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Dear Readers,

With immense pleasure we bring forth the first issue of the year 2016. Like all the previous issues, this issue also encompasses the latest trends in dentistry.

For our team it is an ongoing goal to bring forth articles of high interest and value. I request our readers to kindly give their esteemed feedbacks to strengthen the content of this periodical.

This journal culminates with due support from the management, Principal Sir and Jaypee Brothers Medical Publishers. I wish to thank all of them and also the readers for their enthusiastic contributions. I extend my heartfelt gratitude to the authors, editorial team and reviewers for their consistent efforts.

Warm Regards

Anuraag Gurtu
Editor-in-Chief
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The Effect of Bone Type on Peri-implant Bone Stress in Regular and Narrow Diameter Implants on Oblique Loading: A Three-dimensional Finite Element Analysis

ABSTRACT

Purpose: A three-dimensional (3D) finite element analysis (FEA) was performed to evaluate the influence of bone quality, on the stress/strain in bone surrounding the implant.

Materials and methods: Three-dimensional finite element models created to replicate completely osseointegrated endosseous titanium implants, were used for the purpose of stress analysis. Two study groups consisting of a regular platform (RP) group and a narrow platform (NP) group were used with four different bone densities and loaded using the ANSYS workbench software to calculate the Von Mises and principal (maximum tensile and minimum compressive) stress.

Results: Maximum equivalent stress/strain in bone increased with a decrease in cancellous bone density. Under oblique load, especially in the low-density bone models, maximum equivalent strain was lower with the RP implant model than with the NP implant model.

Discussion: This study confirms the importance of bone quality and its presurgical diagnosis for implant long-term prognosis. Implant and abutment diameter can also influence bone strain, especially in low-density bone.

Conclusion: The results of this study suggest that bone of higher rather than lower density might ensure a better biomechanical environment for implants. Moreover, regular diameter implants could be a better choice in a jaw with cancellous bone of low density.

Keywords: Bone dentistry, Dental implants, Finite element analysis, Implant diameter, Implant loading.

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INTRODUCTION

Implant failure may result from loss of osseointegration or component failure subsequent to restoration and may be related to unfavorable loading or to high stress concentrations. Bone quality is an important factor, with more failures found in bone of lower density. Bone quality influences the long-term success of implant treatment, with poor bone quality leading to lower success rates. The classification for bone quality (types I to IV bone) proposed by Lekholm and Zarb has been widely applied by clinicians in evaluating patient bone for implant placement. Jaffin and Berman found that only 3% of Brånemark System implants (Nobel Biocare, Göteborg, Sweden) placed in type I, II, and III bone were lost after 5 years, while in type IV bone, failure rates were 35% over the same period. van Steenberghe et al also found more failures in maxillae with poor bone quality. Since the bone around implants must react to stresses and strains generated by occlusal loads, bone with poor quality could more easily fail to withstand these loads. Clinically, these factors are difficult to investigate because of limited information and sample variation. To verify the hypothesis that bone stress and strain are influenced by bone quality, a three-dimensional finite element analysis (3D FEA) was performed.

MATERIALS AND METHODS

Three-dimensional finite element models created to replicate completely osseointegrated endosseous titanium implants were used for the purpose of stress analysis. The models were constructed using measurements and geometries similar to previous studies, with isotropic material properties (Table 1). An isotropic material is defined as having identical physical properties in all directions; therefore, only two independent material constants exist. A computer aided design (CAD) package called Pro Engineer Wildfire (Parametric Technology corporation, Waltham, MA, USA) was used to generate the models in a.prt file format. Using the Pro/E feature and parametric-based design capability, the implant critical dimensions, such as the height, diameter, etc. were defined to create a virtual assembly in a mesh form.
Three 3D finite element models were created to replicate an implant (13 mm in length with 0.375 mm V thread depth and 0.6 mm pitch) and abutment (6.5 mm in length) with peri-implant bone tissue in which three different implant-abutment configurations were represented. Two implant abutment models consisting of a regular platform (RP) model where a regular 4.3 mm diameter abutment was connected to regular 4.3 mm diameter implant and a narrow platform (NP) model where a 3.5 mm diameter abutment was connected to a 3.5 mm diameter implant was used. A three-dimensionally generated finite element model of a Ni-Cr restoration of 8 mm height, 8 mm in maximum diameter and with an occlusal thickness of 1.5 mm was designed over the abutment.

Complete osseointegration at the implant-bone interface was simulated by combining the nodes of the implant and bone models. Similar integration of the abutment and implant body was adopted, to be a single unit. The same type of contact was also provided at the prosthesis-abutment interface. This eliminated any potential influence from the micromovement between components.

Each of the two implant abutment models were tested in D1, D2, D3 and D4-bone density environments (Table 1), assumed to be homogeneous, isotropic and linearly elastic. Three dimensionally generated FE models of the bone tissue models in which the two implant-abutment configurations, RP and NP with the prosthesis are embedded was designed to be blocks of 16 mm in height, 11 mm in width and 11 mm in breadth. Oblique load of 90N was applied on the flat surface of the restoration on the abutment of the 3D FEA models (Figs 1 and 2). The oblique loading angle of 35.6° imitated the chewing pattern recorded with a jaw tracking device by Ishigaki et al.

The finite element mesh was generated with the following nodes and elements. The final models had a total of 139,334 nodes and 74,324 elements for the NP model, 113,596 nodes and 65,897 elements for the PS model, and 120,703 nodes and 60,7536 elements for the RP model.

The implant geometries were digitally imported into ANSYS workbench software (Swanson Analysis System, Houston, PA) after converting into .iges file format and used to calculate the Von Mises and principal (maximum tensile and minimum compressive) stress ranges for the bone on implant loading.

The Von Mises stresses were obtained, when each of the implant-abutment models RP and NP along with the restoration, were embedded in bone and subjected to oblique loading.

**RESULTS**

The data obtained from the 3D generated models created using finite element software, makes it possible to compare the stress distribution in the various bone densities surrounding the two implant abutment configurations.
models during oblique loading. The positive values of the maximum principal stress and the negative values of the minimum principal stress were taken to indicate maximum tensile stress and maximum compressive stress, respectively. To enable comprehension of the effect of bone density on the peri-implant bone stress, the percentage differences in stress values among the groups are shown in Table 2.

When the peri-implant bone tissue was analyzed, cortical bone (D1) exhibited lower stress levels than the trabecular bone (D2, D3, D4) in all models and on oblique loading (Table 2). It was clearly observed that platform switching reduced Von Mises stress values for oblique loads. Compressive stress was higher than tensile stress in all models.

**DISCUSSION**

The successful use of dental implants has been well-documented, but implant failures are still unavoidable. Implant failures observed after prosthesis delivery are mainly related to biomechanical complications. The mechanisms responsible for biomechanical implant failure are not fully understood, owing to complications from many related factors, such as loading condition, prosthesis type, implant design, implant position, bone type, and material properties of the bone-implant interface. Unfortunately, these biomechanical aspects are difficult to investigate using solely clinical or experimental approaches with limited information and sample variations.

In all instances, stress/strain values in bone increased with a decrease in cancellous bone density. Low-density bone has low stiffness, generating a significant implant displacement (sinking and tilting under vertical and oblique loads, respectively). This greater displacement led to higher deformation of the bone, and thus to higher stresses and strains in the cortical and cancellous bone, respectively. This result could perhaps be an explanation of the findings in other clinical reports, in which higher failure rates were observed for type IV bone than for types I to III bone.

Bone quality affected strain for both implant abutment models with strain increasing as bone quality decreased. When placing implants in sites of lower bone density, the operator has been encouraged to place longer or wider-diameter self-tapping implants using a conventional drilling technique without countersinking or to use an osteotome technique without drilling. With the use of such osteocompressive procedures, bone density and primary stability of implants may be improved. Extending the healing period prior to prosthesis fabrication may also increase bone density and yield more favorable force transmission.

**CONCLUSION**

Within the limitations of this study, the following conclusions can be drawn:

- Maximum von Mises, compressive, and tensile stresses in the peri-implant bone were lower in the D1 bone models than in the D4 bone models for both RP and NP implant abutment combinations
- Higher density bone and wider diameter implant abutment combination yielded a positive result with regard to lowering of peri-implant bone stress levels, in healthy as well as compromised bone qualities.

The reduction of the stress concentration at the implant-bone interface area is a favorable development to ensure the continuity of osseointegration.

**REFERENCES**


Dentascan Evaluation of Hard Tissue Changes around Implants Placed in Healed Sockets: A Cross-sectional Study

1Neeraj Chandra, 2RG Shiva Manjunath, 3Shankar T Gokhale, 4Shivangi Chandra, 5Anju Rana, 6Arijit Sarkar

ABSTRACT

Aim: Implant placement is a lucrative and offers several advantages. This study was done to find out any hard tissue changes around the implants in faciolingual/palatal direction before and after 6 months of implant placement.

Materials and methods: This study was done on 12 patients (29 implants) who has undergone implant placement. Implant system used was Alpha-Bio®. Dentascan, intraoral periapical (IOPA) and orthopantomogram (OPG), were taken to assess the quantity and the quality of the bone, proximity anatomical structure, dimension of the tooth to be replaced and the faciolingual/palatal width of bone at 1 mm apical to the crest. Then 3 mm apical to the crest and 6 mm apical to the crest was calculated. Second stage surgery was carried out after 6 months depending upon the quality of the bone.

Results: Statistical analysis was done on statistical packages for the social sciences (SPSS) version 15 software. The results were tested using normality tests (Kolmogorov-Smirnov and Shapiro-Wilk). The mean value faciolingual/palatal at the crest was 5.95 ± 0.87 mm before implant placement and 5.12 ± 0.78 after 6 months, 3 mm apical to the crest the mean value was 8.57 ± 1.25 and after 6 months it was 8.39 ± 1.21 and 6 mm apical to the crest the mean value before was 10.55 ± 1.61 and after 6 months it was 10.36 ± 1.64 mm. Results from this present study showed statistically significant bone loss in faciolingual/palatal direction.

Conclusion: We can say that delayed implant placement is a safe and predictable option, and bone remodeling bound to occur after implant placement but the faciopalatal/lingual changes are clinically not significant.

Keywords: Computed tomography, Dentascan, Delayed implant, Faciapalatal/lingual.


Source of support: Nil

Conflict of interest: None

INTRODUCTION

Once the father of modern implants, Dr Per-Ingvar Branemark said “No one should die with their teeth sitting in a glass of water”. He discovered that when pure titanium, when placed in a suitably prepared site in the bone, could become fixed in place due to close bond that developed between the two, a phenomenon that he later described as osseointegration.1,2

Clinicians have long sought to provide their patients with an artificial analog of the natural teeth. They have tried many other variety of materials and other techniques for this. However, after many efforts still it has been not possible to replicate the periodontal tissues. This led to the adaptation of other alternative strategies.3 These alternative strategies have been based on principles of creating and maintaining an interface between the surrounding bone and implant, which is capable of load transmission associated with healthy adjacent tissues, which is predictable in outcome and with high success rate. This outcome proved elusive until the phenomenon of osseointegration was developed.4,5

It is accepted that after the implant placement and through time of function, implants will display some extend of bone loss. However, peri-implant marginal bone loss should be limited, since bone loss may induce pocket formation, which could be unfavorable for long-term health of the peri-implant tissue.6-8

It is always advisable to go for either Dentascan or cone-beam computed tomography (CBCT) before implant placement. Dentascan is a unique computer software, which provides us with computed tomography (CT) imaging of maxilla and mandible in three different planes: panoramic, axial and oblique sagittal. The identical scale and clarity between various views permits us with evaluation of distinct facial and palatal/lingual cortical bone margins, as well as accurate and clear visualization of internal structures, such as incisive and inferior alveolar canals.

Dentascan is a unique new computer software program which provides CT imaging of the mandible and maxilla in three planes of reference: axial, panoramic,
and oblique sagittal (or cross-sectional). The clarity and identical scale between the various views permits uniformity of measurements and cross-referencing of anatomic structures through all three planes. Unlike previous imaging techniques, the oblique sagittal view permits the evaluation of distinct buccal and lingual cortical bone margins, as well as clear visualization of internal structures, such as the incisive and inferior alveolar canals. Today, the main use of dentascan is in preoperative case planning and preoperative modeling of endosseous implants. It enables the dentist to visualize bony structures before placement of implants. One does not have to make decisions at the time of surgery when mucoperiosteal flap is already elevated.9-11

One can say that classic parameters to evaluate the success rates of endosseous implants are the lack of mobility, persistent infection and discomfort; continuous periapical radiolucence and absence of pain. These features accounted for the popularity of the delayed implants.12

Delayed implants is preferred in sites where the available bone height apical to the tip of the root is less than 3 mm, it is impossible to obtain primary implant stability in the bone beyond the apex of the extracted tooth, in addition when there is wide alveolus is precluding the engagement of its bony walls.13

It is proposed that patient exhibiting a pronounced scalloped biotype should be treated with a delayed placement rather than going with immediate implant installation approach.14,15

It is seen that to achieve safe predictable, safe and cost-effective mechanism of rehabilitation, Branemark developed certain recommendations regarding treatment protocols. According to one of the recommendations, there should be waiting time of at least 12 months was necessary following tooth extraction before an endosseous dental implant could be placed. The rationale for this reasoning was to allow resolution of any hard or soft tissue pathology in a proposed recipient site.2

The goal of modern dentistry is to restore the tooth to normal contour, function, comfort, esthetics and health. Now, it has become common to use dental implants for the replacement of missing teeth and it is also a preferred alternative for the restorative dentists without involving adjacent teeth. Patients have gained awareness of the new options that they increasingly request modification or replacement of existing dental restorations (e.g. dentures, fixed partial dentures, and removable partial dentures).

Considering all the above factors, the present study has been taken up with the following aims and objectives:

To evaluate the hard tissue profile around the delayed implant using dentascan software.

**MATERIALS AND METHODS**

The study population consisted of 12 patients; 4 females and 8 males, ranging in age from 20 to 63 years. The Implant system used was Alpha-Bio©. The patients included in this study on the basis of the following criteria: Absence of any local or systemic factors that would inhibit or jeopardize the healing process needed for osseointegration. Patients who were cooperative and those patients who were having good oral hygiene method. The patients were excluded from the study who were medically compromised, having Para functional habits like bruxism, patients who were on medications that might interfere with the peri-implant healing process. Patients who were pregnant and lactating mothers were also excluded. Patients suffering from psychiatric disorders were also excluded from the study. Before implant placement study cast. Orthopantomogram (OPG) and dentascan evaluation was done.

**Preoperative Evaluation of Implant Site**

Before starting surgical procedure, evaluation of soft and hard tissue was done. Gingiva was examined to see the consistency, texture and thickness. The occlusion, periodontal integrity of the dentition, an alignment and the interocclusal space was assessed.

In all the cases, preoperative CT scan of the jaw, intraoral periapical (IOPA) and OPG were taken to assess the quantity and the quality of the bone at the implant placement site, proximity of the implant site to vital anatomical structure, dimension of the tooth to be replaced and the buccolingual width of bone at the crest, 3 mm apical to the crest and 6 mm apical to the crest is calculated (Figs 1 to 6).

![Fig. 1: Three-dimensional image before placement](image)
Surgical Procedure

After injecting appropriate local anesthesia, the osteotomy was initiated with 2 mm pilot drill. By using the sequential large drill sizes, the osteotomy site was enlarged according to the width of implant to be used, keeping one thing in mind that the width of last drill should be 0.5 mm short of the width of the implant. With the use of the ratchet the implant is tightened in a clockwise direction.

