lesions. In addition, depending on the severity of the gingival overgrowth, nonsurgical and surgical periodontal therapy may be required. This article is an attempt to

draw the attention of medical and dental practitioners on the possible impact of cilnidipine, a novel CCB, on gingival hyperplasia.

## Drug influenced gingival enlargement

In the past century, an astonishing array of medications for the alleviation of human diseases has led to the creation of new side effects in the oral cavity. Drugs that specifically affect the gingival tissues have principally caused an increase in either inflammation and/or size.

Aesthetically disfiguring overgrowth of gingiva is a significant side effect which may be associated with

- Anticonvulsant (e.g. phenytoin, sodium valproate, etc.)
- Immunosuppressant (e.g. cyclosporine A) (Figure 1)
- Calcium channel blockers (CCBs) (e.g. nifedipine, verapamil, etc.).

All of these drugs produce clinical lesions and histologic characteristics that are indistinguishable

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from one another.<sup>3,4</sup>

Characteristics of drug-influenced gingival enlargement<sup>5</sup>

- Variation in intra-patient and inter-patient pattern
  - Predilection for anterior gingiva
  - Higher prevalence in children
  - Change in gingival contour leading to modification of gingival size
- Onset within 3 months
- Enlargement first observed at the interdental papilla
  - Change in gingival colour
  - Increased gingival exudate
  - Bleeding upon provocation
- Found in gingiva with or without bone loss but is not associated with attachment loss
  - Pronounced inflammatory response of gingiva in relation to the plaque present
  - Reductions in dental plaque can limit the severity of lesion
  - Must be using Cyclosporin A, phenytoin, or certain calcium channel blockers; the plasma concentrations to induce the lesion have not been clearly defined in humans

### CCBs and gingival enlargement

For many years, Calcium channel blockers have been one of the mainstays of hypertension therapy. CCBs share a common mode of action. However,

the manner in which they exert their pharmacological actions is different between different subclasses. CCBs have also been identified as agents that affect enlargement of the gingiva. They are a class of drugs that exert effects principally at voltage-gated Calcium channels in the plasma membrane and are widely prescribed as antihypertensive, anti-anginal and anti-arrhythmic agents. The prevalence rate of gingival lesions associated with these medications has been estimated to be approximately 20%.<sup>6</sup> Presently, the cause(s) of gingival enlargement by calcium channel blockers are still under investigation but it is hypothesised that these medications have direct influence on gingival connective tissues through stimulation of gingival fibroblasts, thereby resulting in increased production of the connective tissue matrix.<sup>7</sup>

The association between gingival hyperplasia and CCBs was first reported with nifedipine therapy in 1984.<sup>8-9</sup> It is now well recognized that gingival overgrowth is a rare adverse effect of all subclasses of CCBs, with the impression that it is more frequent with the dihydropyridine calcium antagonists. Usually, it is seen within a few months of initiation of therapy and is reversible after discontinuation of treatment.

### Cilnidipine: the fourth-generation calcium channel blocker

Based on the chemical structure, CCBs are categorized into 3 subclasses. The various drugs in each subclass are enumerated in Table I.

Dihydropyridines are among the most widely used medications for the management of cardiovascular diseases. Since their introduction in the 1960s,



Fig 1: Severe enlargement of the gingiva associated with cyclosporine medication in a kidney transplant patient



Fig 2: Cilnidipine induced gingival hyperplasia

dihydropyridines have undergone numerous changes to optimize their safety and efficacy. Currently, four generations of dihydropyridines are available. The generations of dihydropyridines and examples of drugs in each generation are given in Table II.

Cilnidipine is a recently introduced candidate in this group, which is unique in its pharmacological profile. Its uniqueness lies in the fact that it possesses both L- and N type calcium channels blocking activity. Researchers, these days, have an increasing interest on this drug and it is being extensively studied in its preclinical and clinical evolution phases.

### Clinical features

The initial presentation of gingival hyperplasia is as an enlargement of the interdental papillae, thereby giving the gingival tissues a nodular or lobulated appearance. The hyperplastic gingival tissue may extend over the teeth and crowns, and in some cases it can interfere with eating. Gingival inflammation and lack of oral hygiene can aggravate the above process. Indeed, good oral hygiene reduces but does not necessarily eliminate the condition.

### Treatment of drug-induced gingival enlargement<sup>10</sup>

Mild to moderate cases of drug induced gingival enlargement can be managed by conventional non surgical periodontal therapy involving scaling and root planing (SRP). Zanatta et al.<sup>11</sup> has reported a

case of cyclosporin induced gingival enlargement in a 47-year-old male, which was successfully managed by non-surgical periodontal therapy. A recent systematic review<sup>12</sup> has revealed that a 5-day course of azithromycin with SRP reduces the degree of gingival overgrowth induced by cyclosporine A. Azithromycin therapy is conservative, well tolerated, and rapidly effective with minimal side effects, though it is not substitute for adequate debridement, good oral hygiene and regular maintenance care. In patients with severe gingival hyperplasia that may affect esthetics or occlusion, surgical therapy may be the treatment of choice. The main objective of the surgical intervention is excision of the excess tissue, elimination of pockets and restoration of tissue contour thereby correcting the appearance and function. The classical surgical approach includes gingivectomy and gingivoplasty with blades, surgical knives, electrosurgery or with dental laser. In advanced cases which may necessitate osseous contouring, flap surgery is also performed.

### Literature review

Dose-related gingival hyperplasia was demonstrated through experimental studies in dogs using the dihydropyridine calcium antagonist oxidipine at doses 6, 24, and 73 times the intended therapeutic dosage for humans, at 49 days of treatment. The severity and continuation of treatment showed a positive correlation<sup>13-14</sup>. The pathological findings were those of parakeratosis, gingival acanthosis, rete pegs proliferation, mononuclear cell aggregations, and varying densities of fibroblastic and capillary proliferation. Gingival fibroblasts contained strongly sulphated mucopolysaccharides and numerous secretory granules.

Table I. Categories of CCBs

Subclass	Drugs
Benzothiazepines	Diltiazem Clenazem
Phenylalkylamines	Gallopamil Verapamil
Dihydropyridines	Nicardipine Nifedipine Felodipine Amlodipine Aranidipine Azelnidipine Cilnidipine Efonidipine Manidipine Nilvadipine

Table II. Generations of CCBs

Generation of CCBs	Examples of Drugs
First generation	Nicardipine Nifedipine
Second generation	Benidipine, Efonidipine
Third generation	Amlodipine Azelnidipine
Fourth generation	Lercanidipine Lacidipine Cilnidipine

It has been put recognized that the interaction between the CCBs and gingival fibroblasts is calcium-dependent. These drugs affecting intracellular calcium metabolism or transport may stimulate gingival fibroblasts in some patients resulting in hyperplasia of extracellular matrix components, such as the accumulation of glycosaminoglycans which results in gingival hyperplasia. The drug interactions of these medications have also been reported. It is well recognised that, when CCBs which are strong inhibitors of cytochrome P450 (CYP) 3A4 are administered together with statins that are metabolised by the same isoenzyme prior to biliary and renal excretion, may lead to reduced clearance of these drugs with an increase in side effects.<sup>15-16</sup> Indeed, in patients treated with verapamil and simvastatin the serum levels of both drugs were increased, but as yet there is little evidence for this with the dihydropyridine calcium antagonists<sup>17-18</sup>. Nevertheless, when statins and CCBs are co-prescribed especially at high doses, there may possibly be an increase in side effects like gingival hyperplasia. However, the exact mechanism for this remains an enigma.

Recently Mohanty et al.<sup>19</sup> in their study evaluated the safety and tolerability of the calcium antagonists-amlodipine and cilnidipine and compared the incidence of adverse drug reactions between amlodipine and cilnidipine. 258 patients were then divided as (1) Hypertensive patient - the study group received cilnidipine and control group receiving amlodipine. (2) Hypertensive with controlled diabetic patients are also grouped separately as study or control group receiving cilnidipine or amlodipine respectively. The authors arrived at a conclusion that cilnidipine has a better tolerability profile and less adverse reactions than amlodipine, and none of the patients in the study taking cilnidipine reported any incidence of gingival hyperplasia.

Irokawa et al.<sup>20</sup> has recently reported another case of gingival overgrowth induced by immunosuppressant and calcium channel blocker medications, which was effectively treated by non-surgical periodontal therapy. The patient presented with a chief complaint of gingival swelling. She had been receiving cyclosporine following kidney transplantation, along with aspirin and cilnidipine for the prevention of possible complications. She was also diagnosed as having

chronic periodontitis, with a mean probing pocket depth (PPD) of 6 mm; the PD was 4-6 mm at 31% of the sites, and  $\geq 7$  mm at 60% of the sites. With the initial periodontal therapy consisting mainly of plaque control and SRP and then subsequent re-SRP, marked decrease of the gingival overgrowth was observed, concurrently with improvement of the gingival inflammation. After this treatment, none of the sites showed a PPD of  $\geq 5$  mm. After the implementation of the supportive periodontal therapy, the periodontal condition remained stable up to 10 months. In this case report, since the gingival overgrowth was accompanied by edematous swelling of the gingiva which was caused by inflammation, the treatment effort consisting of plaque control and oral hygiene instructions was thought to have contributed to the improvement of the gingival condition in this patient.

Figure 2 shows the clinical picture of a 49 year old patient who reported with a chief complaint of swollen gums with respect to the lower front teeth of two months duration. He was a known hypertensive and was under cilnidipine for the past six months. Clinical examination showed fibrotic papillary enlargement in relation to the lower anteriors with superimposed inflammatory changes. The patient was sent for physician consultation, but was lost for further follow-up. Although a review was not done, the contributory effect of cilnidipine on the gingival presentation of the patient cannot be ruled out entirely.

## Conclusion

The CCBs are a group of drugs that are widely used for the management of populations with hypertension, angina or supraventricular cardiac arrhythmias. Nowadays, majority of these drugs have been replaced with cilnidipine, a newer class in this group, owing to its fewer incidences of side effects. However, as periodontists, a serious and common side effect that should be looked into is the gingival hyperplasia associated with the drug. Unlike other classes of drugs, cilnidipine induced gingival enlargement often clinically presents as a mild exaggeration of plaque induced inflammatory enlargement. So there are high chances of missing out the actual etiology in such cases. So a thorough oral examination of the patient along with a detailed medical and drug history is of paramount importance

in the management of these patients.

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# Ethics in human research

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## ABSTRACT

‘Ethical conduct’ literally means simply doing the right thing, but in reality it means more. It involves acting in the right spirit, out of an abiding respect and concern for one’s fellow creatures. Human research is research conducted with or about people, or their data or tissues, with the sole intention to do good. On rare occasions, the practice of research has even involved deliberate and appalling violation of human beings. Earlier, in the 1900s, there were no regulations regarding the ethical use of human subjects in research. There were no guidelines or any code drawn out for conduct and no Institutional Review Board (IRB). Here is a brief account of why rules and regulations were established and the need for all established research institutes to have an IRB became a necessity.<sup>1</sup>

**Key Terms:** Ethics, Human research, Declaration of Helzinki, Nuremberg code, Belmont report

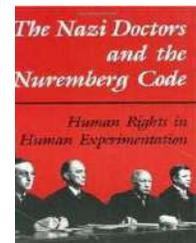
## Introduction

Human research involves significant risks and it is possible for things to go wrong. Despite the best of intentions and care in planning and practice, sometimes things go awry. Now and then mishaps may arise because of technical errors or an ethical insensitivity, neglect or disregard. The human rights that are especially important for medical ethics include the right to life, to freedom from discrimination, torture and cruel, inhuman or degrading treatment, to freedom of opinion and expression, to equal access to public services in one’s country, and to medical care.<sup>2</sup> Ethical codes are important in developing higher standards of conduct, for they are based upon what is considered to be the correct attitude and the correct procedure.<sup>3</sup> Examples of some illegal clinical trials include Cilansetron trial, Zoniporide trial, NDGA trials in India, Maxamine trial in Russia, Cariporide trial in Argentina etc.<sup>4</sup> What follows is a brief discussion of why federal rules and regulations were established and why IRBs became a necessity.