Patient is prescribed with appropriate antibiotics and analgesics as and when required. Chlorhexidine 0.2% mouth wash was given for 2 weeks postoperatively. The patient was evaluated on a monthly basis.

Second stage surgery was carried out after 4 to 6 months depending upon the quality of the bone. This procedure was also carried out under LA with number 15 blade, a crevicular incision was given over the implant site. The cover screw was removed and healing cap was placed. The soft tissue was then suture back. Before starting a second stage surgery the denta scan evaluation was done to calculate the buccolingual width of the bone at the crest (which is 0.5 mm apical to crest) (Figs 7 to 13).

RESULTS

At the second stage surgery, all of the implants were clinically stable and asymptomatic. The results were tested using normality tests (Kolmogorov-Smirnov and Shapiro-Wilk). Dentascan examination failed to show any kind of peri-implant bone loss. If we talk about the buccolingual width, the mean value at the crest was 5.62 ± 0.87 mm before implant placement and 5.35 ± 0.78 after 6 months, 3 mm apical to the crest the mean value was 9.08 ± 1.25 and after 6 months it was 8.87 ± 1.21 and 6 mm apical to the crest the mean value before was 10.81 ± 1.61 and after 6 months it was 10.55 ± 1.64 mm (Table 1).

The mean change was 0.27 ± 0.13 mm at crest, 0.21 ± 0.12 mm at 3 mm apical to the crest and the 0.26 ± 0.13 mm 6 mm apical to the crest. Results from this present study also indicate that there is statistically significant bone loss present in buccolingual/palatal direction but the results are not much of clinical significant (Graph 1).
DISCUSSION
The study’s aim was to determine the changes seen at the end of healing of bone around implants faciolingual/palatal by using dentascan following placement of delayed implants, without any barrier membrane or grafting material. None of the implants failed. When evaluated at second stage surgery, all implants in the current study was clinically stable, asymptomatic and free of any osseous defect. Results from this present study indicate that there is bone loss in delayed implant. The bone loss was present in both vertically as well as in faciolingual/palatal direction. The bone loss in faciolingual/palatal direction was statistically significant but clinically not much significant.
The implants experienced more extensive buccal bone remodeling as compared to lingual/Palatal site. This remodeling could be due to either because of regional accelerated phenomena (RAP) or it could be because we have reflected flap in all the cases.\textsuperscript{16,17} It could also be possible that the result of simultaneous new bone apposition to fill the peri-implant defect and buccal and lingual bone resorption. Such kind of remodeling leads to reduction of the width of alveolar bone and can occur around all the implants studied.\textsuperscript{18}

Botticelli et al in one of his study created 1.0 to 2.5 mm wide circumferential defects in dogs. It was seen that at few sites, the labial bone adjacent to socket was reduced. It was also seen that over 4 months of healing period the defects healed with bone. It was also noted that at sites where labial bone was reduced, proper bone healing has occurred at mesial, distal and lingual defects, but also reduced bone volume has occurred on labial side.\textsuperscript{19}

The same authors had repeated the study, this time special implants were inserted into the defects and leaving a gap of 1.0 to 2.5 mm between surrounding bone and implant. Restorative barriers with or without bone grafts was used to augment some of the sites, while others left for spontaneous healing.\textsuperscript{20}

Results from these studies demonstrate that the there is no need to place a bone grafts or membrane in smaller junctional gap. In the present study, no bone grafts/membranes were used to make the study more authentic. In patients whom we have to place the grafts were excluded from the study.

The dentascan was used in this study to calculate the parameters. Dentascan is a software program, which provide CT imaging of mandible and maxilla in three planes, i.e. axial, panoramic and oblique sagittal. Dentascan provides accuracy, clarity and identical scale which permits the uniformity of measurements. It also provides cross-referencing of anatomical structures. The faciopalatal/lingual width can be measured with the help of sagittal view and it also provides the clear visualization of internal structures, such as the incisive and inferior alveolar canals.\textsuperscript{9,10}

The main use of dentascan today is in the preoperative planning and preoperative modeling of endosseous dental implants and subperiosteal implants. It enables the dental surgeon to visualize the bony structures preoperatively, one does not have to make decisions at the time of surgery when the mucoperiosteal flap is already elevated to visualize the bony structures directly.\textsuperscript{11}

We have measured the faciopalatal/lingual width before implant placement and after 6 months of placement. The measurements were made at the crest, 3 mm apical to the crest and 6 mm apical to the crest. The measurements were repeated after 6 months on the same locations.

The results from the present study demonstrate that delayed implants can heal uneventfully. The stability was good and no complications was observed throughout the investigation. The peri-implant osseous gap originally observed in this study at baseline was clinically filled by hard tissue, which could not be probed. No histological analysis was performed to describe the characteristics of the tissue contracting the implant, but the soft tissues
surrounding the implant appeared free of inflammation. Moreover, the implants themselves did not exhibit mobility and the application of torque forces failed to elicit pain or discomfort.

As per my knowledge so far this is a first study of its kind in which faciolingual width of the bone were calculated using dentascan software.

CONCLUSION

Within the limits of this study, we can say that immediate implant placement is a safe and predictable option, and bone remodeling bound to occur after implant placement but the buccolingual changes are clinically not significant.

However, one should do careful planning and case selection to ensure implant success and final esthetic outcomes.

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Recession Coverage: Bridge from Unesthetic to Esthetic

Harjit Kaur, Sanjeev Jain, Ridhi Aggarwal, Sumit Kocchar

ABSTRACT
One of the most common esthetic concerns associated with the periodontal tissues is gingival recession. Gingival recession is the exposure of root surfaces due to apical migration of the gingival margins apical to the cementoenamel junction. Although it rarely results in tooth loss, it is associated with thermal tactile sensitivity, esthetic complaints and tendency toward root caries. As it frequently disturbs patients because of esthetics, its treatment has gained considerable importance. Many surgical techniques have been introduced including free autografts, connective tissue grafting, various flap designs, guided tissue regeneration, etc. This article describes etiology and the various surgical procedures for recession coverage.

Keywords: Connective tissue grafts, Esthetics, Free autografts, Guided tissue regeneration, Root coverage.


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INTRODUCTION
Gingival recession is the displacement of marginal periodontal tissues apical to cementoenamel junction. It is a common clinical entity observed in patients, populations, regardless of their age and ethnicity. A healthy and natural appearing soft tissue architecture is critical to the establishment of an esthetic smile. As gingival recession remains a highly prevalent problem and has a potential impact on esthetics; therefore, the patients commonly ask about the treatment options for both single and multiple buccal recession defects. Health of gingiva constitutes the pink component of smile which is equally important as the white component. Therefore, the ultimate goal of root coverage procedures is the complete resolution of recession defect, with a minimum probing depth after treatment, along with a nice chromatic and texture integration of the covering tissues with the adjacent resident soft tissues.

ETIOLOGY
The etiology of gingival recession is multifactorial and several factors play role in the development of gingival recession. The common factors include: excessive or inadequate teeth brushing, destructive periodontal disease, tooth malpositioning, alveolar bone dehiscence, thin marginal tissue covering a nonvascularized root surface, high muscle attachment, frenal pull and occlusal trauma. There are four main etiologic factors that can lead to gingival recession are as follows:

1. Periodontal disease
2. Mechanical forces
3. Iatrogenic factors

Periodontal Disease
In periodontal disease, the interaction between bacterial infection and immune response of the host causes matrix degradation, bone resorption, and down-growth of the epithelium, resulting in periodontal pockets, gingival recession or a combination of both. It has been suggested that a localized inflammatory process may induce epithelial proliferation into the connective tissue of the gingiva. The proliferation of the sulcular epithelial cells decreases the zone of connective tissue between the oral and sulcular epithelium. Eventually, this zone of connective tissue is obliterated by the fusion of these two epithelia. The epithelium loses its nutritional source, and gingival recession ensues.

Mechanical Forces
Faulty Toothbrushing
A common cause of recession is an aggressive use of the toothbrush which gradually abrades the gingival tissue. In these cases, while the gingiva appears free of inflammation, the apical shift of the marginal gingiva denudes root surfaces. Changing the brushing technique should be the first step in the treatment of these patients.
Iatrogenic Factors

Orthodontic Movement

Labial movement of the teeth may result in the loss of the alveolar buccal plate, followed by gingival recession.

Restorative Dentistry

Crown preparations extending subgingivally and impression techniques involving gingival retraction may be the reason for localized gingival recession. Poorly-designed partial dentures can cause gingival recession around abutment teeth.

Anatomical Factors

The anatomical factor most commonly correlated with gingival recession is a narrow band of keratinized gingiva. The areas with narrow keratinized gingiva are usually inflamed and potentially more liable to break. Other anatomical features that can be correlated to gingival recessions are the eruption patterns of teeth and their eventual tooth position in relation to the buccolingual dimension of the alveolar process. They have an effect on the position and thickness of the gingiva that will be established around the teeth.

- When a tooth is positioned facially, the bone and soft tissue on the facial of that tooth are thinner and more susceptible to soft tissue recession than the adjacent teeth.
- The lingual of the same tooth exhibits the exact opposite findings: the lingual bone and gingiva are thicker and located more coronal. There is also a high correlation between root prominence and gingival recession.

The causes of recession must be identified, and then corrected before surgical treatment is instituted to prevent further recession after surgery. Soft tissue recession is often stabilized by good nonsurgical therapy; therefore, only a small percentage of teeth with soft tissue recession will require surgical intervention because of progressive recession.

SURGICAL TECHNIQUES FOR ROOT COVERAGE

Methods for root coverage were described as early as 1956 by Grupe and Warren and Cohen and Ross in 1968. These almost always involved coronally or laterally positioned mucoperiosteal flaps which can be described as single-layer techniques.7

First described by Bjorn (1963), free gingival grafts have been widely used in the treatment of certain mucogingival problems like lack of attached gingiva and gingival recession. By using this technique, attached gingiva can be increased in a very predictable way. Furthermore, the results obtained using these procedures have been reported to be stable. Although gingival grafting is a procedure with few clinical complications, excessive hemorrhage of the donor area, failure in the graft union, delay in healing and esthetic alterations due to disparity in the color of the palatal gingiva with respect to the grafted area have been described.16

The publications by Raetzke (1985) as well as Langer and Langer (1985) were the first to describe two-layer techniques, in which the recession is not merely covered by the flap but additionally by a subepithelial connective tissue graft (CTG). This was a decisive turning point since, greater predictability was achieved with this method.

The third group is guided tissue regeneration (GTR), which has been used to cover recessions since the 1990s (Tinti and Vincenti 1990 and Pino Prato et al 1996).

Additional measures, such as chemical conditioning of the root surface or the use of biological mediators, may complement these three groups of techniques (Heinz et al 1999; Bouchard et al 2001; Sculean and Schwarz 2004).

The various methods for surgical techniques for root coverage are classified by Erpenstein and Borchard (2006) as follows:7

1. Mucoperiosteal pedicle flap-single layer technique
   - Rotational flap
     - Lateral sliding flap
     - Double papilla flap
     - Transpositional flap.
   - Coronally advanced flap
     - Trapezoidal flap with vertical incisions
     - Semilunar flap.

2. Split pedicle flaps with subepithelial connective tissue graft-two layer technique
   - Coronally advanced split flap + connective tissue graft
   - Laterally advanced split flap + connective tissue graft
   - Double papilla flap + connective tissue graft
   - Envelope technique + connective tissue graft.

3. Guided tissue regeneration
   - Nonabsorbable membranes
   - Bioabsorbable, prefabricated membranes
   - Bioabsorbable membranes produced at the chair side.

4. Additional measures
   - Conditioning of the root surface (citric acid, tetracycline-HCL, EDTA)
   - Biological mediators (e.g. enamel matrix derivatives, platelet-rich plasma).
A successful root coverage procedure requires a clearly defined intention. This means that a controlled variable (therapy) remains directionless as long as the objective (treatment outcome) is not defined. Even though the diagnosis ‘recession’ is of major importance, it does not solely determine the medical necessity for a surgical intervention. There must be additional findings to ethically justify the surgical procedure. Therapy based on clinical findings is only possible when all evidence-based methods are mastered.

MUCOPERIOSTEAL PEDICLE FLAP-SINGLE LAYER TECHNIQUE

A pedicle graft is a mucogingival flap designed to serve as a soft tissue graft that maintains an intact blood supply from the donor site. Mucogingival flaps can be divided into four major groups based on the direction of the flap movement:
1. Rotated flaps
2. Advanced flaps
3. Apically positioned flap
4. Replaced flap.
Rotated and advanced flaps are used for recession coverage.

ROTATED FLAPS

The displacement is a lateral movement of rotation. At first it was described as the “lateral sliding flap” by Grupe and Warren in 1956. The “oblique rotational flap”, the “rotation flap” and the “transpositioned flap” are modifications in incision design. When the lateral movement is both mesial and distal to the defect, the rotational flap is called a double papilla flap. Bahal et al in 1990 modified the oblique rotational flap and gave transpositional flap, which is a local flap consisting of segment of gingiva and mucosa that turns around a pivot point. It is further of three types:
1. Laterally positioned flap
2. Double papilla flap
3. Transpositional flap.

Laterally Positioned Flap

The technique was described by Grupe and Warren in 1956 as the “lateral sliding flap” and later as the “laterally positioned flap”. This technique uses the donor gingiva from a healthy adjacent tooth to cover the exposed root of a problem tooth. An isolated area of soft tissue recession with no bone loss on the proximal surface is a good indication for the laterally positioned flap to cover the exposed root. The ideal indication is where the donor site has excessive width and thickness of soft tissue, such as in crowded teeth, where the most lingual tooth (donor) will usually have the thickest and most coronally positioned soft tissue and bone. The adjacent tooth is positioned more facial (recipient) and has little or no gingiva with root exposure. The major disadvantage of this technique is that recession occurs routinely over the donor site.

Many modified methods of Grupe and Warren have been developed to avoid gingival recession on the donor site. Staffileno in 1964 advocated the use of a partial thickness flap to avoid recession on the donor site. Grupe in 1966 reported a modified technique to preserve the marginal gingiva by making a submarginal incision on the donor site. However, laterally positioned full-thickness flaps have the best prognosis for exposed root surface coverage.

Pfeifer and Heller in 1971 reported that reattachment on the exposed root surface is more likely to occur with full-thickness laterally positioned flaps than with partial-thickness flaps. Therefore, full-thickness flaps are appropriate for root coverage, and partial-thickness laterally positioned flaps are suitable for increasing the width of the attached gingiva.

Ruben et al in 1976 demonstrated the method of the partial and full-thickness pedicle flap; a full-thickness flap is prepared to cover the exposed root and a partial thickness flap is prepared near the donor site to protect the exposed root site and to prevent bone loss by preserving periosteum.

Double Papilla Flap

In 1968, Cohen and Ross described the double papilla repositioned flap using the interproximal papillae to cover recessions and correct gingival defects in areas of insufficient gingiva.

Transpositional Flap

Bahat et al in 1990 modified the oblique rotational flap introduced by Pennel et al (1965). This is called the transpositional flap. The transpositional flap is a local flap consisting of a segment of gingiva and mucosa that turns around a pivot point. The radius of its arc is the line of greatest tension of the flap. The base is well-anchored in the lip substance. Despite the unfavorable length: width ratio, this random flap is well vascularized through perforating arterioles in its base and through its muscular deep layers. The extension into the vestibule allows the point of rotation to be transferred. This flap becomes shorter in effective length the further it rotates. However, the versatility of this flap for root coverage and other oral plastic and reconstructive efforts is greatly enhanced because of the apical extension of the pivot point.
ADVANCED FLAPS

Advanced flaps move vertically in a coronal direction and do not deviate laterally. These flaps are used to cover exposed root surfaces, and when teeth are not present, this type of flap is used for reconstructive surgery, such as ridge augmentation. It includes as follows:
- Coronally positioned flap
- Semilunar flap.

Coronally Positioned Flap

The coronally advanced flap was first introduced by Norberg in 1926 as an esthetic surgical procedure for root coverage. The ideal case for a coronally positioned flap has adequate thickness and width of the gingiva on the leading edge of the flap to be advanced. This can be native tissue or it can be the result of a previous procedure used to increase the thickness of tissue to at least 1 mm. The keratinized gingiva has to be wide enough to secure a suture and maintain a stable and secure gingival flap during the healing process.

Semilunar Flap

The procedure was originally performed by Tarnow et al in 1986. The semilunar flap differs in the incision design from the coronally positioned flap, but the direction of movement is the same. This flap needs a minimum of 2 to 3 mm of keratinized gingiva with adequate thickness to allow for manipulation.

Modification of coronally advanced flap was proposed by Ozcelik et al (2011) who advocated the use of orthodontic buttons with coronally advanced flap to maximize the stabilization of immediate postoperative location of gingival margin.

RECESSION COVERAGE WITH FREE AUTOGRFTS

Successful coverage of exposed roots for esthetics as well as functional reasons has been the objective of various mucogingival problems. This has been achieved through various free soft tissue grafts. Soft tissues are transferred from an area distant to the recession to cover the defect. The graft can be nonsubmerged, i.e. placed on the surface of the recipient bed; or submerged, when the graft is completely or partially covered by the flap. Nonsubmerged grafts include free gingival graft. Submerged grafts include the subepithelial connective tissue graft which combines a free connective tissue graft and pedicle soft tissue grafts.

SPLIT PEDICLE FLAPS WITH SUBEPITHELIAL CONNECTIVE TISSUE GRAFT: TWO-LAYER TECHNIQUES

Two-layer techniques are characterized by the fact that a connective tissue graft is laid between the flaps (split flaps) and the root surface. The connective tissue graft (CTG) can be harvested with or without a ridge of epithelium, although the latter method predominates. The graft that can be interposed between the two layers can be subepithelial connective tissue graft.

SUBEPITHELIAL CONNECTIVE TISSUE GRAFT (LANGER)

The subepithelial connective tissue procedure is indicated for larger and multiple defects with good vestibular depth and gingival thickness to allow a split-thickness flap to be elevated. Adjacent to the denuded root surface, the donor connective tissue is sandwiched between the split flap. This technique was described by Langer B and Langer L in 1985.

Guided tissue regeneration using membranes is the group of techniques employed for recession coverage. In 1976, Melcher suggested that the cell type that repopulates the root surface after periodontal surgery will determine the type of attachment that forms on the root surface. If mesenchymal cells from the PDL or perivascular region of the bone proliferate and colonize the root surface, regeneration occurs. Alternatively, if lost tissue is replaced by the surrounding tissue to form a scar, repair occurs. There are two types of membranes used in guided tissue regeneration: nonabsorbable and absorbable membranes (sometimes called nonresorbable and resorbable, respectively). These membranes can be classified as:

1. Nonbioresorbable membrane
   - Expanded polytetrafluoroethylene (ePTFE)
   - Miscellaneous membranes (Millipore membrane, rubber dam)

2. Bioresorbable membranes
   - Synthetic polymers
     - Polyurethane
     - Polylactic acid
Recession Coverage: Bridge from Unesthetic to Esthetic

By: [Author Name]


Conditioning of the Roots

One of the most critical steps in root coverage surgery is proper root preparation before placing the soft tissue graft. The key step is root planing to remove plaque and calculus, and to smooth the root. Some practitioners then use chemicals to condition the root, including citric acid, tetracycline hydrochloride, and ethylenediaminetetraacetic acid. The biologic rationale for the procedure is to detoxify and demineralize the root surface to encourage a fibrin linkage between the exposed collagen fibers on the root surface and the graft collagen fibers.

Biological Mediators

These include enamel matrix derivatives (EMD) and platelet-rich plasma (PRP). Enamel Matrix Derivative

Enamel matrix derivative harvested from developing porcine teeth has been reported to induce periodontal regeneration. The rationale for the mechanism of action is that EMD contains a protein preparation that mimics the matrix proteins that induce cementogenesis.

Enamel matrix derivative is an acetic acid extracted protein preparation from developing porcine tooth buds that contains a mixture of low molecular weight proteins. The major constituents are amelogenins, which are highly hydrophobic proteins that aggregate and serve as a nidus for crystallization. Other proteins identified include ameloblastin and enamelin. This protein preparation uses propylen glycol alginate (PGA) as a carrier. The EMD-containing PGA remains highly viscous when stored in the cold or at room temperature. Once it is applied to the tissue at a neutral pH and at body temperature, the PGA carrier decreases in viscosity, and the EMD preparation precipitates. Enamel matrix derivative is absorbed into the HA and collagen fibers of the root surface, where it induces cementum formation followed by periodontal regeneration.

Platelet-Rich Plasma Preparation

Platelet-rich plasma is essentially an increased concentration of autologous platelets suspended in a small amount of plasma after centrifugation. Because the platelets are autologous, they are able to secrete bioactive growth factors upon activation and subsequent degranulation of their alpha granules. These growth factors are also present at increased concentrations in PRP and are involved in key stages of wound healing and regenerative processes including chemotaxis, proliferation, differentiation and angiogenesis. In addition to growth factors, platelets release numerous other substances that are important in wound healing.

CONCLUSION

Gingival recession is a common and undesirable condition. As gingival recession is considered to be multifactorial, knowing the cause of recession would greatly help in planning of an appropriate clinical approach directed to improve the prognosis of this type of periodontal lesion. Due to an increasing public demand for cosmetic dentistry, the treatment of gingival recession has become an important therapeutic and esthetic issue for the contemporary periodontal practice. Ultimate goal of root coverage procedures should be complete coverage of the recession defect with a pleasing color and tissue blend between the treated area and adjacent tissues, thereby achieving both biologic and esthetic success.

REFERENCES

- Lactide/glycolide copolymers (e.g. poly-l-lactin-910)
- Polylactic acid blended with citric acid ester
- Natural biomaterials (e.g. collagen)
- Calcium sulfate.

ADDITIONAL MEASURES

It includes conditioning of the roots and biological mediators.

Platelet-Rich Plasma Preparation

Platelet-rich plasma is essentially an increased concentration of autologous platelets suspended in a small amount of plasma after centrifugation. Because the platelets are autologous, they are able to secrete bioactive growth factors upon activation and subsequent degranulation of their alpha granules. These growth factors are also present at increased concentrations in PRP and are involved in key stages of wound healing and regenerative processes including chemotaxis, proliferation, differentiation and angiogenesis. In addition to growth factors, platelets release numerous other substances that are important in wound healing.

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Gingival recession is a common and undesirable condition. As gingival recession is considered to be multifactorial, knowing the cause of recession would greatly help in planning of an appropriate clinical approach directed to improve the prognosis of this type of periodontal lesion. Due to an increasing public demand for cosmetic dentistry, the treatment of gingival recession has become an important therapeutic and esthetic issue for the contemporary periodontal practice. Ultimate goal of root coverage procedures should be complete coverage of the recession defect with a pleasing color and tissue blend between the treated area and adjacent tissues, thereby achieving both biologic and esthetic success.

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The Shortened Dental Arch

1Venna Srividya, 2Imran Hossain, 3Mukesh Kumar Singhal, 4Chandana Nair, 5Alok Kumar, 6Dinker Goel

ABSTRACT
Clinicians must frequently decide whether or not to treat patients with loss of posterior teeth, a condition called the shortened dental arch (SDA). Although many studies have been reported, there are no clear recommendations for the management of SDA cases. The World Health Organization (WHO) indicates that a functional, esthetic, natural dentition has at least 20 teeth, while the literature indicates that dental arches comprising the anterior and premolar regions meet the requirements of a functional dentition. This treatment option for the partially dentate patient may provide oral functionality, improved oral hygiene, comfort, and, possibly, reduced costs.

Keywords: Dental occlusion, Oral functionality, Shortened dental arch.

INTRODUCTION
With the exception of developmental disorders, every individual develops 28 (32) teeth or 14 (16) functional units, i.e. pairs of opposing teeth. This occlusal system is not stable during life, as changes occur as a result of physiologic as well as pathologic processes, such as occlusal wear, caries, periodontal disease and traumatic injuries. In spite of intervention in the form of preventive and restorative care, changes may accumulate, leading to badly decayed or periodontally involved teeth or to a reduced number of functional units.1,2

The traditional approach in restorative dentistry stresses idealized morphological criteria and mechanically oriented concepts. Many textbooks emphasize the importance of molar support to prevent temporomandibular joint (TMJ) problems and occlusal instability. This compulsion to save or replace every absent tooth may lead to overtreatment.5,4

This type of treatment planning is supported by the 1969 publication “Optimal occlusion,” where Henry Beyron defined the determinants of a healthy dentition. They included a “maximum number of bilateral centric stops”—a requirement that dominated dental treatment planning protocols for many decades.5

Drawing on clinical observation, Ramfjord6 stated that “replacement of lost molars is a common source of iatrogenic periodontal disease, and should be avoided if requirements to esthetics and functional stability can be satisfied without such replacements”.

This traditional type of treatment planning was challenged by Käyser’s7 classic paper “Shortened dental arches (SDAs) and oral function,” which was published in 1981. His observations on 118 patients led to his proposing “that there is sufficient adaptive capacity to maintain oral function in SDAs when at least four occlusal units are left” (Fig. 1).

The SDA concept is based on the considerations that:

• It fits well with current criteria for a healthy occlusion
• An SDA can meet the requirements of normal oral function
• Molars are high-risk teeth for caries and periodontal diseases
• Possibilities for complex restorative treatment are often limited.

Criteria for a Healthy Occlusion
The prime aim of dental care is to maintain a natural functional dentition throughout life, including all the social and biological functions, such as self-esteem, esthetics, speech, chewing, taste and oral comfort. Since 1970 the orientation of occlusal concepts has shifted from dogmatically morphological and mechanical toward physiologic criteria.

The current criteria and underlying assumptions for a healthy or physiologic occlusion, as developed by Mohl et al8 and Ramfjord and Ash9 reflect this shift clearly:

• Absence of pathologic manifestations
• Satisfactory function (esthetics, chewing, oral comfort)
• Mandibular stability
• Variability in form and function of the stomatognathic system
• Adaptive capacity of the stomatognathic system to changing situations.

This physiological and functional approach assumes a variety of forms of the dentition which are still compatible with oral function.
with healthy occlusion and satisfying oral function. An important implication is that the number of teeth may vary, and thus may be less than 28.

**Shortened Dental Arches**

An SDA is a specific type of a dentition with a reduced number of posterior dental units, namely a dentition with a reduction of teeth starting posteriorly.

To provide care for the partially-dentate patient, the factors considered are:

- Oral functionality
- Vertical dimension
- Occlusion
- Maintenance of hard tissue
- Temporomandibular joint health
- Patient comfort.

Oral functionality is defined in this article as the maintenance of masticatory ability and efficiency while preserving the health of soft and hard tissues (Fig. 2).\textsuperscript{10-12}

The literature indicates that masticatory ability is closely related to the number of teeth, and there is impaired masticatory ability when the patient has less than 20 well-distributed teeth.\textsuperscript{10,13} In this context, the SDA may be defined as having an intact anterior region but a reduced number of occluding pairs of posterior teeth.\textsuperscript{14}

In 1992, the World Health Organization (WHO) stated that the retention, throughout life, of a functional, esthetic, natural dentition of not less than 20 teeth and not requiring recourse to prostheses should be the treatment goal for oral health.\textsuperscript{15} It is not possible, however, to quantify the minimum number of teeth needed to satisfy functional demands because these demands vary from individual to individual. Furthermore, both dental and financial considerations strongly influence the treatment plan, and, in fact, dental arches comprising the anterior and premolar regions meet the requirements of a functional dentition.\textsuperscript{7,15} It follows that the replacement of missing molar teeth by cantilevers, resin-bonded fixed partial dentures, implant-supported prostheses, or distal extension removable partial dentures may amount to over-treatment for patients with SDAs.

**Masticatory Efficiency**

Masticatory efficiency and masticatory ability are important components of oral functionality, but patient adaptation to changes in dental arch length with progressive loss of teeth is critical to successful treatment.

They can be separated into two broad categories, subjective and objective evaluations.\textsuperscript{5,10}

Subjective masticatory function or masticatory ability usually is evaluated through interviews with patients assessing their own masticatory functionality.

Objective evaluation of masticatory function or masticatory efficiency commonly involves measurement of the patient’s ability to grind food. Overall, the literature indicates that masticatory ability closely correlates with the number of teeth and is impaired when there are fewer than 20 uniformly distributed teeth in the mouth.\textsuperscript{8}

![Fig. 1: An illustrative example of a shortened maxillary dental arch. This particular patient presented with stable occlusal conditions 25 years after the extraction of the molars.](image1.png)

![Fig. 2: Representation of SDAs, comprising an intact anterior region and a variation of arch length, expressed in occlusal units (OU), i.e. pairs of occluding posterior teeth; one molar unit is considered to be equal to two premolar units.](image2.png)
An early study involving a cross-sectional clinical investigation of 118 patients separated into 6 groups according to the length and symmetry of the SDA. The study suggested that there is sufficient adaptive capacity for patients to maintain adequate oral function in SDAs provided at least 4 occlusal units remain, although these must be symmetrically placed.15

Thus, impaired masticatory ability and associated changes or shifts in food selection are manifested only when there are less than 10 pairs of occluding teeth.

Prosthodontic Considerations

Prosthodontic considerations in patient treatment are occlusal stability, establishing the correct vertical dimension, and preserving the health of the soft and hard tissues as well as that of the TMJ.

Occlusal stability is defined as the absence of the tendency for teeth to migrate other than the normal physiologic compensatory movements occurring over time,16,17 a better definition may be the stability of tooth positioning relative to its spatial relationship in the occluding dental arches.8

Occlusal stability is determined by a number of factors:

- Periodontal support
- The number of teeth in the dental arches
- Interdental spacing
- Occlusal contacts
- Tooth wear.

Distal tooth migration occurs in SDAs, and this may result in an increased anterior load which, in turn, increases the number and intensity of anterior occlusal contacts as well as the interdental spacing.15 Such effects may be exacerbated when unopposed teeth and lone-standing teeth have inadequate periodontal support. Likewise, tooth migration can cause changes in the vertical and horizontal overlap, occlusal wear, and loss of posterior support, among other effects.

Occlusal stability is thought to be reduced with extremely short dental arches, i.e. only 0 to 2 pairs of occluding premolars. While occlusal stability is reported to be greater with longer dental arches, i.e. 3 to 4 occluding units, older patients generally experience increased changes in occlusal integrity.15 Overall, SDAs comprising anterior and premolar teeth satisfy oral functional demands and show similar vertical overlap and occlusal tooth wear patterns to those found with complete dental arches.18

While patients with SDAs have more interdental premolar spacing, greater occlusal contact of anterior teeth, and lower alveolar bone scores (i.e. the alveolar bone height at the distal surface of each premolar8), the differences in dentition and occlusal characteristics from those of complete or longer dental arches appear to change little over time.15 This suggests that the SDA, in fact, is characterized by long-term occlusal stability.