## History

Prior to 1906, when the Pure Food and Drug Act was passed, there were no regulations regarding the

ethical use of human participants in research. There were no consumer regulations, no Food and Drug Administration (FDA), no Common Rule, and no Institutional Review Boards (IRBs). The most dramatic and well-known chapter in the history of research with human participants opened on December 9, 1946, when an American military tribunal opened criminal proceedings against 23 leading German physicians and administrators for their willing participation in war crimes and crimes against humanity. Among the charges were that German Physicians conducted medical experiments on thousands of concentration camp prisoners without their consent. As a direct result of the trial, the Nuremberg Code was established in 1948, stating that “The voluntary consent of the human participant is absolutely essential,” making it clear that participants should give consent and that the benefits of research must outweigh the risks. Although it did not carry the force of law, the Nuremberg Code was the first international document which advocated voluntary participation and informed consent.<sup>5</sup>



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### Thalidomide Incident

In the late 1950s, thalidomide was approved as a sedative in Europe; it was not approved in the United States by the FDA. The drug was prescribed to control sleep and nausea throughout pregnancy, but it was soon found that taking this drug during pregnancy caused severe deformities in the fetus. Many patients did not know they were taking a drug that was not approved for use by the FDA, nor did they give informed consent. Some 12,000 babies were born with severe deformities due to thalidomide. U.S. Senate hearings followed and in 1962 the so-called “Kefauver Amendments” to the Food, Drug and Cosmetic Act were passed into law to ensure drug efficacy and greater drug safety. For the first time, drug manufacturers were required to prove to the FDA the effectiveness of their products before marketing them.



### Tuskegee Syphilis Study (1932-1972)

One of the turning points in the development of a consensus for guidelines for ethical conduct in

research was a project conducted by the US Public Health Service. Six hundred low-income, African-American males, 400 of whom were infected with syphilis, were monitored for 40 years. Free medical examinations were conducted; however, the subjects were not told about their disease. Even though a proven cure (penicillin) became available in the 1950s, the study continued until 1972, with participants being denied treatment. In some cases, when the subjects were diagnosed as having syphilis by other physicians, researchers intervened to prevent treatment. The study sparked off a wide-scale public outrage when it became publicly known, and the US government had to close it in 1973.



Principle	Application
Respect for persons <ul style="list-style-type: none"> <li>• Individuals should be treated as autonomous agents</li> <li>• Persons with diminished autonomy are entitled to protection</li> </ul>	Informed consent <ul style="list-style-type: none"> <li>• Subjects ,to the degree that they are capable, must be given the opportunity to choose what shall or shall not happen to them</li> <li>• The consent process must include three elements:                             <ol style="list-style-type: none"> <li>i. information</li> <li>ii.comprehension, and</li> <li>iii.voluntariness</li> </ol> </li> </ul>
Beneficence <ul style="list-style-type: none"> <li>• Human subjects should not be harmed</li> <li>• Research should maximize possible benefits and minimize possible harm</li> </ul>	Assessment of risks and benefits <ul style="list-style-type: none"> <li>• The nature and scope of risks and benefits must be assessed in a systematic manner</li> </ul>
Justice <ul style="list-style-type: none"> <li>• The benefits and risks of the research must be distributed fairly</li> </ul>	Selection of subjects <ul style="list-style-type: none"> <li>• There must be fair procedures and outcomes in the selection of research subjects</li> </ul>

The Belmont Report established three basic ethical principles – respect for persons, beneficence, and justice – which are the cornerstones for the regulations involving human subjects.(5)

### National Research Act (1974):

Due to the publicity from the Tuskegee Syphilis Study, the National Research Act of 1974 was passed. The National Research Act created the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, which was charged to identify the basic ethical principles that should underlie the conduct of biomedical and behavioral research involving human participants and to develop guidelines which should be followed to assure that such research is conducted in accordance with those principles. The Commission drafted the Belmont Report, a foundational document for the ethics of human participants research in the United States.<sup>6</sup>

### The Belmont Report

Carrying out its charge, the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research prepared the Belmont Report in 1979. The Belmont Report attempts to summarize the basic ethical principles identified by the Commission in the course of its deliberations. The Report is a statement of basic ethical principles and guidelines that should assist in resolving the ethical problems that surround the conduct of research with human participants. The three basic principles and their corresponding applications are:



### Nuremberg code

The Nuremberg Code is a set of research ethics principles for human experimentation set as a result of the subsequent Nuremberg trials at the end of the second world war. Specifically, they were in response to the inhuman Nazi experimentation on non consenting prisoners and detainees during the second world war. The trials were held in the city of Nuremberg, Germany, from 1945 to 1949.<sup>3</sup>

The code, designed to project the integrity of the research subject, set out conditions for the ethical conduct of research involving human subjects, emphasizing their voluntary consent to research. The ten points of the code are:

1. Required is the voluntary, well-informed, understanding consent of the human subject in a full

legal capacity.

2. The experiment should aim at positive results for society that cannot be procured in some other way.

3. It should be based on previous knowledge (like, an expectation derived from animal experiments) that justifies the experiment.

4. The experiment should be set up in a way that avoids unnecessary physical and mental suffering and injuries.

5. It should not be conducted when there is any reason to believe that it implies a risk of death or disabling injury.

6. The risks of the experiment should be in proportion to (that is, not exceed) the expected humanitarian benefits.

7. Preparations and facilities must be provided that adequately protect the subjects against the experiment's risks.

8. The staff who conduct or take part in the experiment must be fully trained and scientifically qualified.

9. The human subjects must be free to immediately quit the experiment at any point when they feel physically or mentally unable to go on.

10. Likewise, the medical staff must stop the experiment at any point when they observe that continuation would be dangerous.

### Declaration of Helzinki

The Declaration of Helsinki (DoH) is a set of ethical principles regarding human experimentation developed for the medical community by the World Medical Association (WMA).<sup>7</sup> It is widely regarded as the cornerstone document on human research ethics.<sup>8</sup> The Declaration was originally adopted in June 1964 in Helsinki, Finland, and has since undergone seven revisions (the most recent at the General Assembly in October 2013). The most recent iteration of Helsinki (2013) was reflective of the controversy regarding the standard of care that arose from the vertical transmission trials. The revised declaration of 2013 also highlights the need to disseminate research results, including negative and inconclusive studies and also includes a requirement for treatment and compensation for injuries related



to research.<sup>9</sup> In addition, the updated version is felt to be more relevant to limited resource settings—specifically addressing the need to ensure access to an intervention if it is proven effective. The Declaration governs international research ethics and defines rules for ‘research combined with clinical care’ and ‘non-therapeutic research.’ The Declaration of Helsinki is the basis for Good Clinical Practices used today.

Issues addressed in the declaration of Helsinki include:

- Research with humans should be based on the results from laboratory and animal experimentation
- Research protocols should be reviewed by an independent committee prior to initiation
- Informed consent from research participants is necessary
- Research should be conducted by medically / scientifically qualified individuals
- Risks should not exceed benefits

### Current Regulations

In 1981, the Department of Health and Human Services (DHHS) and the Food and Drug Administration (FDA) issued regulations based on the Belmont Report. In 1991, the core DHHS regulations (45 CFR Part 46, Subpart A) were formally adopted by more than a dozen other Departments and Agencies that conduct or fund research involving human subjects as the Federal Policy for the Protection of Human Subjects, or “Common Rule.”

The main elements of the Common Rule include<sup>5</sup>:

1. requirements for assuring compliance by research institutions;
2. requirements for researchers obtaining and documenting informed consent;
3. requirements for Institutional Review Board (IRB) membership, function, operations, review of research, and record keeping.
4. additional protections for certain vulnerable research subjects-- pregnant women, prisoners, and children.

Both the Common Rule and the FDA regulations provide protections for human subjects in research.

### Situation In India

As in the case of many other nations, India too has developed national guidelines for research involving human beings. In our country the guidelines, which are often cited and followed, are those issued by the Indian Council of Medical Research, New Delhi. The Indian Council of Medical research brought out the ‘Policy Statement on Ethical Considerations involved in Research on Human Subjects,’ in 1980, and revised these guidelines in 2000, as the ‘Ethical guidelines for Biomedical Research on Human Subjects’. Since then it has been revised and the latest version has been published in 2006.

In its general statement the document stresses on the fact that only such research should be undertaken whose purpose would be to advance the ‘betterment of all, especially the least advantaged’. The manner in which the research is conducted should not compromise the dignity and well-being of the subjects, and it should avoid the historical pitfalls of unethical research, To ensure sound scientific output ‘the research must be subjected to a strict regime of evaluation at all stages of proposal’.<sup>10</sup>

### Institutional Review Board (IRB)

The primary responsibility of the Institutional Review Board (IRB) is to ensure a competent review of all ethical aspects of the project proposals received by it in an objective manner. The composition of IRB committee is multidisciplinary and multi-sectorial in composition. The composition is as follows:

1. Chairperson
2. Convener(Member Secretary)
3. One-population scientist
4. One Social Scientist
5. One medical person from ICMR institute
6. One philosopher
7. One representative of non-governmental voluntary agency
8. One legal expert
9. One lay person from the community

### Current Regulatory Scenario for Conducting Clinical Trials in India

Clinical trials are the key tools in new drug evaluation. India has signed the trade related intellectual property rights (TRIPS) agreement as a

part of the WTO regulations to gearing up to attract more and more researchers from around the world to conduct clinical trials in India.(11)

Currently the clinical trials are regulated by schedule Y of the drug & cosmetics rules, 1945. After the amendment of the D&C act in 2005, the schedule Y was extensively revised to bring the Indian regulations up to par with internationally accepted definitions and procedures. The changes which took place were

- Definitions for Phase I-IV trials, which eliminated the Phase lag.
- Clear responsibilities for investigators; and sponsors.
- Requirements for notifying changes in protocol.

Various institutions playing a prominent role in guiding the clinical trial in India include DCGI (drugs controller general of India), DBT (department of biotechnology), ICMR (Indian council of medical research, CBN (central bureau of narcotics), RCGM (review committee on generic manipulation) GEAC (genetic engineering approval committee) (12)

### Data and Safety Monitoring Board (DSMB)

The Data and Safety Monitoring Board (DSMB) is an independent group of experts that advises NIDCR (National Institute of Dental and Craniofacial Research) and the study investigators. The members of the DSMB serve in an individual capacity and provide their expertise and recommendations. The primary responsibilities of the DSMB are to 1) periodically review and evaluate the accumulated study data for participant safety, study conduct and progress, and, when appropriate, efficacy, and 2) make recommendations to NIDCR concerning the continuation, modification, or termination of the trial. The DSMB considers study-specific data as well as relevant background knowledge about the disease, test agent, or patient population under study.

The membership of the DSMB should reflect the disciplines and medical and dental specialties necessary to interpret the data from the clinical trial and to fully evaluate participant safety. The number of DSMB members depends on the phase of the trial, range of medical issues, complexity in design and analysis, and potential level of risk but generally consists of three

to seven members including, at a minimum:

- Expert(s) in the clinical aspects of the disease/ patient population being studied;
- One or more biostatisticians; and,
- Investigators with expertise in current clinical trials conduct and methodology.

### Conclusion

A profession consists of a limited group of persons who have acquired some special skill and are therefore able to perform that function in society better than the average person. A professional person is expected to have respect for human beings, competence in his chosen field, integrity and a primary concern with service rather than with prestige or profit. Ethical codes are the result of an attempt to direct the moral consciousness of the members of the profession to its peculiar problems. All human beings are born free and equal in dignity and rights; it is the duty of each and every man related or unrelated to science to treat their fellow beings with love and respect.

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# A Complete Outlook On Gingival Biotype - A Review Report

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## Introduction

Gingival biotype is the thickness of the gingiva in the facio-palatal dimension. Gingival biotype plays a vital role among the factors that impede success of dental treatment particularly restorative, regenerative periodontal therapy and periodontal esthetics. The periodontium has been described having two basic forms of biotypes: thin and scalloped or thick and flat.

Oschenbein in 1969 Ross in 1973, Weisgold in 1977 and Olsson and Lindhe in 1991 referred to these as periodontal biotype and also found that thick, flat periodontal biotype to be more prevalent than thin scalloped biotype (85% to 15%).<sup>1,2</sup> Claffey and Shanley defined the thin tissue biotype as a gingival thickness of <1.5 mm and the thick tissue biotype was referred to as having a tissue thickness >2mm. Studies shows that facial surface has thicker gingival biotype in maxilla than mandible. Maxillary canine and Mandibular first premolar have thinnest gingival biotype (0.9-0.7mm). Thickness of gingival/periodontal biotype is also reflected by other features such as alveolar bone contour and thickness, crown shape, amount of keratinized gingival and contour of gingival. Therefore treatment outcome may differ in each individual with different gingival biotype.<sup>1</sup>

Soft tissue biotype was previously called periodontal/gingival biotype or morphotype, but to encompass tissue around both teeth and implants since the advent of implants it has been renamed as SOFT TISSUE BIOTYPE. The term refers to a composite or aggregate of four features of the soft tissues and the teeth they surround that build up to a specific picture.<sup>2</sup> These are:

- The gingival width (keratinised tissue width)
- Gingival thickness (thick or thin)
- Papilla height/proportion.

- Crown width/height ratio

## Classification:

Several classifications (Table: 1) have been put forward by various authors as gingival biotype can differ from tooth to tooth, each individual and other feature. There is no universally accepted classification for gingival biotype as authors have lack of agreement.<sup>3</sup>

## Characteristics of gingival biotype:<sup>2</sup> (Fig: 1 & Fig 2) (Table:2)

### Biotype assessment:

Biotype assessment consists of both invasive and non invasive methods.

Invasive methods used to analyse the gingival thickness direct measurement had various limitations such as lack of accuracy, improper pressure and angulations and invasive approach. Non invasive techniques were devised to overcome the limitations like ultrasonic devices, radiographic techniques and CBCT which were sensitive but quite expensive. 1

### Visual examination:

Simple, straight forward and inexpensive examination of gingiva even though it is not reliable technique and with interexaminer variations (Fig 3).

### Probe transparency:

Probe transparency in the sulcus of gingiva is used to evaluate gingival thickness which helps to determine gingival tissue's ability whether it can cover any underlying material, colour which is necessary for achieving aesthetic results, especially in case of implant and restorative dentistry and also it is a minimally invasive technique(Fig 4).

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### Modified caliper

A tension free caliper is been used to assess the gingival biotype which can be only used at the time of surgery. A study conducted by Kan et al reported significant difference between visual assessment and both the periodontal probe and the tension-free caliper; however, there was no statistically significant difference when comparing the periodontal probe assessment and the tension-free calliper (Fig 5).<sup>5</sup>

### Transgingival probing

Gingival thickness can be measured using periodontal probe under local anesthesia. Gingival thickness can vary due to varied angulations of probe, distortion of tissue during probing and precision of probe.<sup>6</sup>

### Ultrasonic devices

Kydd et al was the first to introduce the ultrasonic device to measure thickness of palatal mucosa. Ultrasonic devices appear to be the least invasive method and offer excellent validity and reliability, but its limitations are it is difficult to determine the correct position for accurate measurement and successfully reproduce measurements.<sup>7,8</sup>

### Cone beam computed tomography (CBCT)

CBCT scans have been used extensively for hard tissue imaging because of their superior diagnostic ability and 3 dimensional imaging. In contrast to transgingival probing and the ultrasonic device, CBCT method is non invasive and also provides an image of the tooth, gingiva and other periodontal structures and can be repeated (Fig 6).<sup>6,9</sup>

Table:1 Various classification on gingival biotype

Authors	classification		
Ochsenbein and Ross	Scalloped and thin	Flat and thick	
Seibert and Lindhe	Thick >2mm	Thin <1.5mm	
Becker et al. (distance between interproximal and mid-facial level of alveolar bone)	Flat 2.1mm	Scalloped 2.8mm	Pronounced scalloped 4.1mm
Kan et al.	Thick >1mm	Thin <1mm	
Claffey and Shanley	Thick >2mm	Thin <1.5mm	
Egreja et al.]	Thick >1mm	Thin <1mm	

Table: 2 Characteristics of gingival biotype

THIN BIOTYPE	THICK BIOTYPE
Delicate thin periodontium	Thick heavy periodontium
Highly scalloped gingival tissue	Flat gingival contour
Usually slight gingival recession	Gingival margins usually coronal to the cemento enamel junction
Highly scalloped osseous contours	Thick, flat osseous contour
Minimum zones of keratinized gingiva	Wide zone of keratinized gingiva
Small incisal contact areas	Broad apical contact areas
Triangular anatomic crowns	Square anatomic crowns
Insult results in recession	Insult results in pocket depth or redundant tissue
Subtle diminutive convexities in cervical third of the facial surface	Bulbous convexities in cervical third of the facial surface

**Clinical significance:**

Soft tissue biotype is an important diagnostic and prognostic factor in treatment planning and impedes the success of dental treatment.<sup>4</sup> Different tissue biotypes respond differently to inflammation and to surgical and restorative treatment; consequently, it is crucial to identify tissue biotype before treatment especially in restorative and esthetic concern.

- Thick biotype is generally healthy peridontium whereas thin biotype is more vulnerable to connective tissue loss and epithelial damage.<sup>10</sup>
- During nonsurgical periodontal treatment loss of attachment is seen in thin biotype (<1.5) and thick biotype (>2mm) shows no signs of loss of attachment.<sup>11</sup>
- In root coverage procedures flap thickness around 0.8-1.2mm had shown more predictable prognosis. Soft tissue grafting like connective tissue graft can be done in thin biotype conditions for better prognosis of root coverage.<sup>12,13</sup>
- Biotype is correlated with the underlying

bony contours; according to researchers thin biotypes have thin labial plate and thick or average biotypes have thicker bony plate. Thick biotypes show greater dimensional stability during remodelling when compared to thin biotypes.<sup>13</sup>

- The role of biotype after crown lengthening on the amount of tissue rebound has been studied, they found that mean tissue growth in patients with thick biotype was significantly greater than those with thin biotype which is due to collateral blood supply in the underlying osseous structure.<sup>14</sup>
- In alveolar ridge remodelling, more extensive remodelling is seen in thin biotype when compared to thick biotypes leading to exaggerated loss of hard and soft tissue volumes. To ensure an esthetic and functional result for augmentive procedures like socket preservation/augmentation studies have shown thin gingival biotype is better results.<sup>15</sup>
- During orthodontic treatment, teeth are moved in various direction which can result in gingival recession, fenestration and dehiscence in thin biotype



Fig: 1 Thin biotype



Fig: 2 Thick biotype



Fig 3 Visual examination



Fig 4 Probe transparency



Fig 5 Modified caliper

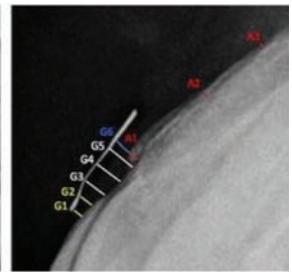
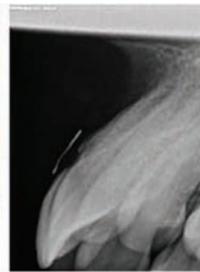


Fig 6 CBCT

conditions.<sup>13</sup>

- Less post-treatment recession was observed after GTR procedures with tissue thickness >1 mm compared with sites <1 mm. A systematic review and meta-analysis suggested a correlation between a critical gingival thickness threshold of >1.1 mm and complete root coverage after connective tissue grafting and GTR procedures.<sup>4</sup>

- Gingival recession is most commonly seen complication in anterior implant placed site. The long term stability of gingival margins around implants and adjacent teeth will depend upon the sufficient height and thickness of the facial bone. To form a stable epithelial connective tissue attachment a minimum of 3 mm of periimplant mucosa is required which serves as a protective mechanism for the underlying bone. Hence, a delayed implant must be considered when there is not enough soft and hard tissue thickness. However, immediate implants can be considered with predictable results in thick biotypes and also maintains the implant papillae height. The thicker biotype prevents mucosal recession, hides the restorative margins and camouflages the titanium implant shadows, is better at concealing titanium, thus reducing the crestal bone resorption.<sup>16,17</sup>

## Conclusion

The thickness of gingiva and nature of masticatory mucosa have a profound impact in Periodontics as it governs the way; the gingival tissue reacts to various physical, chemical or bacterial insults. Gingival biotype depends on different factors in each individual and is an important diagnostic and prognostic character in periodontal management. Understanding the nature of biotype can help the dentist to maintain a favourable treatment with minimising tissue damage and osseous resorption. Predictable results can be achieved on better assessment of gingival biotype and a proper treatment planing.

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# Periodontal status of mandibular second molar following surgical removal of impacted mandibular third molar

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## ABSTRACT

The third molars have received the fair amount of interest in literature. It has been blamed for problems such as—lower incisor crowding, atypical facial pain, caries etc. The removal of impacted third molars is one of the most frequent surgical interventions in dentistry. While making the clinical decision, they are given less importance and often extraction is considered to be the treatment option. The optimal management of impacted mandibular third molar continues to challenge clinicians. It is observed that third molar extraction may lead to gingival changes, loss of bone, development of periodontal pockets, and exposure of the cementum on the distal of the second molars. Despite periodontal problems that can arise with extracted third molars, retention of third molars can also lead to periodontal problems with the adjacent teeth. Some studies also report improvement in periodontal conditions of second molar following the removal of third molar. The objectives of this paper is to determine the effect of the extraction of third molars on the periodontal structures of the second molars.

**Keywords:** Impacted mandibular third molar, Attachment loss, Probing pocket depth, Bone loss

## Introduction

The removal of impacted third molars is one of the most frequent surgical interventions in dentistry, as a treatment measure to alleviate pain and symptoms associated to impaction. The optimal management of impacted mandibular third molar continues to challenge clinicians. Retained, unerupted third molar teeth have been associated with various pathological conditions such as cysts, tumors, pericoronitis, periodontitis, and pathological root resorption along with adverse effects on the neighboring second molar teeth and bone. In a study by Santosh Patil<sup>1</sup> in Indian population Pericoronitis was the most common associated pathology with the third molars (38.9%), followed by dental caries seen in 13.2% of the impacted teeth. Cystic and neoplastic changes were seen around 3.6% impacted teeth and 5.3% adjacent second molars

had caries. The prevalence of pathological conditions associated with the third molar in the Western Indian population was 69.73%. Pericoronitis and caries were commonly seen in relation to the impacted third molars, whereas cystic pathology and root resorption were rarely observed.

Various reasons for third molar removal include

1. Pericoronitis
2. Periodontal disease
3. Prevention or management of caries
4. Root resorption of adjacent teeth
5. Orthodontic considerations
6. Systemic health considerations
7. Prevention or management of odontogenic

cysts

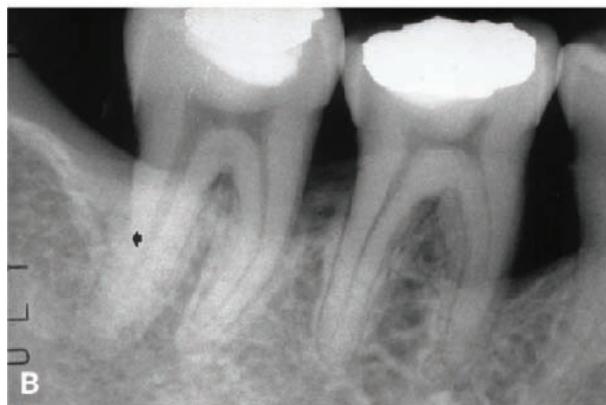
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8. Management of odontogenic tumours
9. Preparation of orthognathic surgery
10. Economic considerations
11. Cheek bite

A number of studies have looked into the impact of removal or retainment of third molars on the periodontal status of the adjacent second molars. The vast majorities of these studies focuses on the mandibular third molars, and are assessed on the basis of attachment levels, pocket depths and bone levels on the second molars. Different studies suggest that surgical removal of mandibular third molar may affect the periodontal health of second molar. In contrast to this, some studies suggest improvement in periodontal conditions of second molar following the removal of third molar.