While there was no evidence that SDAs provoke TMJ problems, it was noted that the risk for pain and joint sounds increased when unilateral or bilateral posterior support is missing.18

Overall, the findings indicated that the SDA concept has a role in contemporary clinical practice.

Treatment options and alternatives as the number of remaining teeth decreases, considerations of oral functionality, prosthodontic treatment, and patient comfort become increasingly important. In other words, does the SDA and reduced food platform area compromise masticatory ability and/or efficiency or adversely influence food selectivity? While restoration of the complete dental arch (i.e. up to and including the second molars) is desirable, this treatment option may not be practical or possible for every patient while occasionally being prohibited by financial constraints. Furthermore, complete dental arch restoration may be inadvisable for compromised and high-risk patients, such as immunosuppressed patients and those undergoing radiotherapy, chemotherapy or both. Nevertheless, the question remains as to what is an adequate and reasonable standard of treatment for the partially dentate patient with the obvious corollary of whether the cost of treatment is justified by the perceived and/or actual clinical outcome.

Acceptable oral health throughout life is the retention of a functional, esthetic, natural dentition of not less than 20 teeth and not requiring recourse to prostheses.

This implies that adult patients have adequate oral functionality when the most posterior teeth are the second premolars. The concept of the shortened but functional dental arch addresses this issue, and the literature indicates that the SDA does not contradict current occlusion theories while offering some important advantages.

In particular, the SDA protocol decreases the emphasis on restorative treatments for the posterior regions of the mouth. In other words, the SDA may avoid the risk of overtreatment of the patient while still providing a high standard of care and minimizing cost.

The shortened dental arch therapy protocol terminates the occlusal platform at the second premolar region. This may be beneficial for the implant patient since no posterior implants are needed; thereby simplifying both the surgical implant placement and its restoration. Likewise, the SDA protocol may be beneficial for the high-risk patient in that restricting the dental arch length reduces the treatment regimen without compromising oral functionality.
SUMMARY

The literature indicates that dental arches comprising the anterior and premolar regions meet the requirements of a functional dentition. However, functional demands, and the number of teeth to satisfy such demands, vary with the individual and, consequently, dental treatment must be tailored to each individual’s needs and adaptive capability. By offering the partially dentate patient a treatment option that ensures oral functionality, improved oral hygiene, comfort, and possibly reduced costs, the SDA treatment approach appears to provide an advantage without compromising patient care.

The SDA concept does not contradict current occlusion theories and appears to fit well with the problem-solving approach favored in modern dentistry. Advocating the SDA offers some important advantages, one of which may be a decreased emphasis on restorative treatments for the posterior regions of the mouth.

REFERENCES

Investing in Periodontal Instrumentation

Sanjeev Jain, Harjit Kaur, Navneet Kaur Sehgal, Divya Saxena

ABSTRACT
Knowledge of the instrument enables the clinician to select proper instrument for the procedure and the correct area in which it will be used. Some important factors that are to be considered are properly maintaining the cutting edge, use of ergonomic handles, variations in handle diameter and shape and use of balanced instruments. A due consideration to all these factors increases the operator’s efficiency for periodontal debridement. This article briefly describes various parts of instruments, their design and how these influence the efficiency of practitioner.

Keywords: Curettes, Handle, Instrumentation, Shank, Sickle scaler, Working end.


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INTRODUCTION
For effective instrumentation, certain general principles are essential to be followed that are common to all periodontal instruments, such as proper positioning of the patient and the operator, illumination and retraction for optimal visibility, sharp instruments, maintaining a clear field, instrument stabilization and instrument activation. A constant awareness of tooth and root morphologic features and condition of periodontal tissues is also essential.

Knowledge of instrument design enables the clinician to select the proper instrument for the procedure and the correct area in which it will be used. Some important factors that are to be considered are properly maintaining the cutting edge, use of ergonomic handles, variations in handle diameter and shape and use of balanced instruments. A due consideration to all these factors increases the operator’s efficiency for periodontal debridement.

PARTS OF AN INSTRUMENT
The three major parts of an instrument are as follows:
1. Working end
2. Shank
3. Handle

Working End
- The working end refers to that part which is used to carry out the purpose and function of the instrument.
- Each working end is unique in the particular instrument.
- The working end of a scaler or curette is called a blade.
- The parts of a sharp blade are:
  - Cutting edge: A very fine line where two surfaces meet. For example, the face and the lateral surface meet to form a sharp cutting edge of curette.
  - Lateral surfaces: The lateral surfaces meet or are continuous to form the back of the instrument (Fig. 2).
  - Back surface: The surface opposite the face is the instrument back (Fig. 3).

Fig. 1: Parts of an instrument
Fig. 2: Lateral surface of an instrument
Toe or tip: The cutting edge of the curette meet to form a rounded surface called a toe. The cutting edges of the sickle scaler meet in a point called a tip.

Working end identification:
- A double-ended instrument has two design numbers, one to identify each working end of the instrument. For example, the original gracey series of the instruments include seven double ended instruments, such as the Gracey 3/4, Gracey 5/6, Gracey 11/12 and Gracey 13/14.
- Name and number marked along the handle: In this case, each working end is identified by the number closest to it.
- Name and number across the handle: In this case, the first number identifies the working end at the top and the second number identifies the working end at the lower end of the handle.

The leading third of the working end:
- A working end has three sections:
  1. The leading third
  2. The middle third
  3. The heal third.
- The leading third is the portion of the working end that is kept in contact with the tooth surface during instrumentation.
- On curettes, the leading third is termed the toe-third of the working end.
- On sickle scalers, the leading third is termed the tip-third of the working end.

Shank
- The shank connects the working end with the handle.
- The instrument shank is the extension device that increases the length of the instrument so that the working end can be placed on the root.
- The shanks of most of the periodontal instruments are bent in one or more places to facilitate placement of the working end against the tooth surface.
- Simple shank design or straight shank:
  1. A shank that is bent at one plane (front to back).
  2. They are used primarily on the anterior teeth.
- Complex shank design or curved shank:
  1. A shank bent in two planes (front to back and side to side) to facilitate instrumentation of posterior teeth.
  2. An instrument with complex shank is needed to reach around the crown and onto the root surface.
- Functional shank—the portion of the shank that allows the working end to be adapted on to the root surface. It begins below the working end and extends to the last bend in the shank nearest the handle.
- Lower shank or the terminal shank—the portion of the shank nearest to the working end.

Shank Length
- The distance from the cutting edge of the blade to the junction of the shank and handle in most of instruments is 35 to 40 mm (1½ inches).
- Too short shank limits the action.

Shank Flexibility
- Instruments are made with shanks with varying degrees of thickness and rigidity that relate to the purpose for which instrument is used:
  - Rigid shank—heavier shank is stronger and is able to withstand greater pressure without flexing when applied during instrumentation. Strong instruments are needed for heavy calculus deposits, e.g. sickle scalers.
  - Flexible shank—thinner shank may provide more tactile sensation which is transmitted to clinician’s fingers, e.g. explorers.

Handle
When selecting an instrument, handle specifications primarily benefit operator comfort. The position and grasp of the handle in conjunction with the finger or hand rest are significant in tactile sensitivity and the activation of the working end.

Overall Design
Single-ended instrument: Handle has one working end.
Double-ended instrument: May have paired (mirror image) or complementary working ends.
Cone-socket handles: These are separable from the shank and working end. They permit screw-in instrument exchanges and replacements.
Weight of the Handle

Handle weight is the final consideration in handle selection. These are solid-handled and hollow-handled instruments. Most clinicians find that hollow handles are lighter and less strenuous to use and improve tactile sensitivity more than solid-handled instruments.8

Diameter

Four diameters of instrument are available. The most common diameters available from manufacturers are 3/8, 5/16, 1/4, 3/16.

The ideal instrument for comfort and best tactile sensitivity has, e.g. a light weight, serrated, handle with a 3/8 or 5/16” diameter.

Surface Texture: Serrations/Texturing/Knurling

Instrument handles may be smooth, ribbed or knurled. A thinner, smooth handle may require a tighter grasp to prevent slipping, which can lessen tactile sensitivity and increase clinician’s fatigue.5

Instrument Balance

A periodontal instrument that has working ends that are aligned with the long axis of the handle is a balanced instrument.

During instrumentation, balance ensures that finger pressure applied against the handle is transferred to the working end, resulting in pressure against the tooth.

CLASSIFICATION OF PERIODONTAL INSTRUMENTS

Periodontal instruments are divided into following types, or classification, based on the specific designed characteristics of the working-ends and their use.

Assessment or Diagnostic Instruments7,14

- Periodontal probe:
  - Marquis color coded probe
  - UNC-15 probe
  - University of Michigan "O" probe with William’s markings
  - Michigan "O" probe
  - UNC-12 probe
  - Naber’s furcation probe
  - Glickman probe
  - Gilmore probe
  - World Health Organization (WHO) probe
  - Orascoptic probe
  - Vine Valley probe
  - Viva-care TPS probe
  - Florida probe
  - Foster Miller probe
  - Interprobe
  - Toronto automated probe
  - Ultrasonographic (US) probe.

- Explorers:
  - #23 Shepherd’s hook explorer
  - Pig tail explorer
  - #17 explorer
  - 11/12 explorer
  - #3—A explorer
  - Orban type explorer.

Scaling, Root Planing and Curettage Instruments8,12

Supragingival Scaling Instruments

- Sickle scalers-curved or straight:
  - SH 6/7
  - SH 5/33
  - Sickle 204 SD
  - U 15/30 Ball and Indiana University sickle scaler.
  - Cumine scaler.

Subgingival Scaling Instruments9,12

- Hoe scaler:
  - Mc Call’s # 3,4,5,6,7,8
  - 6/7 orban mesial/distal.

- Chisel:
  - Weldelstaedt chisel
  - Binangle chisel
  - Straight chisel.

- File scalers:
  - 10/11 orban buccal/lingual
  - 12/13 orban mesial/distal
  - 3/7 Hirschfeld buccal/lingual
  - Quetin furcation curettes.
Curettage Instruments

- Universal curettes:
  - Barnhart curettes # 1–2
  - Younger good # 7–8
  - Mc call’s #13–14, #17–18
  - Columbia curettes #13–14, 2R–2L,4R–4L.
- Area-specific curettes:
  - Gracey # 1–2 and 3–4
  - Gracey # 5–6
  - Gracey # 7–8 and 9–10
  - Gracey # 11–12
  - Gracey # 13–14
  - Gracey #15–16
  - Gracey # 17–18
  - Extended shank curettes
  - Mini-bladed curettes
  - Micro-mini curettes
  - Garcey curvettes
  - Langer and mini langer curettes.

Ultrasonic and Sonic Instruments

Mechanized instruments for scaling and cleansing the tooth surfaces and curetting the soft tissue wall of periodontal pocket.12

Periodontal Endoscopes

Periodontal endoscopes used to visualize deeply into subgingival pockets and furcation, allowing the detection of deposits.12

Cleansing and Polishing Instruments

- Rubber cups
- Bristle brushes
- Dental tape
- Air-powder polishing.

Surgical Instruments

Excisional and Incisional Instruments

- Periodontal knives
  - Kirkland knife
  - USC Towner 19/20
- Interdental knives
  - Orban’s knife
  - Merrifield knife
- Surgical blades
  - No. 11
  - No. 12
  - No. 15
- Electrosurgery

Surgical Curettes

- Prichard curette
- # 3/4, 5/6, 7/8,11/12,13/14 surgical curettes.
- Kirkland curettes.

Sickles

- Ball-scaler #B2-B3.

Periosteal Elevators

- Woodson elevator
- Prichard elevators
- No. 24 G
- Goldman fox no. 14
- No. 9 Molt periosteal elevator.5

Surgical Chisels

- Wieldstadt chisel
- Oschsenbein chisel
- Rhodes chisel
- Kirkland 13 K/TG.

Surgical Files

- 9/10 Schluger curved file
- 1S/2S Sugarman file mesial/distal file
- 3S/4S Sugarman file buccal/lingual.

Scissors

- Goldman fox no. 16 scissors
- #9 Dean’s scissors9
- Metzenbaum scissors.10

Tissue Nippers

- Goldman fox bone/soft tissue nipper
- Tissue pliers 1 × 2 curved.

Tissue Forceps

- Debakey forceps
- Allis tissue forceps.

Needle Holders

- Castroviejo needle holders
- Crile wood needle holders.

BP Handle

- Graduated handle no. 3
- Long handle no. 5, 7, 9.

Hemostat

- Curved
- Straight.
**Rongeur Forceps**

- A side cutting forceps
- The side and end cutting forceps (Flow Chart 1).

Accessibility facilitates thoroughness of instrumentation. The position of the patient and operator should provide maximal accessibility to the areas of operation. Inadequate accessibility impedes thorough instrumentation, prematurely tires the operator and diminishes his or her effectiveness.\(^{12}\)

The patient and the operator positions are of great importance. With low seated dentistry, the patient’s head is placed in the lap of the operator with the light directed into the mouth from a position round the patient\(^{14}\) (Table 1).

Whenever possible, direct vision with direct illumination from the dental light is most desirable. If this is not possible indirect vision may be obtained by using the mouth mirror and indirect illumination may be obtained by using the mirror to reflect light to where it is needed. Indirect vision and indirect illumination are often used simultaneously.\(^{12}\)

### EFFECTS OF ADEQUATE VISION AND ACCESSIBILITY

- Instrumentation is more thorough
- Trauma to the oral tissues is minimized
- Length of time required may be lessened, thereby lessening fatigue for patient and clinician
- Patient cooperation can be increased because of shortened treatment time and less discomfort.

### Contributing Factors for Adequate Vision and Accessibility

- Patient and clinician positions.
- Efficient use of direct or reflected illumination by mouth mirror for each tooth surface.

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**Flow Chart 1: Sequence of instrumentation**

1. Me (assume the clock position for the treatment area)
2. My patient (establish patient chair and head position)
3. My non-dominant hand (grasp the mirror and establish a finger rest with the non-dominant hand)
4. My equipment (adjust the unit light, pause and self-check the clinician, patient and equipment position)
5. My dominant hand (grasp the instrument. Pause to evaluate my finger placement in the grasp)
6. My finger rest (establish a finger rest near the first tooth to be treated)
7. Pause to evaluate my finger rest: Is the tip of ring on a secure tooth surface is ring finger straight, acting as support beam
8. Get ready (working end in the get ready zone in the middle third of the crown)
9. Position working end (position the working end just beneath a calculus deposit)
10. Lower instrument handle (the face of the working end hugs the tooth)
11. Prepare to make a stone (tilt lower shank toward the tooth, lock toe-third of the working end in tooth)
12. Insert (slide the face along the tooth surface and insert beneath the gingival margin. Maintaining the 0° angulation, keep sliding to reach the soft tissue base of the pocket)
13. Position working end (position the working end just beneath a calculus deposit)
14. Prepare to make a stroke (tilt lower shank toward the tooth, lock toe-third of the working end in tooth)
Adequate yet gentle, retraction of lips, cheeks and tongue with consideration for patient’s comfort and clinician’s convenience. [11]

**INSTRUMENT GRASP**

A proper grasp is essential for precise control of movements made during periodontal instrumentation.