### The periodontal status of second molar and surgical removal of impacted mandibular third molar

Several conflicting findings have been published



Periapical radiographs of the second molars taken from a control molar (A) and an experimental molar (B). The arrows indicates the bottom intrabony defect on the distal surface.

in previous literature regarding the effects of impacted third molar extraction on the periodontal health of the adjacent second molar. Some authors have shown improvement of periodontal health distal to the adjacent second molar, whilst others have demonstrated loss of attachment and reduction of alveolar bone height. Ash.M et al<sup>2</sup> in 1962 studied Two hundred and twenty-five mandibular and maxillary third molars adjacent to second molars and the status of the periodontal structures of the second molar was evaluated prior to, just after, two weeks, six months, and one year after extraction of adjacent third molars. They found out extraction of completely and partially covered third molars results in a high incidence of periodontal pocket formation on the distal of second molars. Except in young patients, apically placed completely covered third molars should not be extracted simply because they are impacted. After completion of the roots of third molars or after the early twenties in age of patients, the potential for loss of periodontal support of second molars is significantly greater from extraction of impacted third molars than from their retention. The potential for reformation of the normal height of the alveolar crest on the distal of the second molar bears a positive relationship to the terminal period of development of the third molar. Impacted or potentially impacted third molars should be extracted as early in their development as possible to prevent the high incidence of loss of supporting structure on the distal of second molars.

Trevor A et al<sup>3</sup> in 1984 conducted a study to find out the following (a) the effect of surgical removal of the third molar on the periodontal status of the second molar; (b) the influence of flap design on these results; (c) the influence of the initial height of the alveolar bone on the distal of the second molar on subsequent changes in attachment level. They concluded that (a) the surgical removal of the fully impacted mandibular third molar led to the loss of attachment on the distal of the second molar; (b) flap design had no influence on the degree of attachment loss; (c) the initial height of the alveolar bone on the distal of the second molar had no influence on the loss of attachment. Daniel Richardson and Thomas B. Dodson<sup>4</sup> studied the risk of periodontal defects after third molar surgery and found that 48% had worsening of their periodontal measures after third molar removal who

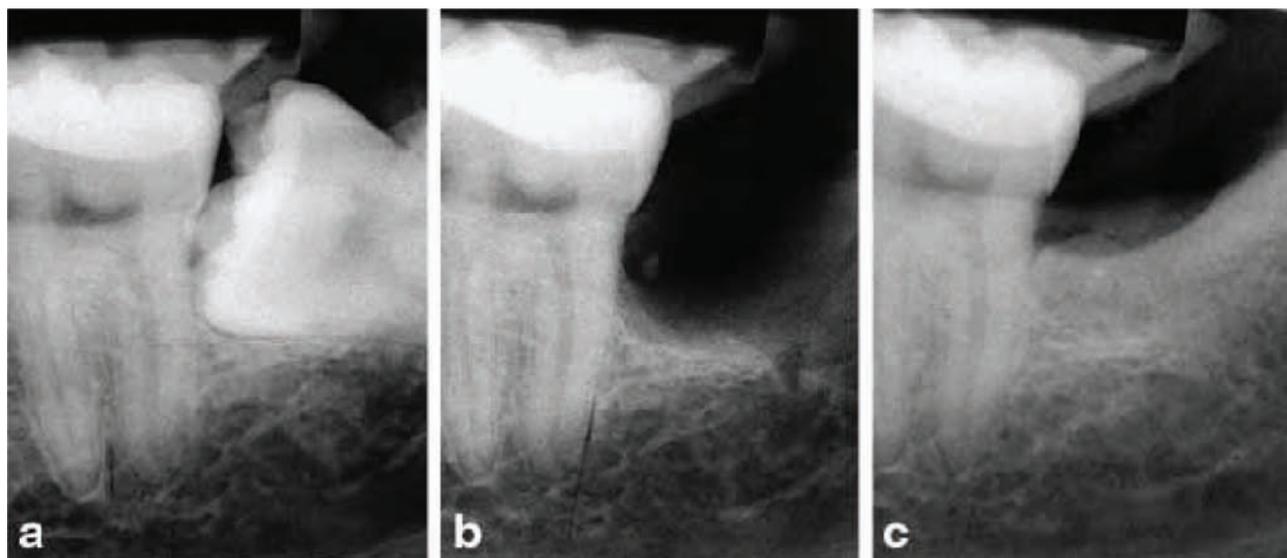
had healthy periodontal status preoperatively. A study by Kan KW et al<sup>5</sup> in 2002 suggest that periodontal breakdown initiated and established on the distal surface of a mandibular second molar in the vicinity of a 'mesio-angular' impacted third molar in association with inadequate plaque control after extraction can predispose to a persistent localized periodontal problem. A radiographic study by Ana Inocencio Faria et al<sup>6</sup> in 2013 suggests that a high-risk periodontal impacted third molar leads to radiographic infrabony defects of at least 4 mm associated with slight or moderate bone loss at the distal aspect of the second molar. Peng. KY et al<sup>7</sup> in 2001 suggested that surgical removal of mandibular third molar may lead to a periodontal breakdown on the distal surface of the second molar. In their study greater periodontal break down including probing depth, attachment loss, and radiographic alveolar bone loss was found at the distal site of the second molar after third molar extraction.

In contrast to this, there was improvement in periodontal conditions of second molar following the removal of third molar and were reported by Krausz et al<sup>8</sup> in 2005. They suggests that Extraction of an impacted third molar resulted in a significant gain of alveolar bone height on the distal aspect of the adjacent second molar. In a study by Petsos H et al<sup>9</sup> in 2016, Average baseline probing pocket depth was reduced from 3.3 mm to 2.6 mm after 6 months ( $p < 0.05$ ). Average probing attachment level was reduced

from 3.0 to 2.5 mm. They suggest that young patients may benefit from an early removal of mandibular third molar.

### Comparison of flap techniques and regenerative procedures in third molar surgery

To reduce the risk of developing periodontal defects, different treatment strategies have been proposed. They consisting of adjunctive systematic debridement of mandibular second molar distal root surface, specific access flap designs, soft-tissue suturing, regenerative procedures, and bone grafting techniques. But it is still unclear whether any of the proposed treatment approaches result in better periodontal healing at the distal surface of the second molar. Barbato et al in<sup>10</sup> 2016 conducted a systematic review to evaluate and synthesize scientific evidence on the effect of surgical interventions for removal of mandibular third molar on periodontal healing of adjacent mandibular second molar. They concluded that GTR-based procedures with or without combined grafting therapies provide some adjunctive clinical benefit compared to standard non-regenerative/non-grafting procedures. However, the overall low quality of evidence suggests a low degree of confidence and certainty in treatment effects. Evidence on variations of surgical mandibular third molar removal techniques based on flap design, type of suturing, and periodontal care of mandibular second molar



Radiographs taken presurgically (a), at suture removal (b), and 12 months postoperative (c). Barriers were used to cover the defect in both cases.

is limited both qualitatively and quantitatively. Rosa et al<sup>11</sup> in 2002 conducted a study to compare the influence of two mucoperiosteal flaps on periodontal healing of adjacent second molars after extraction of impacted mandibular third molars and found out that Independent of the design of the mucoperiosteal flap used in extracting an impacted mandibular third molar, the periodontal condition of the adjacent second molar worsened from 3 to 6 months. Karapataki S et al<sup>12</sup> in 2000 studied the healing, following guided tissue regeneration (GTR) treatment, of bone defects distal to mandibular 2nd molars after surgical removal of impacted mesioangularly or horizontally inclined third molars in patients greater than 25 years. It can be concluded from this study that much research is still needed to clarify the healing process at the distal surface of the second molar after surgical removal of the mandibular third molar. The results did not reveal any clear-cut benefit of using a resorbable GTR barrier in conjunction with surgical removal of an impacted mandibular third molar.

Trevor A et al<sup>3</sup> in 1984 conducted a study to find out the following (a) the effect of surgical removal of the third molar on the periodontal status of the second molar; (b) the influence of flap design on these results. They concluded that (a) the surgical removal of the fully impacted mandibular third molar led to the loss of attachment on the distal of the second molar; (b) flap design had no influence on the degree of attachment loss.

## Conclusion

The removal of impacted third molars is one of the most frequent surgical interventions in dentistry. Different studies suggest that surgical removal of mandibular third molar may affect the periodontal health of second molar. In contrast to this, there was improvement in periodontal conditions of second molar following the removal of third molar. To reduce the risk of developing periodontal defects, different treatment strategies have been proposed such as specific access flap designs, soft-tissue suturing,

regenerative procedures, and bone grafting techniques. But it is still unclear whether any of the proposed treatment approaches result in better periodontal healing at the distal surface of the second molar. Both periodontal and surgical literature lacks evidence of support to make any direct conclusions and more longitudinal studies comparing the periodontal health and third molars are needed.

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# Root Biomodification: The Current Scenario.

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## ABSTRACT

The challenge of regeneration is to reconstitute the periodontal complex onto a root surface which is the site of marginal periodontitis. The goal of this regeneration procedure is to determine the alterations in the diseased root surface that would create an appropriate and hospitable surface for cell attachment and eventual development of a fibre attachment. Numerous studies have been conducted on various agents used for root biomodification but still there exists a controversy on it. This article throws light into the current scenario of different root conditioning agents used for root biomodification and their key features.

**Keywords:** Root biomodification, citric acid, EDTA, fibronectin, enamel matrix protein, laser.

## Introduction

Periodontitis is a multifactorial chronic inflammatory disease characterized by destruction of tooth supporting tissues<sup>1</sup>. Changes in the tooth surface wall of periodontal pockets interfere with new attachment, which is embedment of new periodontal ligament fibers on to new cementum previously denuded by the periodontal disease. The periodontium consists of cells and tissue complex organized spatially into the basic components of cementum, periodontal ligament and alveolar bone. The challenge of regeneration is to reconstitute this complex onto a root surface that is the site of marginal periodontitis. The goal of this regeneration procedure is to determine the alterations in the diseased root surface that would create an appropriate and hospitable surface for cell attachment and eventual development of a fibre attachment. Although meticulous root instrumentation has been advocated, root surface will inevitably be covered by smear layer which acts as a barrier for connective tissue attachment to the root surface. Thus, for regeneration to occur, disinfection

and modification of the contaminated root surface in order to restore its biocompatibility becomes the necessity. One approach toward improving periodontal healing is to clean and to enhance the root surface so that it is biologically compatible. This so called conditioning includes removing bacteria, endotoxins, and other antigens found within the cementum–dentin of a pathologically exposed root. In addition to scaling and root planing, some agents are used for root surface conditioning. Perhaps the oldest and most frequently attempted type of periodontal regeneration has involved chemical modification of tooth surface.

## History

The concept of acid demineralization in periodontal therapy was first introduced in the 1800s as a substitute for scaling and calculus removal. The use of acids as an adjunct to scaling and calculus removal was reported in the New York Dental Records in 1846. As early as 1833, Marshall presented a case of pocket eradication with “presumable clinical reattachment” after the use of Aromatic sulfuric acid.<sup>2</sup> In the 1890s,

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Younger and Stewart described the use of acids in conjunction with the mechanical removal of calculus and cementum. Their rationale for its use as an aid to reattachment was the microscopic evidence of hypermineralization of diseased roots with obliteration of lacunae of cellular cementum by calcific deposits. The potential of acid demineralization of root surfaces as an adjunct to new attachment procedures gained popularity following studies by Urist that suggested that dentin following acid demineralization possessed inductive properties. Register & Burdick in 1975 evaluated various acids for their potential to promote new connective tissue attachment. The acids tested were hydrochloric, lactic, citric, phosphoric, trichloroacetic and formic acid. Several studies have reported controversial results regarding the use of root surface conditioning.<sup>3</sup>

### Biologic considerations

Polson and Caton (1982) evaluated the factors influencing periodontal repair and regeneration. In 2 monkeys, central incisors with reduced periodontium were transplanted into sockets of normal height, and central incisors with normal periodontium were transplanted into sockets of reduced height. After 40 days of healing, the normal roots transplanted into the reduced periodontium had connective tissue reattachment in the periodontal ligament and supracrestal regions. The exposed roots placed into the normal periodontium were lined with epithelium interposed between the root surface and the alveolar bone. The results indicated that root surface alterations, rather than the presence of a reduced periodontium, inhibit new connective tissue attachment.<sup>4</sup>

### Rationale for root biomodification

Root biomodification may serve several purposes:

- Removal of the smear layer following mechanical debridement
- Demineralization of the root surface (citric acid)
- Selective removal of hydroxyapatite and exposure of the collagenous matrix of the root surface (EDTA)
  - Local delivery of antimicrobial compound (tetracycline HCL)
  - Inhibition of collagenolytic activity

(tetracycline HCL)

- Enhancing cellular responses
- Preventing of epithelial down-growth
- Improving retention of different biomolecules to exposed collagen
  - To express a cementoblast phenotype for colonizing cells.
  - Conditioned root surface enhances the formation of new connective tissue attachment<sup>5,6</sup>.

### Methods of root conditioning

Various methods for root conditioning have been attempted; namely mechanical, chemical and a combination of the two.

#### Mechanical methods

Mechanical modification of root surface involves scaling and root planing. This includes removal of cementum, removal of softened dentin, or the smoothing of surface irregularities (figure 1). Although, the effectiveness of scaling and root planing has been well documented, its efficacy in making the root surface disease free has been questioned, since such root modification may not completely remove contaminated cementum particularly in apical areas. A smear layer will inevitably cover the instrumented surface. Thus alternate approaches were suggested to overcome the limitations inherent in the mechanical root cleansing therapy<sup>2</sup>.

#### Chemical methods

Root surfaces affected by periodontal diseases can undergo structural and chemical changes due to the effects of cytotoxic and other biologically active substances from periodontal pathogens. This bacterial contamination prevents the reattachment of gingival and periodontal cells and cannot be reversed by the use of conventional scaling and root planing procedures alone, as they are not able to fully eliminate the infection due to the production of a compact smear layer. Because the presence of a smear layer is unsuitable for reattachment of periodontal connective tissue, the purpose of surface demineralization is to recreate a biologically active substrate for periodontal cellular reattachment. Therefore, chemical conditioning agents are often used to help remove root surface impurities including minerals and cytotoxic materials derived

from bacterial products<sup>6,7,8</sup>.

### Classification of root surface biomodification agents<sup>5,7</sup>

1. Root conditioners
  - Citric acid
  - Tetracycline HCl
  - EDTA
  - Fibronectin
  - Laminin
  - Doxycycline
  - Minocycline
  - Polyacrylic acid
  - Phosphoric acid
  - Formaline
  - Chlorhexidine
  - Chondroitin sulfate
  - Hydrogen peroxide
  - Cetylpyridium chloride and sodium-n-lauroylsarcosine
  - Cohns factor
  - Sodium hypochlorite
  - Stannous fluoride
  - Bile salts and plasma fractions
2. Enamel matrix proteins
3. Platelet rich plasma
4. Recombinant human growth factors
5. Hyaluronic Acid
6. Lasers

### Citric acid.

Citric acid was suggested for smear layer removal by Register (1973) and has been studied extensively. It contains two or more groups in its molecule which can combine with calcium and act as chelating agent. The factors influencing the effects of citric acid on root surface include concentration and pH of the acid, duration of application and mode of application. The pH 1-3, and the duration of application 2-5 minutes using a rubbing pressure on the root surface gives the beneficial results. Most commonly used is pH 1 for 2-3mins.<sup>9,10</sup> (figure 3)

Characteristic features are as follows<sup>5</sup>:

1. Antibacterial Effect (Daly et al, 1982)
2. Exposure of root collagen and opening of dentinal tubules (Polson et al, 1984)
3. Root Detoxification (Aleo et al, 1974)
4. Removal of smear layer (Polson et al, 1984)
5. Initial clot stabilization (Wikesjo et al, 1991)
6. Demineralization prior to cementogenesis (Register, 1975)
7. Enhanced fibroblast growth and stability (Boyko et al, 1980)
8. Prevention of epithelial migration along the denuded roots (Polson et al 1983)

A probing attachment level gain of 2.1 mm for the acid-treated teeth resulted, compared to 1.5 mm for controls (Cole et al; 1981).<sup>5</sup>

No evidence was observed of accelerated cementogenesis or functional connective tissue attachment. Stahl and Froum (1955) also noticed that the exposure citric acid had no apparent effect on supra alveolar collagen fibres, which were left intact on the root surfaces.<sup>11</sup>

### Drawbacks<sup>5,7,10</sup>

- Formation of extremely acidic environment in the surrounding tissues, which may result in unfavourable wound healing responses (Blomlof et al; 1996).
- Its low pH has also been shown to induce cytotoxic effects when in direct contact with periodontal cells (Lan et al; 1991)
- Root resorption and ankylosis

### Tetracycline.

The tetracyclines are a group of bacteriostatic antimicrobials effective against a wide range of organisms. They are the derivatives of the polycyclic naphthalene carboxamide. Tetracycline hydrochloride, Doxycycline hydrochloride and Minocyclines have been used as root conditioning agents to demineralize the root surface as it binds strongly to the root surface and can be released in an active form over extended periods of time. Tetracycline has been shown to bind to dentin with the maximum binding occurring when tetracycline is applied at 50 mg/ml or greater. The bound tetracycline is released and serves as a local

antimicrobial delivery vehicle for up to 14 days. 0.5% solution at a pH of 3.2 and is applied for 5 minutes. The solution is prepared by adding 1 standard ml of sterile water to the contents of each capsule, then thoroughly mixing the two. The material is applied with lateral pressure using passive burnishing technique using a sterile cotton pledget.<sup>3</sup> (figure 3)

Rationale for use of Tetracycline hydrochloride<sup>5</sup> (VP Terranova et al, 1986) :

1. Increases fibronectin binding which stimulates fibroblast attachment and growth
2. Smear layer removal, exposure of dentin tubules
3. Endothelial cell growth factor binding to dentin, stimulating periodontal ligament cell proliferation / migration
4. Adsorbs to enamel and dentin. acts as antimicrobial local delivery system
5. Collagenolytic enzyme inhibition preventing bone resorption

Tetracycline treatment of the tooth surface and subsequent application of fibronectin promotes the attachment and growth of gingival fibroblasts. These findings suggest that tetracycline and fibronectin may be used to treat periodontally involved tooth surfaces (Terranova et al; 1986).

Tetracycline conditioning of the root surfaces during flap surgery has no additional regenerative benefit (Erdinc et al; 1995).

### Fibronectin.

Fibronectin is a high molecular weight extracellular matrix glycoprotein with a molecular weight of approximately 440 KDa and is the main component that holds the clot together. It is a dimer consisting of two nearly identical monomer strands linked by a pair of disulphide bonds. 120.38 mg/ml saline of saline is used for root conditioning.

Key features which makes it different from others are,

1. Promotes mesenchymal cell adhesion, Chemotaxis and growth
2. Speeds the linkage process by being chemoattractive for fibroblasts and stabilizing the clot between the exposed root surface collagen and

new fibers within the tissue.

Caffesse RG et al. (1987) suggested that Periodontally the application of Fibronectin to partially demineralized roots has been shown significantly:

1. To enhance the effects of demineralization with regard to new attachment and
2. To enhance cell proliferation from periodontal ligament and supra crestal area.

Significant gains in clinical attachment and probing depth reduction was reported when citric acid and fibronectin were used (Rahul G et al; 1991). No increased benefits are seen at concentration above serum levels.

### Ethylene-diamine-tetra-acetic acid (EDTA)

EDTA is a chelating agent which is used widely during endodontic treatment. EDTA exerts its demineralizing effect through chelating divalent cations at neutral pH. 18% EDTA at neutral pH is beneficial. (figure 4)

Amaral et al. (2011) in an in vivo study compared the effect of various concentrations of EDTA from 12%-24% in neutral pH from 30 seconds to 3 minutes and concluded that initial fibrin clot adhesion is limited with EDTA use.<sup>13</sup>

### Laminin

The most abundant components of basement membranes are the laminins and type IV collagens. Laminin is a glycoprotein of high molecular weight. Specific features are,

1. It promotes gingival epithelial chemotaxis
2. The demineralized surface attract fibronectin and favour fibroblast proliferation. (According to Terranova and Martin, 1982, a mineralized surface attract laminin which favours epithelial proliferation, which is undesirable. In contrast, a demineralized surface attract fibronectin and favour fibroblast proliferation. This is known as *reciprocal utilization of biologic mediators*.)

Terranova et al. (1986) have demonstrated that laminin promotes epithelial cell adhesion and growth to tetracycline and glycoprotein conditioned surfaces<sup>5</sup>.

### Chlorhexidine

The most common mouth rinse is used in a

concentration of 0.12% for beneficial results. Bogle G, Rathburn E, Oliver R, and Egelberg J (1974) studied the effect of post operative use of chlorhexidine on regeneration of bifurcation defects in dogs. Chlorhexidine applied to the root surface during surgical treatment of bifurcation defects in dogs resulted in an increase in bone height but not in the level of connective tissue attachment<sup>5</sup>.

Alleyn et al, (1991) in his human in vitro study reported that exposure of root surfaces to chlorhexidine significantly inhibits subsequent fibroblast attachment which may interfere with regeneration of periodontium<sup>14</sup>.

### Doxycycline

It is an effective antimicrobial agent against periodontal pathogens. The solution is prepared by adding 1 standard ml of sterile water to the contents of each capsule, then thoroughly mixing the two.<sup>3</sup>

1. It has anti enzymatic properties.
2. Topical application of doxycycline has shown a long lasting substantivity on periodontally diseased root surfaces.
3. Antibacterial effect of doxycycline persists on the conditioned root surface upto 14 days.

Demirel K, et al , (1991) demonstrated that the antibacterial effect of doxycycline persists on the conditioned root surface upto 14 days.

### Polyacrylic acid

Being a weak acid polyacrylic acid has been used as root surface conditioning agent. Wiland et al. (1990) in a comparative study on the healing of the periodontium using Polyacrylic acid for 20 seconds and citric acid for 3 minutes to condition root surface during periodontal therapy, observed that Polyacrylic acid treated teeth have shown more apical migration. They also observed a greater connective tissue adhesion to root surfaces compared to citric acid treated root surfaces<sup>5</sup>.

### Formalin

Morris and Singh reported clinical responses in 44 cases treated by interproximal denudation and root surface conditioning with a formalin solution<sup>6</sup>. Radiographic evaluations indicated bone growth in 45 of 65 defects and clinical attachment gain of 2.7mm.

Since there were no controls, they did not determine how much of the response was due to the surgical approach and how much resulted from the formalin application

### Chondroitin sulfate

Moss M, Kruger and Reynolds DC observed that the use of chondroitin sulfate in extraction sites accelerated the repair but did not affect the ultimate quantity or quality of bone produced<sup>5</sup>.