**Functions of the Instrument Grasp**

**Dominant Hand**
- The right hand is the dominant hand for the right-handed clinician.
- A few rare people are completely ambidextrous and others are partially dexterous with the non-dominant hand, a useful capability when carrying out dental and dental hygiene procedures.
- The dominant hand is used to hold and activate the treatment instrument. The manner in which the instrument is held influences the entire procedure. [11]

**Non-dominant Hand**
- The right-handed clinician uses the left hand and the left-handed clinician uses the right hand for essential supplementary functions to assist the dominant hand.
- The mouth mirror is held by the non-dominant hand.
- With the appropriate grasp and finger rest, the following effects can be provided
  - Control of the position of the mirror for indirect vision, indirect lighting and retraction.
  - Assistance in providing the dominant hand with an auxiliary finger rest.

**Grasp Dynamics**
- A rigid grasp, in which the instrument is gripped tightly, lessens the tactile sensitivity, and hence the effectiveness of instrumentation.

**Types of Grasp**

**Modified Pen Grasp**

**Description:** The modified pen grasp is a three finger grasp with specific target points of the thumb, index finger and middle (second) finger all in contact with the instrument.
- **Thumb:** The center of the upper aspect of the pad.
- **Index finger:** The center of the upper aspect of the pad.
- **Middle finger:** The inside upper corner of the pad, behind the upper corner of the nail.

**Location on handle:** The instrument is held by thumb and index finger on handle. The upper corner of the middle finger is placed on the upper portion of the shank to hold and guide the movement.
- **Role of middle finger:** The shank of the instrument is held against the inside upper corner of the pad of the middle finger. The instrument is not held across the nail or the side of the middle finger, as in pen grasp usually used for writing.
- **Specific position:** The specific position of the middle finger is essential to instrument control to prevent the instrument from slipping during adaptation and activation and to optimize application of lateral pressure.
- **Role of ring finger:** The ring finger is used to establish a finger rest/fulcrum.

**Additional support:** The side to side contact of index, middle and ring fingers allows for greater stability, strength and control during instrumentation.
Investing in Periodontal Instrumentation

**Palm Grasp**

**Description:** The handle of the instrument is held in the palm by cupped index, middle, ring and little fingers. The thumb is free to serve as the fulcrum.

**Limitations of use:** Instruments for calculus removal, root planing and maintenance of root debridement are not used with a palm grasp. The possible exception is a chisel scaler when it is used to remove gross calculus by push stroke.

**Examples of uses for palm grasp:** Air syringe, rubber dam clamp holder, chisel for restorative work, non-dominant hand stabilizing the instrument for sharpening.

When a variation in finger rest is used, basic rules for stability and control are applied, and rests on movable tissues are avoided. Three types of variations are:

**Substitute**

- Missing teeth where finger rest is usually applied.
  - For an edentulous area, a cotton roll or gauze sponge may be packed into the area to provide dry finger rest.
  - Otherwise, a rest across the dental arch or in the opposite arch may be required to provide stability.

- Mobile teeth or teeth with inadequate bony support.
  - Avoid mobile teeth for finger rests or use only with minimal pressure for brief periods. Not only would the rest on a mobile tooth be unstable, but also the pressure, movement and undue stress on the tooth could traumatize and tear the periodontal ligament fibers.
  - Index finger of the non-dominant hand may be placed in the vestibule over a cotton roll or dry gauze square.
  - The usual finger rest can be placed on the index finger to aid retraction and visibility, particularly in the mouth of a small child.

**Supplementary**

- Place the index finger of the non-dominant hand on the occlusal surfaces of teeth adjacent to the working area. The finger rest can then be applied to the non-dominant index finger. This is known as finger on finger.
- Such supplements are helpful for achieving a parallel orientation to the terminal shank to proximal surfaces.
- Supplemental rests are not useful for certain distal surfaces where the mouth mirror is essential for vision.

**Reinforced**

- In this type, a support is placed between the instrument handle and the working end to provide additional strength and force, particularly for hard, tenacious calculus in pockets.
- Index finger of non-dominant hand can be rested on the tooth adjacent to the one being scaled, while the thumb is placed on the instrument shank (or handle) for a reinforcement.
- Greater control of the instrument can result and when applied correctly, the danger of instrument breakage is reduced.
- A definite rest for both hands is needed to distribute the pressure.

**CONCLUSION**

Correct knowledge of instruments is mandatory before their clinical usage. It enables the clinician to select the proper instrument for the procedure and the correct area in which it will be performed. Small variations in shank length, curvature and flexibility of periodontal treatment instruments profoundly affect their use and effectiveness. Moreover, minimizing occupational risks in the workplace increases the likelihood of long-range health and wellness for the practitioner.

**REFERENCES**

Unraveling the Link between Periodontal Health and Cardiovascular Diseases

ABSTRACT

Periodontitis is a multifactorial disease which destroys the connective tissue and bone that supports the teeth. The host response to infection is an important factor in determining the extent and severity of periodontal disease. Systemic factors modify periodontitis through their effect on normal immune and inflammatory mechanisms. Periodontal disease and cardiovascular diseases (CVD) have been found to share risk factors, such as age, gender, socioeconomic status and most importantly, smoking. The periodontal disease provides a rich source of subgingival microbial and host response products. Two main processes may provide a causative link between these two diseases: the lipopolysaccharide and monocyte-related responses. But, the association between these two disease groups is related more to the existence of common risk factors and common underlying pathophysiology.

Keywords: Arrhythmia, Atherosclerosis, Hypertension, Ischemic heart disease, Infective endocarditis, Periodontitis.

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INTRODUCTION

Good oral hygiene and oral health can improve our overall health, reducing the risk of serious disease and perhaps even preserving our memory in our golden years. The phrase "healthy mouth, healthy you" really is true—and backed by growing scientific evidence.

The relationship between cardiovascular disease (CVD) and periodontal disease has been studied for more than 20 years. Increased prevalence and incidence of CVD has been observed in subjects with periodontal disease. Both conditions share similar components in their pathophysiology as both have an inflammatory component and have been associated with infectious agents and share risk factors, such as age, gender, socioeconomic status and most importantly, smoking.5

Through this article, we aim to discuss the association between periodontal diseases and CVD.

PREVALENCE

Periodontal diseases are one of the most prevalent oral diseases affecting more than 50% of Indian community. In a prospective study of a national sample of adults, subjects with periodontitis had a 25% increase in the risk for coronary heart disease (CHD) compared with those with no or minimal periodontal disease. Among young males (25–49 years of age) periodontitis increased the risk of CHD by 70%. The level of oral hygiene is also associated with heart disease. Patients with poor oral hygiene, as indicated by higher debris and calculus scores, had a two-fold increased risk for CHD. In another study, subjects with greater than 20% bone loss had a 50% increased risk for CHD compared with those with up to 20% bone loss. The extent of sites with probing depth greater than 3 mm was strongly related to the incidence of CHD.2

Since periodontal disease is common in population, it may account for significant portion of proposed infection-associated risk for CVD.

PERIODONTITIS AND ATHEROSCLEROSIS

Atherosclerosis has been defined as a progressive disease process that involves the large to medium-sized muscular and elastic arteries.9 Periodontitis and atherosclerosis have many potential pathogenic mechanisms in common which are as in Flow Chart 11.

Mechanisms by which the Infections may Produce Atherosclerosis

Monocyte-derived Cytokines

The proinflammatory cytokines produced by monocytes (IL-1, IL-6 and tumor necrosis factor α) inhibit lipoprotein lipase, and thus lipemia is a prominent feature of chronic infections but also upregulate adhesion molecule expression on endothelial cells and can stimulate mito-
genesis and fibrinogen production.\textsuperscript{19} These cytokines achieve high circulating levels in severe sepsis syndromes in which they are associated with pyrexia and fever. Monocyte infiltration into the subintima is a crucial pathogenic process in plaque development, and it is crucial as both an infiltrating cell and a cell that can initiate the process by releasing cytokines, upregulating adhesion molecules and binding to them. It can also produce IL-8, which aids in the recruitment of more leukocytes to the area.\textsuperscript{14}

\textbf{Periodontally Specific Mechanisms}

Periodontal disease is capable of predisposing to vascular disease given the abundance of Gram-negative species involved, the readily detectable levels of proinflammatory cytokines in crevicular fluid, the dense immune cell infiltrates involved, the association of peripheral fibrinogen and white cell counts, and the extent and chronicity of this disease.\textsuperscript{14}

\textbf{Effect of Lipopolysaccharide}

Infections produce changes in lipid metabolism which may favor atherosclerosis. Proinflammatory cytokines, such as TNF-\(\alpha\) and IL-1 inhibit lipoprotein lipase and bacterial products, such as lipopolysaccharide and muramyl dipeptide may have direct effects on endothelium such that atherosclerosis is promoted. Infections increase plasma fibrinogen levels, and these acute-phase proteins are significantly linked to atherosclerosis and also to infectious states, including the presence of periodontal disease.\textsuperscript{14}

\textbf{Hyper-reactive Mononuclear Phagocytes}

Hyper-reactive mononuclear phagocytes may be constitutive in susceptible individuals or may be induced in patients who smoke or those with infections, such as periodontal disease. These may be induced if leukocytes are passing through lesions in vessels traversing close to areas of high proinflammatory cytokine release, lipopolysaccharide presence, matrix metalloproteinase activity or prostaglandin or protease release. These leukocytes may, by virtue of their induced hyperresponsiveness, promote atherosclerosis at distant sites, particularly in areas of disturbed blood flow.\textsuperscript{14}

\textbf{PERIODONTAL DISEASES AND HYPERTENSION}

Hypertension is the most common CVD. It is well known that hypertension and periodontitis share common risk factors, namely, smoking, stress, increased age and socioeconomic factors.\textsuperscript{2}

\textbf{Possible Linking Pathways for the Association between Hypertension and Periodontitis}

\textbf{Inflammation}

The inflammatory response accompanying periodontitis has been proposed as an important factor that may exert adverse effects on the regulation of blood pressure (BP). Inflammation is, therefore, a ‘double edged sword’ as this adaptive response might eventually become maladaptive after a chronic time. The level of serum high-sensitivity C-reactive protein (hs-CRP) was found to be more increased in patients with periodontitis and it decreased significantly after periodontal treatment. The association
of CRP with hypertension in the setting of periodontitis has not been consistent due to many other factors that can elevate inflammatory markers or hypertension itself is a multifactorial disease. Recently, it has been proposed that hs-CRP may be a useful marker linking periodontal disease and chronic inflammation which leads to endothelial dysfunction.\(^{18}\)

**Oral Infection**

Periodontal bacterial infection may also be involved in the development of hypertension. The periodontal pathogens are able to destruct and invade gingival tissues by proteolysis then enter the systemic circulation, causing transient bacteremia. *Porphyromonas gingivalis* is the most prevalent bacterium harbored in atheromas. *Porphyromonas gingivalis* and its vesicles not only promote low-density lipoprotein (LDL) binding to macrophages but also induce macrophages to modify native LDL, which plays an important role in foam cell formation. Therefore, periodontopathogens from periodontal lesions into the circulation may deliver virulent factors to the arterial wall to initiate and/or promote foam cell formation in macrophages, thus contributing to development of CVD.\(^{16}\)

**Oxidative Stress**

Reactive oxygen species (ROS), such as superoxide anions and hydrogen peroxides are chemically reactive molecules. They damage cellular components including lipid membranes, nucleic acids and proteins. However, excessive production of ROS leads to oxidative stress with an increase in the formation of free radicals as well as a decrease in antioxidant levels. Periodontitis induces excessive production of ROS in periodontal tissue. As the condition of periodontitis worsens, the production of ROS increases in response to periodontal inflammation; subsequently ROS enter the systemic circulation. Hence, the increase in circulating oxidative stress elicited by periodontitis may cause detrimental effects on systemic health. Reactive oxygen species are widely accepted as the mediators for vasoconstriction and vascular inflammation and are strongly related to hypertension.\(^{16}\)

**Endothelial Dysfunction**

Nitric oxide (NO) is released by the endothelium in order to regulate homeostasis of vascular system. High BP has been suggested to be associated with the imbalance between antioxidant and ROS production. It may be due to a reduction in NO bioavailability, either via a decrease in production or an increased deactivation by ROS in the vascular wall. Periodontal disease may contribute to endothelial dysfunction which eventually increases the risk of hypertension.\(^{16}\)

**PERIODONTAL HEALTH AND INFECTIVE ENDOCARDITIS**

Infective endocarditis is caused by microbial infection of the endothelial lining of the heart. The two most common causative microorganisms are aerobic bacteria, such as *Staphylococcus aureus* and *Streptococcus viridians*, either of which may be normal commensals in the oral cavity. Although Gram-negative bacteria and anaerobes rarely cause infectious endocarditis, there is increased reporting of endocarditis secondary to some of the HACEK group of organisms (*Haemophilus influenzae*, *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens* and *Kingella kingae*).\(^{17}\)

**Role of Oral Cavity in Endocarditis**

Although it appears that approximately 25% of cases of infective endocarditis are caused by streptococci that inhabit the mouth, the role of dental procedures as a cause of infective endocarditis has been a controversial issue in medical and dental practice back almost to the beginning of the twentieth century.\(^{12}\)

The patients with gingivitis or periodontal disease may have as much as 10 mm\(^2\) of gingival sulcus surface area, providing the opportunity for these organisms to thrive and gain entrance into ulcerated and richly vascularized tissue. It is now accepted that the severity of dental and periodontal disease also influence the incidence, magnitude and duration of bacteremia and, therefore, the risk for infective endocarditis.\(^{4}\)

**Dental Procedures Creating Bacteremia Risk**\(^{6}\)

Extractions, implant placement, periodontal and endodontic procedures, intraligamentary injections, subgingival placement of antibiotic fibers and strips and procedures where bleeding is expected.

**Dental Procedures with Low Bacteremia Risk**\(^{4}\)

Local anesthetic injections, suture removal, impressions, fluoride treatment, radiographs, placement of removable prosthodontic appliances.

**Cardiac Conditions associated with the Highest Risk of Adverse Outcome from Endocarditis for which Prophylaxis with Dental Procedures is Recommended (American Heart Association in 2008)**\(^{16}\)

- Previous history of infective endocarditis
- Prosthetic cardiac valves or prosthetic material used for cardiac valve repair
Congenital heart disease with the following conditions:
- Unrepaired cyanotic CHD, including palliative shunts and conduits
- Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first 6 months after the procedure
- Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibit endothelialization)
- Cardiac transplantation recipients who develop cardiac valvulopathy.

**FACTORS INFLUENCING BACTEREMIA**

**Dental Disease Indicators**
- Thayer W (1926) suggested that poor oral hygiene and dental disease were more important in the incidence of infective endocarditis than dental procedures.22
- Other studies have shown a high incidence of bacteremia from the removal of noncarious, non-periodontally involved teeth.20

**Invasiveness of the Dental Procedure**
- Transient bacteremia occurs with the manipulation of periodontal tissues, whether it be from brushing, chewing, use of irrigation devices, dental prophylaxis, suture removal or other periodontal procedures involving the gingiva. Gingivectomy and root planing are reported to cause bacteremia in 55 to 80% of cases.11
- Routine dental cleaning (i.e. scaling) likely causes disruption of a larger surface area of gingival tissues than an extraction and, therefore, may be more invasive in nature, magnitude and duration of bacteremia.17
- The real risk for infective endocarditis comes from naturally occurring bacteremia (such as toothbrushing and chewing food), rather than from invasive procedures, especially if the pathophysiology of infective endocarditis includes chronic as well as acute bacteremia. Guntheroth (1984) suggested that some individuals may generate bacteremia for 90 hours per month from normal activities, compared to 6 minutes for the average dental extraction.7

**Role of Antimicrobial Agents**
Elimination of organisms associated with invasive procedures can occur either at the source, i.e. the mouth or after they enter the systemic circulation.