### Sodium deoxy cholate and human plasma fraction Cohn IV

These agents can dissociate endotoxin into subunits and might thereby detoxify the diseased root surface. The human plasma fraction possibly contains fibronectin.

Wirthlin MR and Hancock EB(1980) in a tissue culture study applied 2% NAD and 5% Cohn's fraction IV to periodontally diseased root surfaces from which plaque and calculus had been removed. This resulted in significantly more fibroblast attachment to the surfaces than treatment with phosphate buffered physiologic saline.<sup>5</sup>

### Stannous fluoride

Selvig et al studied the use of stannous fluoride and tetracycline on repair after delayed replantation of root planed teeth in dogs<sup>5</sup>. Root surface treatment with SnF<sub>2</sub> followed by tetracycline, resulted in complete absence of inflammatory resorption and ankylosis as compared to the control group.

UM Wikesjo et al undertook a study in beagles to assess the effect of stannous fluoride as an adjunct to regenerative surgery<sup>7</sup>. Those surfaces treated with stannous fluoride showed almost complete epithelialization of the defect and sometimes even epithelialization of the supporting alveolar bone. The mechanism, whereby stannous fluoride has this untoward effect on the connective tissue dentine wound interface is not yet clear<sup>5</sup>.

### Hyaluronic acid (HA)

HA is an essential component of the periodontal ligament matrix and plays various important roles in cell adhesion, migration and differentiation mediated by the various HA binding proteins and cell-surface receptors such as CD44. HA has been studied as a

metabolite or diagnostic marker of inflammation in the gingival crevicular fluid (GCF) as well as a significant factor in growth, development and repair of tissues. It is used as a gel formulation in 0.2% concentration<sup>5</sup>. The peculiar features are,

1. accelerates the bone regeneration by means of chemotaxis, proliferation and successive differentiation of mesenchymal cells
2. shares bone induction characteristics with osteogenic substances such as bone morphogenetic protein-2 and osteopontin. (Mendes RM et al, 2003)
3. induces the production of proinflammatory cytokines by fibroblasts, keratinocytes, cementoblasts and osteoblasts.

### Enamel matrix proteins

It is well established that organic matrix play a key role in mineralization. The enamel matrix proteins are involved in early tooth development and play a vital role during formation of cementum, periodontal ligament and alveolar bone. Application of enamel matrix proteins on root surface creates a biological environment similar to that during tooth development favouring periodontal regeneration (Hejil L, 1997). It is a viscous gel consisting of enamel derived proteins from the tooth bud in a polypropylene liquid, 1ml of a vehicle solution is mixed with a powder and delivered by a syringe to the defect site. 90% of the protein in this mixture is amelogenin, rest is primarily proline-rich non-amelogenins, tuftelin, tuft protein, serum proteins, ameloblastin, and amelin.<sup>5,7</sup>

The characteristics which make EMP beneficial

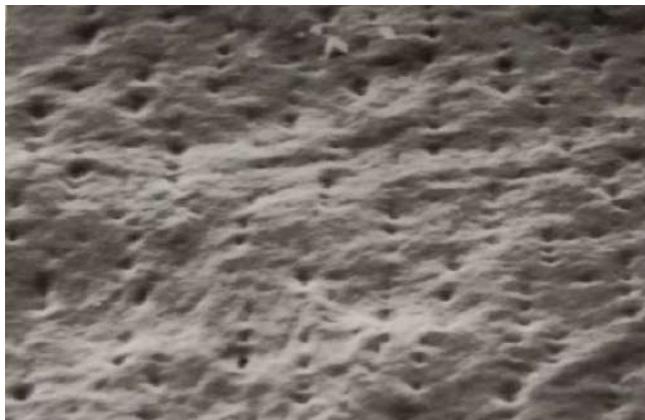


Fig 2: Scanning Electron Microscope image of a root-planned plus citric acid-treated root surface.<sup>4</sup>

are,

1. It promotes periodontal regeneration as it mimics events that take place during the development of periodontal tissues
2. Total protein production by PDL cells increases and mineralized nodule formation of PDL cells also increases
3. It increases production of growth factor
4. It limits epithelial down growth
5. Increased matrix formation

### Platelet rich plasma

Platelets are important component of blood coagulation cascade. Major components of platelet structure are secretory granules (primary, secondary and tertiary granules), which contain growth factors,



Fig 1: Scanning Electron Microscope image of a root-planned surface<sup>4</sup>

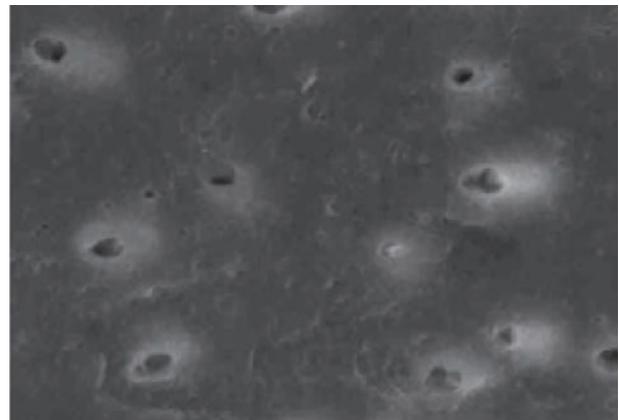


Fig. 3: Scanning Electron Microscope image showing absence of smear layer and exposed dentin in Tetracycline Hydrochloride-treated root surface.<sup>13</sup>

coagulation proteins, adhesion molecules, cell activating molecules, cytokines, integrins, inflammatory molecules, and some other molecules, which are synthesized in megakaryocytes and packaged into the granules through vesicle trafficking processes<sup>7</sup>.

The concept behind PRP application for periodontal regeneration is to obtain high density platelet concentrate from patient's own blood and then applying this concentrate in the area of periodontal wound healing where regeneration is desired. Platelet derived growth factor (PDGF) is a major mitogen for fibroblasts, smooth muscle cells, and other cells. It has been shown that PDGFAB is a potent stimulator of DNA synthesis in fibroblasts (Wang HL et al, 1994)<sup>7</sup>

### Recombinant human growth factors

Growth factors are polypeptide molecules released by cells in the inflamed area that regulate events in wound healing. Various growth factors which are believed to contribute to periodontal regeneration include the platelet derived growth factor (PDGF), insulin like growth factor (IGF), transforming growth factor (TGF), epidermal growth factor (EGF), fibroblast growth factor (FGF), and bone morphogenetic protein (BMP). In general, these growth factors promote proliferation of fibroblasts from the periodontal ligament and favour bone formation.<sup>7</sup>

The effect of human platelet derived growth factor- BB on attachment of periodontal ligament cells on root surfaces was investigated. The results demonstrated that citric acid combined with platelet derived growth factor-BB showed better results than EDTA and tetracycline hydrochloride on attachment

of periodontal ligament cells on root surfaces (Becerik S et al, 2009).

### Lasers

Lasers have been studied for their effect on root surface as well as for their effects on the behaviour on periodontal ligament cells. Recently, lasers have been recommended as an alternative or adjunctive therapy in the control and treatment of periodontally diseased root surface. They are capable of sterilizing the diseased root surface and thus ultimately promoting cell reattachment. (Hess and Myers 1990) said that the removal of root surface contaminants with these techniques allows for the, elimination of inflammation and possible attachment to adjacent hard tissue<sup>8</sup>.

### Diode lasers

Diode lasers with outputs of 500 mW or less are used in low-level laser therapy (LLLT) to provide biomodulation, wound repair, and pain relief. Lasers of other wavelengths are better suited for periodontal regenerative procedures in regard to root preparation.<sup>8</sup>

Kreisler et al. (2002) evaluated possible morphologic alterations of root surfaces treated with a 809-nm GaAlAs diode laser under standardized in vitro conditions, as well as the effect of a saline solution and a human blood film on the root surface. At a power output of 1 W or less, however, the result was little to no damage on the root surface, whereas power selections of 1.5, 2.0, and 2.5 W produced various degrees of carbonization (charring) and heat-induced surface cracking at a distance of 0.5 mm to the specimen. The angle of irradiation had a significant effect on the degree of root surface damage. They



Fig. 4: Scanning Electron Microscope image showing absence of smear layer and exposed dentin in EDTA-treated root surface.<sup>13</sup>

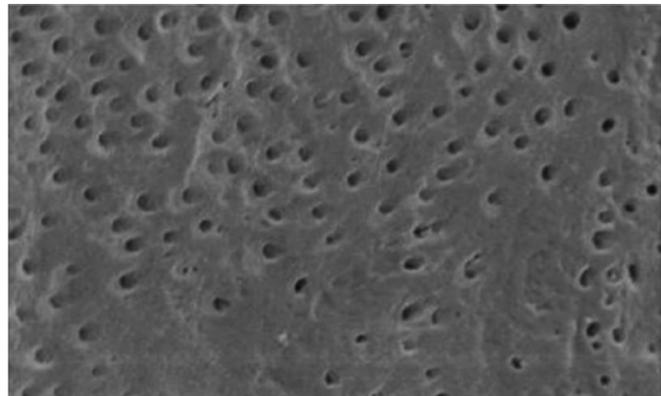


Fig. 5: Scanning Electron Microscopic image of smear layer removal of MTAD treated root surface.<sup>15</sup>

concluded that to avoid damage to the root surface, one alternative is the addition of irrigation. Another possibility is to delay use of the diode laser until 1 to 2 days after SRP, to decrease the possibility of laser-blood interaction.

### **Nd: YAG laser (1064 nm)**

It was developed by Geusic in 1964 and it has been proposed as an instrument with great potential for effective root preparation. Use of Nd: YG lasers as an adjunct to hand instruments and ultrasonics may have a role in both surgical and non-surgical periodontal therapy (Ito K et al 1993). It is applied in pulsed Nd:YAG laser- settings of 50 and 80 mJ, with a delivery time of less than 3 min, and orientation of the laser tip parallel to the root surface.<sup>8</sup>

➤ Application of the Nd: YAG laser to root surfaces results in: (Morlock BJ et al 1992)

- Alterations in root surface protein to mineral ratio.
- Affects the ability of fibroblasts to attach
- Alters the nature of the smear layer following conventional scaling and root planing.
- Inactivates the endotoxin in the superficial layer of the root surface
- Control of inflammatory cytokines. (Page RC, 1991.)

Wilder-Smith P (1995) & Trylovich (1992) have shown that significant rise in the intrapulpal and root surface temperature and root surface alteration which is unfavourable for fibroblast attachment.

### **Er: YAG laser**

Hibst et al (1988) gave a first description of effects of Er: YAG laser on dental hard tissues.

Peculiarities of this laser are:

1. Er:YAG laser has a greater effect on tubular occlusion with less thermal change
2. Less thermal damage to the adjacent tissues.
3. Erbium lasers remove dental hard tissue and bone as well as soft tissue without carbonization.

Yamaguchi et al. (1997) have demonstrated the ability of Er: YAG laser to remove 83% of lipopolysaccharides from root surfaces, facilitate removal of smear layer after root planing, remove

calculus and cementum and leave a surface similar to an acid etched appearance. Thus suggesting Er:YAG laser as a useful root conditioner.<sup>8</sup>

### **Carbon-di-oxide laser (10600nm)**

Patel et al. (1964) were the first to develop CO<sub>2</sub> laser. CO<sub>2</sub> lasers are capable of ablating calcified tissues effectively. However, they have the same limitations of thermal side effects such as cracking or charring at target site and pulpal damage like the Nd: YAG laser.