**Mouthrinses**
- Chlorhexidine, 1% povidone-iodine, peroxylorurate monohydrate, sodium perborate-ascorbic acid compound, a phenolated solution, and a variety of other topical antimicrobial agents when used as a rinse and/or an irrigant in the gingival sulcus prior to extraction or scaling procedures have beneficial effects. But some studies have shown no effect on microflora and bacteremia following irrigation or rinsing with antimicrobial agents. These antimicrobial rinses and irrigations do not permeate much more than 3 mm into the gingival sulcus and, therefore, do not reach the area of greatest importance where bacteria gain entrance to the systemic circulation.17
- Despite these conflicting results, the American Heart Association guidelines propose the use of a chlorhexidine hydrochloride rinse prior to invasive procedures.17

**Systemic Antibiotics**
- Current literature suggests that systemic antibiotics decrease, but do not eliminate, the incidence of bacteremia following dental extractions.
- Antibiotics, such as amoxicillin may not influence the incidence, nature or magnitude of the initial bacteremia following manipulation of the gingival tissues, they probably influence the duration.19
- Antibiotic prophylaxis minimizes the risk of infective endocarditis but does not preclude its occurrence and in addition, prophylaxis targets only Enterococcus and Streptococcus spp., which account for 65% of cases of infective endocarditis.6

Therefore, the major risk for infective endocarditis is due to organisms that originate in the mouth due to poor oral hygiene and dental diseases rather than from dental procedures.

**PERIODONTITIS AND ISCHEMIC HEART DISEASE**

Ischemic heart disease (IHD) includes disorders, such as angina pectoris and myocardial infarction. It may occur whenever there is an imbalance between myocardial oxygen supply and demand.10

Acute myocardial infarction is usually caused by the complete occlusion of a coronary artery. It is typically caused by an atherosclerotic plaque rupturing in platelet aggregation and formation of thrombus.3

During periodontitis, dental plaque microorganisms may disseminate through the blood to infect the vascular endothelium and contribute to the occurrence of myocardial ischemia and infarction. There is direct action of periodontal pathogens that produce endotoxins and the release of proinflammatory mediators by the host monocytes, causing local and systemic destruction of the connective tissue and vesicles of P. gingivalis favor platelet aggregation and thromboembolic events.13
Lipopolysaccharides produced by periodontal pathogens that pass to the blood alongside inflammation mediators such as TNF or interleukin 1 β can induce secretion of acute phase proteins, such as CRP. These proteins can form deposits in damaged blood vessels, with consequent activation of phagocytes and release of nitrous oxide, contributing to the formation of atheromas.

Biological principles relating to periodontitis and acute myocardial infarction including the direct effect of periodontal bacteria, the indirect effect of host mediators, the effect of lipopolysaccharide or endotoxin of periodontal bacteria and the effect of activated mononuclear phagocytes have been described by many researchers.19

It has been reported that individuals with high levels of mean whole mouth alveolar bone loss at baseline had a greater relative risk of total CHD than those with low bone loss at baseline.19

Holmlund (2010) proposed that mortality caused by CVD was predictable from the number of remaining teeth. He found that people with ten or fewer teeth were seven times at more risk of death caused by CHD than the ones with 25 or more teeth. Similar findings were reported by Samani et al (2013).19

Thus, the presence of significant relation between periodontitis and MI could be an alarm to treat periodontitis carefully.

MANAGEMENT OF PATIENTS WITH CARDIO-VASCULAR DISEASES

Dental treatment in the medically compromised patient primarily involves having an understanding of the nature of the patient’s disease and how it can impact their physiology and their response to periodontal treatment and post-treatment healing.

The following Measures should be Undertaken for Patients with Atherosclerosis6

- Patients should be made completely aware of the possible relationship between heart disease and periodontitis.
- Patients at high risk for atherosclerotic disease should be subjected to a complete periodontal examination.
- Aggressive prevention of periodontitis should be undertaken in patients at risk for atherosclerotic disease. Comprehensive periodontal treatment should be instituted in these high risk patients.
- Patients with periodontal disease should have a thorough medical evaluation, inclusive of systemic conditions, medications, and risk factors for atherosclerosis.

Treatment of patients with periodontitis and pre-existing atherosclerotic disease should be coordinated by cardiologists and periodontist.

Hussain et al (2003) concluded that anti-infective periodontal treatment, such as scaling and root planing and administration of subgingival drugs as an adjunctive therapy results in the reduction of CRP and fibrinogen levels. Iwamoto et al (2003) found that mechanical periodontal therapy combined with subgingival administration of minocycline reduced levels of CRP and TNF-α in patients with increased risk for atherosclerosis.8

The best medicine to lower cholesterol is a statin, also known as a HMG-CoA reductase inhibitor. Statins block an enzyme called HMG-CoA reductase, which controls the production of cholesterol in the liver.21

Key Points to Remember in Managing the Dental Patient with Hypertension

- Hypertensive patients should be encouraged to take their prescribed anti-hypertensive medication on the day of their dental procedure. It is desirable that patients bring their medications with them to confirm prescriptions and doses.
- Reduce the patient’s stress with comfortable positioning, reassuring statements, soothing music, preoperative and/or intraoperative sedation. These all decrease anxiety, consequently lowering BP. Develop a signal which the patient can offer during the procedure if he or she becomes uncomfortable.15
- Maintain a complete and current medical history file, including prescription and non-prescription medications, allergies, special diets and a list of medical diagnoses with specific reference to respiratory and cardiac problems. A record of vital signs is imperative.
- Communicate with the patient’s physician about uncontrolled hypertension. Uncontrolled hypertensives are required to bring written documentation of improved management from their physician.
- Afternoon dental appointments may be preferred.15
- When treating hypertensive patients the clinician should not use a local anesthetic containing an epinephrine concentration greater than 1:100,000 nor should use vasopressor to control local bleeding. Local anesthesia without epinephrine may be used for short procedures (< 30 min). Administration of local anesthetics containing epinephrine to patients taking nonselective beta blockers (e.g. propranolol, nadolol) may cause elevated BP.

Guidelines for Periodontal Treatment Plans for Patients Susceptible to IE15

- Teeth with severe periodontitis and a poor prognosis may require extraction. Teeth with less severe involvement in a motivated patient should be retained, treated and maintained closely.
• All periodontal procedures including probing require antibiotic prophylaxis, gentle oral hygiene methods are excluded. Pretreatment chlorhexidine rinses are recommended before all procedures.

• To reduce the number of visits required, and thereby minimize the risk of developing resistant bacteria, numerous procedures may be accomplished at each appointment, depending on the patient’s needs and ability to tolerate dental treatment.

• Allow at least 7 days between appointments preferably (10–14 days). If this is not possible select an alternative antibiotic regimen for appointments within a 7 days period.

• There should be no need to place patients at risk for infective endocarditis on extended antibiotic regimens after treatment. Therefore, patients who have had periodontal surgery are not generally placed on antibiotics for the first week of healing. If patients are placed on such regimens, the dosage are inadequate to prevent endocarditis during ensuing appointments. Regular recall appointments and maintenance of periodontal health are important for patients susceptible to IE (Table 1).

A patient who has an angina episode in the dental chair should receive the following emergency medical treatment:

• Discontinue the periodontal procedure.

• Administer 1 tablet (0.3–0.6 mg) of nitroglycerine sublingually.

• Reassure the patient and loosen restrictive clothes.

Table 1: Antibiotic regimen for infective endocarditis

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Antibiotic</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard oral regimen</strong></td>
<td>Amoxicillin</td>
<td>2 gm 30–60 minutes before procedure</td>
</tr>
<tr>
<td><strong>Alternate regimen for patients allergic to amoxicillin/penicillin</strong></td>
<td>Clindamycin or azithromycin or clarithromycin (clarbid) or cephalaxin (sporidex) or cefadroxil (cephadrox)</td>
<td>600 mg 30–60 minutes before procedure</td>
</tr>
<tr>
<td><strong>Patients unable to take oral medications</strong></td>
<td>Ampicillin (ampilin)</td>
<td>2 gm intramuscularly or intravenously within 30 minutes before procedure</td>
</tr>
<tr>
<td><strong>Patients unable to take oral medications and allergic to penicillin</strong></td>
<td>Clindamycin or cefazolin (orizolin)</td>
<td>600 mg intravenously within 30 minutes before procedure (must be diluted and injected slowly)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 gm intramuscularly or intravenously within 30 minutes before procedure</td>
</tr>
</tbody>
</table>

• Administer oxygen with the patient in a reclined position.

• If the signs and symptoms cease within 3 minutes, complete the periodontal procedure if possible, making sure that the patient is comfortable. Terminate the procedure at the earliest convenient time.

• If the signs and symptoms do not resolve within 2 to 3 minutes, administer another dose of nitroglycerine, monitor the patients vital signs, call the patient’s physician and be ready to accompany the patient to the emergency department.

• A third nitroglycerine tablet may be given 3 minutes after the second. Chest pain not relieved by 3 tablets of nitroglycerine indicates myocardial infarction. Dental treatment should be deferred for at least 6 months after myocardial infarction because peak mortality occurs during this time.

**Congestive Heart Failure**

Patients with poorly controlled or untreated CHF are not candidates for elective dental procedures. These individuals are at risk of sudden death usually from ventricular arrhythmias. Because of the presence of orthopnea (inability to breathe unless in an upright position) in some CHF patients, the dental chair should be adjusted to a comfortable position for the patient rather than patient being placed in a supine position. Short appointments, stress reduction with profound local anesthesia and possibly conscious sedation and use of supplemental oxygen should be considered.

Oxygen should be readily available at all times. Intraoperative oxygen at low flow rate of 2 liters/minute via nasal cannula is useful for the patients with frequent bout of angina or symptomatic heart failure.

**Arrhythmia**

Common medications used to treat arrhythmia include quinidine, procainamide, lidocaine, mexiletine, amiodarone and adenosine. Automatic cardioverter defibrillators are being used now to correct cardiac arrhythmia as well as pacemakers. Pacemakers are usually implanted in the chest wall and enter the heart transvenously. Older pacemakers were unipolar and could be disrupted by dental equipment that generated electromagnetic fields such as ultrasonic and electrocautery units. Newer units are bipolar and are generally not affected by dental equipment.

Following measures should be undertaken in patients with cardiac pacemakers and automatic defibrillators:

• Consult with physician to determine underlying cardiac status, type of pacemakers as automatic defibrillator and any precautionary measures to be taken.
• Automatic defibrillators activate without warning when certain arrhythmias occur. This may endanger the patient during dental treatment because of sudden patient movement. Stabilization of the operating field during periodontal treatment with bite blocks or other devices can prevent unexpected trauma.15
  – Epinephrine, anticholinergics, and any other drug that has excitatory influences on the heart should be used with caution in patients who present with a history of any cardiac arrhythmia.
  – Amiodarone may prolong the QT interval triggering "Torsades de pointe", a lethal ventricular tachycardia. This potential is enhanced by macrolide antibiotics such as erythromycin. It is also implicated in adverse interactions with lidocaine and fentanyl.1
  – Amiodarone can increase warfarin levels by reducing their renal clearance that leads to increased bleeding.23

SPECIAL CONSIDERATION FOR PATIENTS ON ANTICOAGULANT THERAPY

• Patients with thromboembolic disease, prosthetic valves or coagulation problems are often on anticoagulant therapy.
• Coumarin is the most common medication used for outpatient anticoagulation. It is a vitamin K inhibitor. Hence, vitamin K–dependent coagulation factors (II, VII, IX and X) are all depleted by the competitive inhibition of vitamin K.6
• The coumarin effect is measured by monitoring the prolongation of the prothrombin time. A therapeutic prolongation of prothrombin time is one that is 1.5 to 2 times the normal clotting time.6
• The international normalized ratio (INR) is the new international reference for a standardized prothrombin time.
  
  International normalized ratio = (patient prothrombin time/mean normal prothrombin time)ISI

  The normal value is 1.0. Most outpatients are maintained between 2.0 and 3.5 international normalized ratio.
• For patients on coumarin, verify the prothrombin time (or international normalized ratio) on the day of the procedure.
• The procedure to be done determines the acceptable INR. Infiltration anesthesia, scaling and root planing may be done safely in patients with INR less than 3.0. Block anesthesia, minor periodontal surgery and simple extractions usually require an INR less than 2.0 to 2.5. Complex surgery or multiple extractions may require an INR less than 1.5 to 2.0.15

The physician must be consulted about any changes (discontinuing or reducing) in anticoagulant dosage until the desired INR is achieved. The dentist must inform the physician what degree of intraoperative or postoperative bleeding is usually expected with the procedures planned. If the INR is higher than the level at which significant bleeding is likely to accompany a particular procedure, the physician may elect to change anticoagulant therapy. Earlier, the anticoagulants was discontinued for 2 to 3 days before periodontal treatment. But nowadays, many clinicians may no longer recommend discontinuing anticoagulation for many procedures because this has significant potential risks to patients health.15
• The patients requiring dental surgical procedures in primary care and who have an INR below 4.0 should continue warfarin therapy without dose adjustment.15

CONCLUSION

"Oral health is a window into general health"

The periodontal management of the medically compromised patients should be done with utmost care and caution. Periodontist should always be prepared for any complications that might occur during treatment by having knowledge of the medical conditions and emergency drugs.

Dentists and physicians should work in cooperation to educate these patients about this relationship in an effort to improve the quality of health and contribute to their long-term survival. Good communication should be established between the dentist and physician to maximize good dental and physical health.

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ABSTRACT
Oral epithelial dysplasia is a histopathological diagnosis, i.e. associated with increased risk of oral cancer. The risk factors of oral cancer mainly predilected in alcoholics and smokers. According to the recent documented literature available, these two risk factors are not completely responsible for the development of the disease but they acts just an aggravant to the diseased state; although smoking and alcoholism are mostly studied, the nonhabitual subjects are very rare which develop such lesions. The presence of oral epithelial dysplasia in nonhabitual patients is usually rare and interesting to acknowledge that it exists without these two major predisposing factors in nonusers. We hereby present a case of epithelial dysplasia that occurred in a patient with no adverse habit which was treated successfully by buccal fat pad grafting following excision of the lesion that healed uneventfully and did not undergo lethal malignant transformation into oral cancer.

Keywords: Alcohol, Buccal fat pad, Epithelial dysplasia, Oral, Oral cancer.

CASE REPORT
A 47 years old male patient reported to the department of oral and maxillofacial surgery with the chief complain decayed tooth in right upper first molar and wanted extraction for the same. Patient revealed that he was a non-smoker and nonalcoholic. Patient was well-oriented and only gives history of use of tooth powder for cleansing teeth.

The inspectory findings revealed grossly decayed tooth in relation to 16. The soft tissue finding revealed a white discoloration over the left side of buccal mucosa (Fig. 1) without any other abnormalities. The lesion was nonscrapable when scraping of the lesion was tried. When investigated via questionnaire, the patient revealed that he was apparently fine 6 months before when he experienced burning sensation in left buccal mucosa and that whitish lesion developed as a small sensation in the oral cavity at the affected site or it may be symptomless too but the effected mucosa is thickened, the condition has unknown causes but the predisposing factors are several including various forms tobacco use. There poses no relation between patient’s gender, age or ethnicity and risk of oral epithelial dysplasia.3 This condition if not paid attention leads to malignant transformation. Oral epithelial dysplasia is an important risk factor in predicting subsequent development of invasive carcinoma.2

INTRODUCTION
Epithelial dysplasia refers to the changes in cellular components of buccal mucosa at microscopic level similar to the dysplastic changes seen in the oral cancer; although it is a type of precancerous lesion but it is not mandatory that the lesion definitely develops into squamous cell carcinoma. These dysplastic changes can occur in any site of the oral cavity but usually can be seen at various sites of oral cavity, such as buccal mucosa, tongue and floor of the oral cavity. The condition clinically presents as reddish blue or white discoloration of the mucosa at affected site. It might manifest with burning sensation in the oral cavity at the affected site or it may be symptomless too but the affected mucosa is thickened, the condition has unknown causes but the predisposing factors are several including various forms tobacco use. There poses no relation between patient’s gender, age or ethnicity and risk of oral epithelial dysplasia.3 This condition if not paid attention leads to malignant transformation. Oral epithelial dysplasia is an important risk factor in predicting subsequent development of invasive carcinoma.2

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Fig. 1: Lesion presents with respect to the left buccal mucosa of the patient
An Accidental Finding of Epithelial Dysplasia of Left Buccal Mucosa in Extraction Patient: A Rare Case Report

Due to the symptoms and signs, a provisional diagnosis of lichen planus was made. Various other varieties of mucocutaneous white lesions were considered, creating a clinical dilemma over the diagnosis. To rule out all other entities, we performed incisional biopsy for obtaining a definitive diagnosis.

The biopsy report revealed hyperkeratinized epithelium overlying inflamed connective tissue stroma. The epithelium was stratified squamous hyperkeratinized and showed mild to moderate dysplastic features such as basilar hyperplasia, nuclear hyperchromatism, increased nucleocytoplasmic ratio, pleomorphism, prominent intracellular bridges, loose bundles of collagen fibers, and inflammatory cells were also seen suggestive of hyperkeratosis with mild epithelial dysplasia.

On obtaining the confirmatory diagnosis as mild epithelial dysplasia, we performed wide surgical excision of the lesion and reconstruction with buccal fat pad and collagen membrane (Figs 3A and B). Postoperative antibiotics, analgesics, and antioxidants, along with antioxidant therapy, were given to the patient to allay the condition and promote uneventful healing of the surgical site.

The post-treatment follow-up of the patient was done up to 6 months (Figs 4A and B) and it was found that there were no further signs of recurrence of the previous lesion and burning sensation to the site was also resolved completely.

DISCUSSION

Epithelial dysplasia refers to changes in cellular components of buccal mucosa at microscopic level similar to the dysplastic changes seen in oral cancer; although it is a type of precancerous lesion but it is not mandatory that the lesion definitely develops into squamous cell carcinoma. It is currently impossible to predict accurately which lesion will progress. Jaber et al. did a study to compare the clinical features and long-term outcome of oral epithelial dysplasia between users and nonusers of tobacco and alcohol on 456 patients diagnosed as having oral epithelial dysplasia were reviewed. Oral epithelial dysplasia in nonusers of tobacco and alcohol was...
uncommon, accounting for only 8.1%. The tongue and buccal mucosa were the most commonly affected sites. An erythroleukoplakic-type lesion with mild dysplasia was the common presenting feature. These findings support the notion that oral epithelial dysplasia may also develop in persons who have never used tobacco or alcohol. Lesions more commonly occurred in women, especially in the tongue and buccal mucosa, and were mostly of the erythroplakic type.1

Huff et al4 reported a case of epithelial dysplasia. The following case report illustrates how a case of mild epithelial dysplasia in a high-risk site was managed via cryotherapy. Conventional radical excision in the retro-myo-lyohyoid region carries an elevated risk of injury to the lingual nerve that may result in permanent paresthesia and loss of taste. Scar tissue formation may lower the quality of life by complicating the swallowing and agglutination functions of the tongue.4 Therefore, avoiding surgical insult was desirable and in the patient’s best interest. Cryotherapy can be used for the treatment but it is very technique sensitive and gives equal results as surgical scalpel excision in curative aspect.

Chan and Wolf5 stated that oral mucosal lesions are commonly encountered in clinical practice. A study conducted in the United States reported that understanding of the fundamentals of diagnosing mucocutaneous lesions requires a sound knowledge of its origin and clinical course, and of biopsy methods using contemporary diagnostic tools and technique. Excisional biopsy can be used as a diagnostic tool as well as the treatment of the lesion.

Toshihiro et al11 published a study to evaluate the applicability of pedicled buccal fat pad grafting for the reconstruction of the defects surgically created during oral surgery. The graft was used to cover palate, maxilla, upper gingival buccal mucosa, lower gingiva, oral floor and tempromandibular joint region.11 This study proved that buccal pad fat grafting is feasible for the reconstruction of surgically induced defects.

Rastogi et al12 published a study to evaluate the efficacy of collagen membrane as a biodegradable wound dressing material for surgical defects of the oral mucosa. They concluded that the nature of collagen membrane was observed and was found to be a very suitable alternative to other graft materials mentioned for the repair of defects in the mucous membrane of the oral cavity. Therefore, when used judiciously in a controlled clinical situation, collagen membrane is biologically acceptable to the oral mucosa and is, from the clinical point of view, an excellent wound graft material for raw surface wound.12

Oral dysplasia shows significant rate of transformation into cancer but the rate is decreased significantly by excision.6 Saito et al9 advocated that surgical excision of the lesion is better option as malignant transformation is reduced as compared to those who did not receive surgical treatment.9 Reddi and Shafer8 reported that wide excision of the lesion is better treatment protocol rather than any conservative approach.8

Dost et al10 also advocated that the present histological grading system is not useful for predicting patient outcomes or for determining management strategies. Definitive treatment of all oral epithelial dysplasias is recommended until a more reliable system is developed to assess the progression or transformation of the lesion.10

In the present study, we treated this case of epithelial dysplasia by excision of the lesion and the defect formed was reconstructed by buccal fat pad which was covered with a collagen sheath and secured with absorbable sutures. Follow-up showed better results that revealed complete cure of the condition and restoration of the oral epithelium again to its normal state.
CONCLUSION

The epithelial dysplasia is although a very rare entity in nonalcoholics and nonsmoker patients and is usually has very mild symptoms in early phase; so it is generally ignored by the patient and can even be ignored by the general dental surgeon because patient not getting any severe discomfort and requires the treatment regarding the chief complain only. Accidental finding of such lesions can be seen only by an experienced surgeon who examines the oral tissues minutely with excellence. Such conditions should be well-diagnosed before they transform into carcinoma like debilitating and deleterious disease and should not be ignored rather it should be treated appropriately with proper protocol.

We performed wide excision of the lesion with reconstruction by buccal fat pad and securing it by collagen membrane and absorbable sutures. This technique showed satisfactory results with proper healing of the lesion and no recurrence.

REFERENCES

Gingival Veneer: An Alternative to a Relapsed Periodontal Treatment!

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ABSTRACT

Periodontal plastic surgeries performed for the recession coverage in millers class III and IV recession cases usually give less expected esthetic results or might lead to recurrence. The periodontal attachment loss and bone loss often creates open interdental spaces, elongated clinical crowns and altered phonetics thus compromising the esthetics as well as function culminating in lowering the social confidence of the patient. Gingival prosthesis made from acrylics, composite resins, silicones or porcelain-based materials can be used as an alternative for such cases. This case report describes the fabrication of an esthetic, soft and flexible silicone based gingival veneer in a relapsed periodontal plastic surgical case. Thus providing an economical, functional and esthetically acceptable solution.

Keywords: Esthetics, Gingival recession, Gingival veneer, Periodontal prosthesis.

INTRODUCTION

Gingival recession is the most common clinical manifestation of many periodontal diseases, as it has a relatively high incidence rate.1 Gingival recession can cause loss of interdental papilla and lead to open embrasures, which project in the form of black triangles. The black triangles that appear as a result of gingival recession will distort an amiable smile. The condition can be corrected or managed by two approaches.

The first option is mucogingival surgery or periodontal plastic surgery, with gingival augmentation coronal to the recession. This is suitable for mild to moderate type of gingival recessions. In severe gingival recession conditions, as in cases of periodontal disease PD Miller's class III and IV recessions,2 mucogingival surgeries may give less predictable esthetic results or might cause recurrence.3

The second option, gingival replacement with artificial substitutes, is more helpful in managing severe gingival recession situations.4–6 The synonyms of gingival veneer are flange prosthesis, gingival mask, gingival veneer prosthesis, gingival replacement unit and artificial gingiva. Gingival veneer prosthesis is considered when other methods are unpredictable or impossible.7 Prosthetically, these appliances might be of either removable or fixed variety capable of replacing large volumes of tissue. Fabrication materials may vary from pink autocure and heat-cured acrylics, porcelains, composite resins and thermoplastic acrylics, silicone based soft materials to flexible nylon based thermoplastic material.8,9

• To cover—exposed crown margins, exposed implant components and root surfaces and reduce the length of the clinical crown.
• To block out the black triangles between teeth in which gingival recession has occurred
• In relapsed treatment outcome of periodontal plastic surgeries
• To fill in the space between the crown and the soft tissue
• To prevent air flow through or beneath maxillary fixed restorations or through the spaces between the teeth and thus improving phonetics
• To provide increased lip and cheek support for those patients who require it
• It is also beneficial for patients with high lip lines and a gummy smile who have been treated with osseo-integrated dental implants
• To hide the dark lines around old crowns that are often seen with patients who have experienced gingival recession
• It also aids the prosthodontist to design implant supported prosthesis with optimal configurations permitting easy access for oral hygiene maintenance.
The gingival veneer is contraindicated in patients with poor plaque control, unstable periodontal health, high caries activity, smoking and known allergy to acrylic or silicone.

The gingival veneer is retained mechanically, with tiny extensions of the mask material slightly projecting between the roots of the natural teeth or the implants just coronal to the gingival margin. Part of the retention also comes from the natural capillary action created by the saliva and lastly part of the retention is dependent on the pressure of the lips against the gingival prosthesis.

This case report presents a restorative non-surgical approach for an esthetically compromised patient following periodontal plastic surgery, fiber splinting, diastema closure by composite resin and using a removable self-cure silicon based resin gingival prosthesis. It describes the use of a silicon based gingival veneer to hide the deformities in mandibular anteriors.

CASE REPORT

A 42 years old male patient who was referred to the outpatient department of periodontology and implantology, complaint of spacing between the lower front teeth along with slight mobility which was unesthetic according to him while speaking (Fig. 1). He wanted to save his mobile tooth. Radiographic examination revealed two third of bone loss wrt 31 and more than half of bone loss wrt 41 (Fig. 2). Patient gave history of having undergone periodontal plastic surgery 2 years back for the treatment of recession wrt 31 and 41 region, which had relapsed due to poor oral hygiene maintenance and high technique sensitiveness of such procedures leading to further recession in that area with SC Miller’s grade II mobility wrt 31.11 Now patient wanted some conventional esthetic non-surgical treatment for the same. So, the decision was made to fabricate a removable prosthesis to close the space between the teeth and make that area self cleansing for the patient.

The treatment plan encompassed initial scaling and root planing followed by coronoplasty with respect to 41. On subsequent visit study model was prepared using irreversible hydrocolloid impression material (Tropicalgin, Zhermack, Rovigo, Italy) and was poured in dental stone. Teeth were then splinted from distal of left mandibular canine to distal of right mandibular canine (Figs 3 and 4). Splinting was done lingually using fiber splint (Interlig Fiber Splint, Angelus) (Fig. 5). Once teeth were splinted, mesial aspect of 31 and 41 were etched, bonded and built-up was done using composite to close the diastema to some extent (Fig. 6).

After periodontal and restorative part, prosthetic elastomeric impression was made of mandibular arch (Fig. 7). The impression was poured in type IV die stone. On final master cast, modeling wax was added to exact shape of the final prosthesis followed by flasking and dewayxing of the wax up (Fig. 8). Soft liner material (Silagum, comfort soft relining, DMG, made in Germany) was used with different melanin pigment materials to match patients adjacent gingival color, for packing followed by bench curing (Fig. 9). After recovery of gingival prosthesis from the flask (Fig. 10), intraoral try-in was performed, it was then finally trimmed and polished, and was delivered to the patient (Fig. 11). The prosthesis was extremely thin and had enough flexibility to get engaged in the undercuts. The patient found the prosthesis very comfortable and esthetic while speaking.

The patient was instructed for use of prosthesis as well as maintenance of his oral hygiene. He was asked to soak it in water every night and when not in use. He was advised to avoid brushing the appliance as this may remove the polish and roughen the surface over time. The patient was quite happy with the pleasing esthetics without any further surgical intervention or discomfort. Patient was kept on periodic maintenance phase (Fig. 12)
and no appreciable dimensional changes were noticed in the prosthesis during this period of 6 months.

DISCUSSION

In this current case scenario, the treatment plan was decided upon as the fabrication of a removable prosthesis excluding the other treatment options of fabricating a fixed prosthesis or the employment of a surgical therapy. In contrast to a fixed prosthesis, a removable gingival prosthesis possessed numerous advantages with an ability to create an ideal tissue contour and esthetics and finally, facilitating thorough cleaning and maintenance of oral hygiene. Finally, the tissue portion of the fixed
Gingival Veneer: An Alternative to a Relapsed Periodontal Treatment!

A removable gingival prosthesis cannot be adjusted whenever required and hence, the ability to retrofit is retarded compared to a removable gingival prosthesis. While weighing the pros and cons of utilizing a surgical treatment option over the removable gingival prosthesis, for this exacting case scenario, the removable gingival prosthesis had a definite set of superior advantages compared to the extensive surgical treatment options. The limitations of the surgical approach include the concurrent surgical costs, postoperative discomfort and healing time and the unpredictability of the surgical outcome. Also, the morbidity associated with the second surgical donor site and accompanying possible intraoperative and postoperative complications are avoided.\textsuperscript{12}

Removable gingival prosthesis can be made using different materials and methods of fabrication and should possess adequate retention to avoid displacement during mastication, speech and soft tissue movements. A resin or silicone veneer may satisfy requirements for lip support and can improve speech by eliminating the escape of air from the above placed prosthesis.\textsuperscript{13} The acrylic gingival veneer has the drawbacks of being hard, rigid and difficulty in fitting accurately around multiple teeth while they have the advantage of being color stable and last longer. This procedure is a relatively easy, inexpensive, and practical way to allow an esthetic replacement of the gingiva that also permits hygiene procedures for the underlying prosthesis. Patients with poor oral hygiene or dexterity are not candidates for this type of prosthesis. Another alternative is the use of a flexible gingival veneer made of silicone. This is both comfortable and accurately fitting. The main drawback is that it requires reconstruction once every year, as the prosthesis loses its physical properties like color, flexibility and also dimensional changes are observed. Plaque control and cleanliness are of prime importance. Smoking and frequent drinking of tea or coffee are discouraged.\textsuperscript{7} Ideal tissue contours are waxed, processed and then shade-matched to the surrounding tissues to provide an esthetically pleasing and functional restoration.\textsuperscript{8} The procedure is simple, noninvasive, economical and less time consuming for both the patient and clinician.
CONCLUSION

Dental esthetics is not only based on the “white component” of the restoration but also on the “pink component”. In patients with periodontal attachment and bone loss, gingival deformities are often seen that lead to esthetic and phonetic problems. Flexible soft liner gingival veneers are a feasible option in such cases. With the improved esthetics, patients can smile and talk again without the fear of “black triangle”.