Misra V, et al. (1999) in an in vitro study evaluates the effect of CO<sub>2</sub> laser on the periodontally involved root surface observed that Laser irradiation of 1 second at 3W completely removed the smear layer with minimal change in the diameter of the dentinal tubules. Crespi R et al (2002, 2005) in a scanning electron microscopic study showed increased fibroblast attachment after root conditioning in pulsed defocus mode.<sup>8</sup>

### **Root canal irrigants as root biomodifier**

The use of intracanal irrigant on periodontally affected root surface was first suggested by B.Houshmand et al. (2011) using MTAD (root canal irrigant, A mixture of tetracycline, citric acid and a detergent -Tween 80) as a root conditioner with a statistically significant difference were seen in smear layer removal from periodontally affected root surface when compared with saline.<sup>15</sup>(figure 5) C.Tandon et al concluded that MTAD as a root biomodifier have a significant role in periodontal wound healing and future new attachment both in vitro and in vivo.<sup>6</sup>

### **Current status**

Angelo Mariotti (2003) in a systematic review on efficacy chemical root surface biomodifiers in the treatment of periodontal disease concluded that chemical modifiers like EDTA, citric acid or tetracycline provides no benefit clinical significance to regeneration in patients with chronic periodontitis.<sup>16</sup>

AAP Regeneration Workshop on Periodontal Soft Tissue Root Coverage Procedures (Dimitris N. Tatakis et al 2015) concluded that the use of root modifiers or other surface biomodification procedures did not provide superior gains in clinical outcomes, either short or long term, than those expected for procedures performed without such agents.<sup>17</sup>

Kratee Sharma et al., (2015) reported that the application of root biomodification agents provide no or minimal clinical benefit with respect to gain in attachment levels or reduction in probing pocket depths. Thus, their role in regeneration is still unpredictable and questionable<sup>11</sup>.

### Conclusion

Periodontal regeneration has come to the forefront of periodontal research and practice. It has become apparent that, if the goal of periodontal regeneration is to be realized, the problem of regeneration needs to be approached from a biological perspective. The in vivo and in vitro studies clearly indicate a greater potential for cell and fiber attachment to demineralized root surfaces. Other factors such as spatial relationships and wound stabilization may also play a role in the extent and predictability of periodontal wound healing following root surface demineralization. Appropriate root surface conditioning may, therefore, regulate the adsorption of plasma proteins, enhance adhesion of the blood clot and stimulate deposition of collagen against the root surface. An understanding of the early events in wound healing, therefore, appears critical to the selection of appropriate agents and their potential to promote regeneration.

The recent use of lasers on root surface does show promising results in vitro but more human randomized clinical trials are needed to prove its potential. Root canal irrigants are newly emerging agents tested for its therapeutic efficacy on root surface and still more studies are required. However, the current scenario suggests that root biomodification does not have any additional benefit in periodontal regeneration. Long term clinical studies are necessary to give a definite conclusion.

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# Periodontal flap: basics revisited

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## ABSTRACT

Surgical periodontal procedures are in general use for treating periodontal disease. The fact that “diseased” roots can be cleaned more efficiently by “visual instrumentation” is the reason why surgical therapy is successful. Since the primary objective of periodontal therapy is to control bacterial infection, the surgical approach should meet the following requirements like proper accessibility and visibility for scaling and root planing; re-establishment of a healthy clinical status and its long-term maintenance by the patients and the dental team; and restoration of the periodontal apparatus when attachment loss occurs. The traditional surgical approach when treating periodontally diseased sites includes exposure of the area surgically, debridement of the diseased sites and the adjacent involved root surfaces and closure.

## Introduction

Of the numerous periodontal surgical techniques, flap surgery remains the standard procedure for periodontitis therapy. The method is characterized by precise incisions, flap reflection and an atraumatic procedure, whose goal is not necessarily pocket elimination but “healing” (regeneration or a long junctional epithelium) of the periodontal pocket with minimum tissue loss. Widman introduced the reverse bevel scalloping type of gingival incisions in 1916 as a modification of Neumann’s periodontal flap surgery. Widman made a scalloped gingival incision around the neck of the teeth about 1 mm. away from the teeth, raised a high mucoperiosteal flap beyond the apices of the teeth, curetted away the remaining soft tissue collar around the teeth, did a thorough root planing of the teeth, a minor trimming of bone for flap adaptation, and closed the flap by individual interproximal sutures. Because the alveolar process is only partially exposed, post-operative pain and swelling are rare.<sup>1</sup>

Flaps accomplish:-

- 1) Increased accessibility to root deposits
- 2) Eliminate or reduce pocket depth by resection of pocket wall.
- 3) Expose the area to perform regenerative methods.

## Definition

A periodontal flap is a section of the gingiva and/or mucosa surgically separated from the underlying tissues to provide visibility of and access to the bone and root surfaces.

The flap allows the gingiva to be displaced to a different location in patients with mucogingival involvement.

## Classification of flaps

Periodontal flaps can be classified based on the following:-

- 1) Bone exposure after flap reflection
- 2) Placement of flap after surgery
- 3) Management of the papilla

- 1) based on bone exposure after flap reflection<sup>2</sup>
  - a) Full thickness flap (mucoperiosteal flap)

In this, all the soft tissue, including the periosteum is reflected to expose the underlying bone.

This complete exposure of and access to the underlying bone is INDICATED when RESECTIVE OSSEOUS SURGERY is to be done.

- b) Partial thickness flap (mucosal flap)

This includes only the epithelium and the underlying connective tissue. Bone remains covered by

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a layer of connective tissue, including the periosteum. Also, called as SPLIT THICKNESS FLAP.

It is indicated when the flap is to be positioned apically or when the operator does not desire to expose bone. As when the bone is stripped of its periosteum, there is loss of marginal bone.

### Partial thickness flap is also indicated when:-

- a) Crestal bone margin is thin.
- b) When the flap is to be placed apically.
- c) When dehiscences and fenestration are present.

The periosteum left on the bone may also be used for suturing the flap when it is displaced.

### 2) Based on placement of the flap after surgery

- a) Non-displaced flap

When the flap is returned and sutured in its original position.

- b) Displaced flap

When the flap is displaced apically, coronally or laterally from its original position. Both full and partial thickness flaps can be displaced. The attached gingiva has to be totally separated from the underlying bone, so as to enable the unattached portion of the gingiva to be moveable. Palatal flaps cannot be displaced owing to the absence of unattached gingiva.

### 3) Based on management of the papilla

- a) Conventional flap

In this type of flap, the papilla is split beneath the contact point of the two approximating teeth to allow reflection of the buccal and lingual flaps. The incision is scalloped to maintain gingival morphology with as much papilla as possible.

Conventional flaps are used when:-

- 1) The interdental spaces are too narrow, there by precluding the possibility of preserving the papilla.

- 2) When the flap is to be displaced.

- b) Papilla preservation flap

This flap incorporates the entire papilla in one of the flaps by means of crevicular interdental incisions to sever the connective tissue attachment and a horizontal incision at the base of the papilla leaving to connecting to one of flaps.

### Design of the flap

#### Design of the flap is dictated by:-<sup>3</sup>

- Surgical judgement of the operator
- Objectives of the operation
- Degree of access to the underlying bone and root surfaces necessary
- Final position of the flap

Preservation of good blood supply to the flap is an important consideration.

#### INCISIONS

- Horizontal
- Vertical

#### Horizontal incisions

✱ Horizontal incision are directed along the margin of the gingiva in a mesial and distal direction

✱ Three types of horizontal incisions have been recommended<sup>4</sup>

#### 1. THE INTERNAL BEVEL INCISION (primary incision or initial incision)

✱ The internal bevel incision (#11) starts 1-3 mm from the gingival margin towards the alveolar crest.(the starting point on the gingiva is determined by the flap is apically displaced or not)

✱ It is the most basic incision to most periodontal flap procedures.

✱ This flap is reflected to expose the underlying bone and root.

✱ It achieves three important objectives:-

- It removes the pocket lining
- It conserves the relatively uninvolved outer surface of the gingiva.
- It produces a sharp thin flap margin for adaptation to the bone-tooth junction.

ALSO, called as the primary or initial or reverse bevel incision (because its bevel is in the reverse direction from that of the gingivectomy incision)

#### Indication

- 1) Primary incision of flap surgery if there is sufficient band of attached gingiva
- 2) Desire to correct bone morphology (osteoplasty or osseous resection)

- 3) Thick gingiva (such as palatal gingiva)
- 4) Deep periodontal pocket and bone defect
- 5) Desire to lengthen clinical crown

Important points to be taken in to consideration are:-

- Preserve the gingival tissue as much as possible
- Prepare a thin and uniform flap which can adapt to bone and tooth surface closely
- For a thick gingiva, thin the flap edge and create a better post operative gingival morphology.

- ✱ That portion of the gingiva left around the tooth contains the epithelium of the pocket lining and the adjacent granulation tissue.

- ✱ It is discarded after the second and third incisions are performed.

## 2) THE CREVICULAR INCISION 5

- ✱ Termed as the **SECOND INCISION** or **SULCULAR INCISION** is made from the base of the pocket to the crest of the bone. (#12 D blade)

- ✱ This incision together with the initial incision/ reverse bevel incision, forms a V-shaped wedge ending at or near the crest of the bone. This wedge of tissue contains most of the inflamed and granulomatous areas that constitute the lateral wall of the pocket, as well as the junctional epithelium and the connective tissue fibers that still persist between the bottom of the pocket and the crest of the bone.

- ✱ The incision is carried around the entire tooth

- ✱ A periosteal elevator is inserted in to the initial incision, and the flap is separated from the bone. With this access, the third incision is made.

## 3) THE THIRD INCISION (INTERDENTAL INCISION)

- ✱ It is an **INTERDENTAL** incision along the alveolar crest and alveolar septum from the buccal to the lingual side

- ✱ It separates the collar of the gingiva that is left around the tooth.

- ✱ Orban knife is usually used for this incision.

The incision is made not only around the facial and lingual radicular area but also interdentally connecting the facial and lingual segments, to completely free the gingiva around the tooth.

ALL these incisions allow the removal of the gingiva around the tooth..

IF NO VERTICAL INCISIONS ARE MADE, THE FLAP IS CALLED ENVELOPE FLAP.

## Vertical incisions

- ✱ **VERTICAL** or **OBLIQUE** releasing incisions can be used on one or both ends of the horizontal incision, depending on the design or the purpose of the flap.

- ✱ For **APICAL DISPLACEMENT** of flap, vertical incisions at both ends of the horizontal incision are required.

- ✱ Vertical incision must reach beyond the mucogingival line, reaching the alveolar mucosa to allow for release of the flap to be displaced.

- ✱ Incisions on the lingual and palatal areas are avoided.

- ✱ Facial incisions should not be made in the center of the interdental papilla or over the radicular surfaces of the tooth.

- ✱ Incisions are made at the line angles of a tooth either to include the papilla or exclude it.

- ✱ Avoid short flaps (mesiodistal) with long, apically directed horizontal incisions because they could jeopardize the blood supply to the flap.

- ✱ **SEVERAL** investigators, proposed the so-called interdental denudation procedure, which consists of horizontal internal beveled, non-scalloped incisions to remove the gingival papillae and denude the interdental space.

- ✱ This technique will completely eliminate the inflamed interdental areas, which heal by second intention and result in excellent gingival contour.

## Elevation of the flap

### For full thickness flap <sup>6</sup>

- ✱ When full thickness flap is desired, the reflection is achieved by blunt dissection.

- ✱ Periosteal elevator is used to separate the mucoperiosteum from the bone by moving it mesially, distally and apically until the desired reflection is accomplished.

### For partial thickness flap

- ✱ Sharp dissection is necessary to reflect the flap using a BP blade.

## COMBINATION

✿ The flap is started as a full thickness procedure and then a partial thickness flap is made at the apical portion.

✿ In this way, the coronal portion of the bone which may be subject to osseous remodeling is exposed, while the remaining bone remains protected by its periosteum.

### The flap technique for pocket therapy

FLAPS are used for pocket therapy to accomplish the following 7

- 1) Increased accessibility to root deposits
- 2) Eliminate or reduce pocket depth by resection of the pocket wall.
- 3) Expose the area to regenerative methods.

❖ Modified widman flap facilitates instrumentation but does not attempt to reduce pocket depth.

❖ Two flap techniques have their main purpose the reduction or elimination of pocket depth, i.e. undisplaced flap, apically displaced flap.

❖ The decision of whether to perform one or the other technique depends on two important anatomical landmarks:- establish the presence and width of the attached gingiva

### The various flap procedures

#### The original widman flap

❖ This was one of the first described flap procedure by LEONARD WIDMAN in 1918.

❖ In the article “THE OPERATIVE TREATMENT OF PYORRHEA ALVEOLARIS”, he described a mucoperiosteal flap to remove pocket epithelium and inflamed connective tissue, thus, facilitating optimal cleaning of the root surfaces.

#### Technique:-

➤ Sectional releasing incisions were made to demarcate the area of surgery

➤ Incisions were made at the midbuccal gingival margins of the two peripheral teeth of the treatment area and continued several mm out in to the alveolar mucosa.

➤ Gingival incision was made following the outline of the gingival margin connecting the releasing

incisions. This separates the pocket epithelium and inflamed connective tissue from the non-inflamed gingiva.

➤ Similar incisions were made on the lingual aspect if required.

➤ Mucoperiosteal flap was elevated to expose atleast 2-3mm of marginal alveolar bone.

➤ Collar of the inflamed tissue around the neck of the teeth was removed with curettes.

➤ Exposed root surfaces were scaled.

➤ Bone recontouring was recommended to achieve ideal anatomic form of the underlying bone.

➤ After debridement, buccal and lingual flaps were placed back and secured with interdental sutures.

➤ Widman pointed out the importance of placing soft tissue margin at the alveolar crest, so that no pockets remain.

➤ This resulted in exposure of the root surfaces.

➤ Often, interproximal areas were left without soft tissue coverage.

According to widman (1918), the main advantages of this flap over gingivectomy are:-

1. Less discomfort for the patient, since healing occurred by primary intention.
2. It was possible to reestablish a proper contour of the alveolar bone in sites with angular bony defects.

#### The modified flap operation

❖ Described by KIRKLAND in 1931.

❖ It's a surgical procedure to be used in the treatment of “periodontal pus pockets”, it's basically an access flap for proper root debridement.

#### ❖ technique

❖ Incisions were made intracrevicularly through the bottom of the pocket on both the labial and the lingual aspects of the interdental area.

❖ Incisions were extended in a mesial and distal direction.

❖ Gingiva was reflected labially and lingually to expose the diseased root surfaces, which were carefully debrided.

❖ Angular bony defects were curetted.

❖ After complete debridement and elimination of pocket epithelium and granulation tissue, flaps were

replaced to their original position.

- ❖ Secured with interproximal sutures.
- ❖ No attempt was made to reduce the preoperative pocket depth.
- ❖ In contrast to the previous two flaps, this modified flap operation did not include:-

1) Extensive sacrifice of the non-inflamed tissues.

2) Apical displacement of the gingival margin.

❖ Since, no root exposure can be used in the anterior region of the dentition.

❖ Another advantage of this flap was potential for bone regeneration in intrabony defects which occurred frequently according to KIRKLAND(1931)

### The main objectives of the flap procedures so far were to:-

1. Facilitate the debridement of the root surfaces as well as the removal of the pocket epithelium and the inflamed connective tissue.

2. Eliminate the deepened pockets (original Widman flap and Neumann flap)

3. Cause minimal amount of trauma to the periodontal tissues and discomfort to the patient.

### The modified widman flap

☞ In 1965, Morris revived a technique described early in the century in periodontal literature – called it unrepositioned mucoperiosteal flap.

☞ Ramfjord & Nissle (1974) described the modified widman flap technique, which is also recognized as the open flap curettage technique.

☞ The technique does not follow the objectives of the original widman flap (apical displacement of flap & osseous recontouring to obtain pocket elimination.)

☞ It offers the possibility of obtaining an intimate post-operative adaptation of healthy collagenous connective tissue to tooth surfaces, also provides access for proper root instrumentation & immediate closure of the area.

### Technique:

☞ Initial incision is performed with a BP knife (# 11)

☞ Incision should be parallel to the long axis of

the tooth.

☞ Incision should be placed 0.5 – 1 mm from the buccal gingival margin to properly separate the pocket epithelium from the flap.

☞ If the pockets on the buccal aspects of the teeth are less than 2 mm deep or if esthetic considerations are important, an intracrevicular incision may be made.

☞ The scalloped incision should extend as far as possible in between the teeth, to allow maximum amounts of the interdental gingiva to be included in the flap.

### On palatal aspect:

☞ Similar incision is placed but the scalloped outline of the initial incision may be accentuated by placing knife at distance of 1-2 mm from the mid palatal surface of the teeth.

☞ Extend incision sufficiently interproximally – so as to have sufficient amounts of tissue in the palatal flap for proper coverage of the interproximal bone when flap is sutured.

☞ Vertical releasing incision not required.

☞ Buccal/palatal full thickness flaps are elevated using periosteal elevator.

☞ Only a few mm of alveolar bone crest should be exposed.

☞ To allow for gentle separation of the collar of pocket epithelium from the root surface – second incision (intracrevicular) is made around the teeth to the alveolar crest.

☞ Third incision is made in a horizontal direction & in a position close to the surface of the alveolar bone crest separates the soft tissue collar of root surfaces from the bone.

☞ Pocket epithelium & granulation tissue curetted.

☞ Exposed root surfaces are scaled & planned except for a narrow area of close to the alveolar bone crest in with remnant of attachment fibers may be preserved.

☞ Angular bone defects are carefully curetted.

☞ After curettage, flaps are trimmed & adjusted to the alveolar bone to obtain complete coverage of interproximal bone.

☞ If the adaptation can't be achieved with soft

tissue recontouring, some amount of bone has to be removed from the outer aspect of alveolar process to facilitate proper flap adaptation.

- ☞ Interproximal sutures placed & surgical dressing placed.

- ☞ Dressing & suture removed after 1 week.

### Advantages

- a) The possibility of obtaining a close adaptation of the soft tissues to the root surfaces.

- b) The minimum of trauma to which the alveolar bone and soft connective tissues are exposed.

- c) Less exposure of root surfaces, which from an esthetic point of view is an advantage in treatment of anterior segments of dentition.

Ramfjord and colleagues compared Widman procedure, as modified by them with curettage technique and other pocket elimination methods that include bone contouring when needed over randomly assigned patients. Results analyzed 7 years post therapy. Similar results reported with 3 methods tested but long term maintenance of shallower levels of pocket depth and attachment levels is higher with Widman flap.

### General indications

different techniques are often used and combined in such a way that overall objectives are met.

Flap operation with or without surgery

- ☞ Flap operation can be used in all cases where surgical treatment of periodontal disease is indicated.

- ☞ Flap procedures are particularly useful at sites where pockets extend beyond mucogingival border and/or where treatment of bony lesions and furcation involvements is required.

Advantages of operation include:-

- o Existing gingiva is preserved
- o The marginal alveolar bone is exposed whereby the morphology of bony defects can be identified and the proper treatment rendered.

- o Furcation areas are exposed, the degree of involvement and the “tooth-bone” relationship can be identified.

- o The flap can be repositioned at its original level or shifted apically, thereby making it possible to adjust the gingival margin to the local conditions.

- o The flap procedure preserves the oral epithelium and often makes the use of surgical dressing

superfluous.

- o The post operative period is usually less unpleasant for the patient when compared to gingivectomy.

### Treatment decisions for soft and hard tissue pockets

Soft tissue pockets:-

- o Depending on the surgical technique used, the soft tissue flap should be either apically positioned at the level of the bone crest (Original Widman Flap, Neumann Flap and Apically repositioned flap)

- o OR maintained in a coronal position (Kirkland Flap, Modified Widman Flap & Papilla Preservation Flap)

- o The maintenance of the presurgical soft tissue height is of importance from an esthetic point of view, particularly in the anterior tooth region.

- o However, long term clinical trials results have shown that major differences in the final position of the soft tissue margins are not evident between surgical procedures involving coronal and apical positioning of the flap margin.

- o The reported difference in the final positioning of flap margin between surgical techniques is attributed to osseous recontouring (Townsend-Olsen et al.,1985, Lindhe et al.,1987, Kaldahl et al., 1996, Becker et al., 2001)

- o In many patients, positioning of the flap coronally is important in anterior tooth region in order to give patient a prolonged period of adaptation to soft tissue recession.

- o In the posterior tooth region, apical positioning should be standard.

- o Goal should be to achieve complete soft tissue coverage of the alveolar bone (In buccal/lingual and proximal sites)

Hard tissue pockets :-

- o Usually opt for conversion of an intrabony defect in to suprabony defect, which is then eliminated by an apical repositioning of the soft tissues.

- o Osseous recontouring of angular bony defects and craters involves excisional techniques which should be used with caution.

- o Factors that are considered in treatment decision:-

Esthetics

Tooth/tooth site involved

Defect morphology

Amount of remaining periodontium

o The various treatment options available for hard tissue defects may include

- ◆ Elimination of the osseous defect by resection of bone (osteoplasty and/or ostectomy)

- ◆ Maintenance of the area with out osseous resection ( hoping for some type of gain of clinical attachment)

- ◆ Compromising the amount of bone removal and accepting that certain pocket depth will remain

- ◆ An attempt to improve healing through the use of a regenerative procedure.

- ◆ Extraction of the involved tooth if the bony defect is considered too advanced.

After all of the necessary procedures are completed the flap is placed in the desired position. The flap should remain in this position without tension. It is convenient to keep the flap in place with light pressure via the use of a piece of guaze to allow the blood clot to form.

### Healing after flap

☞ Immediately after suturing (0-24 hours) a connection between the flap and the tooth or bone surface is established by a blood clot which consists of fibrin reticulum with many PMN leucocytes, erythrocytes, debris of injured cells and capillaries at the edge of the wound.

☞ A bacteria and an exudate or transudate also result from the injury

1-3 days after flap: - Space between the flap and tooth or bone is thinner and epithelial cells migrate over the border of the flap, usually contacting the tooth at this time.

When the flap is closely adapted to the alveolar process, there is only minimal inflammatory response.

1 week after: - Epithelial attachment to tooth is established by hemidesmosomes and basal lamina. Blood clot is replaced by granulation tissue derived from gingival connective tissue, bone marrow and periodontal ligament.

2 weeks after: - Collagen fibers begin to appear parallel to tooth surface. Union of flap to tooth is still weak, due to prescence of immature collagen fibers, although clinically it appears normal.

One month after: - Fully epithelised gingival crevice with a wee-defined epithelial attachment. There is beginning functional arrangement of supracrestal fibers.

FULL – THICKNESS flaps, which denude the bone, result in a superficial bone necrosis at 1-3 days, osteoclastic resorption follows and reaches peak at 4 to 6 days, declining thereafter. This results in loss of bone of about 1 mm, bone loss is grater if bone is thin.

OSTEOPLASTY: - (Thinning of buccal bone) using diamond burs, included part of the surgical technique, results in areas of bone necrosis, with reduction in bone height, which later is remodeled by new bone formation.

Bone repair reaches its peak at 3-4 weeks.

Initial healing stages- bone loss occurs (radicular and interdental) which have cancellous bone, the subsequent repair stage results in total restitution with out any loss of bone; whereas in radicular bone, particularly if thin and unsupported by cancellous bone, bone repair results in loss of marginal bone.

### Conclusion

The primary objective of periodontal therapy is to stop the progression of periodontal disease by controlling infection and thus preserving the health of the periodontal tissue. Surgical elimination or reduction of soft or hard tissue may not necessarily lead to clinical success, which implies very restrictive indications for osseous surgery, gingivectomy and apically positioned flaps within the framework of periodontal therapy. Once again, the most vital factors influencing the outcome of periodontal therapy are optimum oral hygiene on the part of patients and postoperative plaque control by therapists.

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