REFERENCES

Born with a Tooth: A Case of Natal Teeth

ABSTRACT

Tooth eruption follows a chronology corresponding to the date when the tooth erupts into the oral cavity. This date has been established in the literature and is subject to small variations depending on hereditary, endocrine and environmental features. At times, however, the chronology of tooth eruption suffers a more significant alteration in terms of onset, with the possibility that the first teeth will be present at birth or arise during the first month of life. According to the definition presented by Massler and Savara (1950), taking only the time of eruption as reference, natal teeth are those observable in the oral cavity at birth and neonatal teeth are those that erupt during the first 30 days of life. This definition has been accepted and utilized by most authors. This case report presents a case of natal tooth which reported to the Department of Pediatric and Preventive Dentistry, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India.

CASE REPORT

A 1-month-old child reported to the department of pediatric and preventive dentistry with the complain of difficulty in feeding from her mother. On clinical examination, a tooth like mobile calcified mass was seen on the alveolus of the mandible of the child (Fig. 1).

On further eliciting the history of the presenting illness, the mother revealed that the tooth like mass had erupted a few days post birth.

The tooth like mass was diagnosed as natal tooth and extraction was planned.

The neonatal teeth were extracted with topical anesthesia (Figs 2 and 3) and immediately the child was asked...
to be fed by her mother. This would aid in hemostasis and also distract the child from the pain postextraction. Mild analgesics were prescribed and the parent was advised to render analgesics to child only if necessary. The child was recalled after 4 weeks for review (Fig. 4). The wound healed uneventfully and the child was asymptomatic.

**DISCUSSION**

Presence of teeth since the time of birth has been the subject of curiosity and study since the beginning of time, being surrounded by beliefs and assumptions. The occurrence of natal and neonatal teeth has been associated with diverse superstitions among many different ethnic groups and cultures. Shakespeare contributed his thoughts on natal teeth in “King Henry the Sixth” when he refers to Richard the Third in his quotation, “teeth hadst thou in thy head when thou wast born to riguity thou camest to bite the word”. In some cultures like Malaysian communities, a natal tooth is believed to herald good fortune. Chinese community considers presence of these teeth as a bad omen and the affected children are considered to be monsters and beavers of misfortune. In Poland, India and Africa, superstition prevailed for a long-time, and in many African tribes children born with teeth were murdered soon after birth because they were believed to bring misfortune to all they would contact. In England, the belief was that babies born with teeth would grow to be famous soldiers, whereas in France and Italy, the belief was that this condition would guarantee the conquest of the world.²⁻⁵

**Incidence and Prevalence**

The incidence of natal and neonatal teeth has been estimated to be 1:1000 and 1:30,000. Incidence of natal and neonatal teeth reported in literature was highly varied and depends on the different ethnic groups studied. The incidence of occurrence of natal and neonatal teeth is 85% in mandibular incisors, 11% in maxillary incisors, 3% in mandibular canines and molars and only 1% in maxillary posterior regions. More than 90% of natal and neonatal teeth are prematurely erupted whereas less than 10% are supernumerary. There was no difference in prevalence between males and females. However, Kates et al in 1984 reporting a 66% proportion for females against a 31% proportion for males.⁶

**Clinical Presentation**

Morphologically, the natal/neonatal teeth are poorly developed and are small and cone shaped. They have a yellowish-brown or whitish opaque color and have a hypoplastic enamel or dentin. Occasionally they may be of normal size and shape. Spouge and Feasby in 1966 clinically classified natal/neonatal in; Mature: When they are fully developed in shape and comparable in morphology to the primary teeth; Immature: When their structure and development are incomplete. The term mature may suggest that the tooth is well-developed compared to the remainder of the primary dentition and that its prognosis is relatively good. In contrast, the term immature assumes the presence of an incomplete structure and implies a poorer prognosis for the tooth in question. Recently in 1997 Hebling classified natal teeth into four clinical categories (1) Shell-shaped crown poorly fixed to the alveolus by gingival tissue and absence of a root; (2) Solid crown poorly fixed to the alveolus by gingival tissue and little or no root; (3) Eruption of the incisal margin of the crown through gingival tissue; (4) Edema of gingival tissue with an unerupted but palpable tooth.⁷ If the degree of tooth mobility is more than 2 mm, the natal teeth of category (1) or (2) usually need
extraction. Since in the present case, the complain tooth was in category (1), extraction was planned.

**Diagnosis**

Natal teeth are usually diagnosed based on a complete history and physical examination of infant. A radiographic verification of the relationship between a natal and/or neonatal tooth and adjacent structures, nearby teeth, and the presence or absence of a germ in the primary tooth area would determine whether it belongs to the normal dentition or supernumerary, so that indiscriminate extractions would be performed. Bohn nodules and cysts of the dental lamina differentiated from natal and neonatal teeth by radiographic examination. The maintenance of natal and neonatal teeth of the normal dentition is important, since the premature loss of a primary tooth may cause a loss of space and collapse of the developing mandibular arch, with consequent malocclusion in permanent dentition.\(^1\),\(^3\),\(^8\)

**Complications**

- Ulceration to the nipple of the mother and interference with breastfeeding.
- Potential risk of the infant inhaling the tooth into his/her airway and lungs if the tooth becomes dislodged due to its great mobility.
- Ulceration to ventral surface of the tongue: this condition was first described by Caldarelli in 1857 in association with general organ failure in a child, followed by death. Riga and Fede histologically described the lesion, which then started to be called Riga-Fede disease.
- Difficulty in feeding or refusal to feed due to pain.\(^1\),\(^9\)

**Precautions**

If the treatment option is extraction, this procedure should not pose any difficulties since these teeth can be removed with a forceps or even with the fingers. However, authors emphasized the precautions that should be taken when extracting natal and/or neonatal teeth: avoiding extraction up to the 10th day of life to prevent hemorrhage, assessing the need to administer vitamin K before extraction, considering the general health condition of the baby, avoiding unnecessary injury to the gingiva, and being alert to the risk of aspiration during removal.

According to Rusmah (1990), tooth extraction is contraindicated in newborns because of the risk of hemorrhage. However, administration of vitamin K before the procedure permits safe extraction. Berendsen and Wakkerman (1987) also mentioned the risk of hemorrhage in extractions performed before 10 days of life when vitamin K was not administered. Allwright (1976) reported the extraction of 25 natal and neonatal teeth in 15 babies with no episode of hemorrhage even though no therapeutic precaution had been taken. However, all the extractions reported by the author were performed in babies older than 20 days: the same protocol was followed in our case also.\(^2\),\(^8\)

**CONCLUSION**

Natal and neonatal teeth are rare events in the oral cavity. The decision to keep or to extract a natal and/or neonatal tooth should be evaluated in each case, keeping in mind scientific knowledge, clinical common sense, and parental opinion after the parents are properly informed about all aspects involved in this situation.

**REFERENCES**

A Little of Lateral Thinking! The Lateral Pedicle Flap

1Rika Singh, 2Sunil Kumar Mall

ABSTRACT

Denuded root surface or gingival recession is a very common clinical condition which among other problems, brings about esthetic discomfort, sensitivity, etc. Several techniques have been proposed to cover the denuded root looking for satisfactory outcomes both esthetically and functionally. The laterally positioned flap (LPF) is a pedicle graft technique that, despite of some limitations and a few indications, may achieve good outcomes in some cases. This case report highlights the use of the laterally positioned pedicle flap technique along with tetracycline hydrochloride as a root surface biomodification agent, in the management of localized gingival recession defect. Postoperatively, the clinical condition was stable with significant root coverage and satisfactory healing of the gingival tissues with no signs of inflammation.

Keywords: Denuded root, Gingival recession, Laterally displaced flap, Root coverage.


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It is well-documented that gingival recession can be successfully treated by means of various surgical approaches. If the biologic conditions for accomplishing root coverage are satisfied like no loss of interdental soft and hard tissues height and other anatomic variations, proper root coverage can be achieved irrespective of the technique utilized.1 The surgical technique for the procedure to be selected depends upon on the local anatomic characteristics of the site to be treated and on the patient’s demands. The selection of the surgical technique is influenced by the patient especially when concerned about an esthetic problem due to the exposure of root surfaces during smiling or function.2 Various surgical techniques have been proposed for coverage of exposed root surfaces with different indications and limitations.3

The main indications to various mucogingival procedures for root protection are: Increase in the width of keratinized tissue,4 root coverage,5 correction of edentulous ridges,6 peri-implant correction,6 biological dressing,6 aid to maxillofacial surgery,7 adjunctive frenectomy,8 and prevent gingival recessions in orthodontic movements.9 For the development of a marginal tissue recession, alveolar bone dehiscence is considered a prerequisite.9

For treating an area of isolated gingival recession, Grupe and Warren10 introduced the laterally positioned flap (LPF), which is one of the most predictable methods. Success of the technique depends on the surgical design and presence of adequate width of attached gingiva adjacent to the recession site. It is most predictable on teeth with localized labial recession.11 The results are more satisfactory as the soft tissue utilized to cover the root exposure is similar to that originally present at the buccal aspect of the tooth with the recession defect. Also as the second surgical site is not involved (as in case of free gingival graft or connective tissue graft), the postoperative course is less troublesome.2

Several modifications have been suggested to the original LPF technique of Grupe and Warren in 195610 with the prime objective to reduce the risk of gingival recession at the donor site. Instead of a full-thickness flap, a partial thickness flap was proposed by Staffileno.11 Grupe and Warren10 suggested performing a submarginal incision at the donor site in order to preserve the marginal integrity of the tooth adjacent to the recession defect. A full-thickness flap performed close to the recession defect to cover exposed root, and a split-thickness flap laterally to the full-thickness one, was introduced by Rubens et al13 with the objective to cover the bone exposed at the donor site of the full-thickness flap.

Reports on the laterally moved flap surgical technique are quite dated.2,11-15 Using LPF Caffesse and Guinard16 found 69% coverage after 1 month, which did not recede after 3 years. For the predictable results, the importance of proper case selection was told by McFall17 who reported a success in 25 out of 27 cases. For the long-term stabilization of root coverage procedures, elimination of the etiologic factors, such as vigorous tooth brushing technique, local irritants, such as calculus, improperly adapted restorations and also adoption of a strict and proper plaque control method is a must.18 This objective

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of this case report was to describe a case where root coverage was achieved with a LPF and tetracycline hydrochloride was used as a root biomodification agent.

CASE REPORT
A 35-year-old male patient, with good general health, searched for assistance complaining of esthetic dissatisfaction in his lower anterior tooth region. The periodontal examination revealed Miller’s class II recession in relation to 41 (Figs 1 and 2). There was probing depth of 2.0 mm and radiographic examination showed no bone loss interdentally. Patient’s medical and dental histories were noncontributory. Four weeks before surgery full-mouth scaling and polishing were performed and oral hygiene instructions were given to eliminate habits related to the etiology of the recession.

Re-evaluation of the tooth (41) at 4 weeks showed apicocoronary 6.5 mm of recession (Fig. 1), mesiodistally 3 mm of recession (Fig. 2). Accordingly after the patient’s consent, it was decided to treat the site by lateral pedicle flap to achieve root coverage.

SURGICAL PROCEDURE
Preparation of Recipient Bed
The patient was asked to rinse with 10 ml of 0.12% chlorhexidine for 30 seconds, following which local anesthesia was administered. After adequate, local anesthesia had been achieved, the exposed root was planed thoroughly to reduce the convexity. Root conditioning was achieved by burnishing the root using a cotton pellet saturated with tetracycline hydrochloride solution for about 3 minutes. A no. 15 scalpel was used to make a "V" shaped incision about the denuded root, removing adjacent epithelium and connective tissue (Fig. 3).

Preparation of Donor Site
A partial-thickness flap is begun with a scalloped inverse beveled incision at the gingival crest using a no. 15 scalpel blade. The donor flap should be one and a half times the size of the recipient area to be covered and 3 to 4 times longer than wider (Fig. 4). The incision extends from ‘V’ shaped incision to the vertical incision. This incision is not made down to the bone. The horizontal incision is stopped at the mucogingival junction. All of the interproximal papillae are partially dissected, thinned and maintained.

A vertical incision is now made with a no. 15 scalpel blade at the donor site but is not made down to the bone. It is extended far enough apically to ensure adequate mobility of the flap (Fig. 5). The base of the flap is kept wide to permit adequate vascularity. The flap should be free enough to permit movement to the recipient site, with no tension. The recipient site was covered with the pedicle flap and sutured by means of sling sutures (5-0 vicryl sutures) (Fig. 6). After suturing, a periodontal dressing was placed to protect the surgical site (Fig. 7).

Postoperative Instructions
The patient was asked to refrain from tooth brushing at the surgical site for 2 weeks. A 0.12% chlorhexidine mouth rinsing was advised twice daily for 3 weeks and for postoperative pain control, combiflam was prescribed, twice daily for 3 days. The periodontal dressing was removed 2 weeks postoperatively. Healing was uneventful and was completed in about 6 weeks. There was significant reduction in the recession size (Figs 8 and 9).

DISCUSSION
In the present case, the patient had a Millers class II recession in the tooth no. 41. Laterally positioned flap
procedure performed in this case provide several advantages to the recession site, such as esthetic improvement in the region, greater protection against root abrasion, reduction of dentin hypersensitivity as reported by the patient and also absence of the second surgical site or the donor site. Only classes I and II recessions have predictability of covering 100% of the root by means of surgical techniques. Class III recessions have predictability of partial coverage and class IV has no predictability for covering. The ultimate clinical goal of any surgical root coverage procedure is complete root coverage along with the esthetic correction, resolution of
A Little of Lateral Thinking! The Lateral Pedicle Flap

Fig. 9: Three months—postoperative

hypersensitivity and prevention of root abrasion. For the treatment of localized gingival recession defects, LPF or root surface biomodification yields higher percentages of complete root coverage. The results of the present case report indicate that the use of LPF, along with tetracycline hydrochloride, yielded significant root coverage. Laterally positioned flap involves repositioning of donor tissue from an area adjacent to the recession defect to cover the exposed root surface. Using a modified LPF technique in the management of Miller class I gingival recession defects, 95.5% mean root coverage and 83.4% complete root coverage was achieved in a recent randomized controlled clinical study. Furthermore, another clinical study has revealed a statistically significant increase in the width of keratinized tissue (the distance between the gingival margin and the mucogingival junction) with the LPF compared to the CAF technique.

The percentage of root coverage outcome can be improved with root surface biomodification agents. These agents are used in an attempt to remove the smear layer and also the bacterial endotoxins, to widen the orifices of dentinal tubules, and for the exposure of the dentinal collagen matrix. This dentinal collagen matrix is thought to provide a substrate that supports the chemotaxis, migration, and attachment of fibroblasts that are fundamental to successful periodontal wound healing. Tetracycline hydrochloride was used as a root conditioning agent in the present case.

CONCLUSION

Within limits of the present case report, it may be concluded that LPF technique along with tetracycline hydrochloride not only provides a biocompatible surface, but also improves the tenacious connective tissue attachment of the flap to the root surface and, as a consequence, enhances the clinical outcome in the form of significant coverage of the denuded root.

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