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Periodontics-Prosthodontics - An Interdisciplinary Approach

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Abstract

As the mean age of the population is increasing and the current therapeutic concerns is for teeth to be retained. It is now quite common to encounter complex clinical situations like severe tooth-tissue loss, advanced periodontal disease along with significant esthetic concerns. Dentists now a days, not just restore teeth to make them better for functioning, but also cater an increased esthetic concern of the patients.Thus, many a times, patients who present with a complex restoration also require an esthetic rehabilitation. Although periodontal factors do not usually have a direct effect on the survival of fixed prosthesis however a harmony between prosthesis and periodontium remains critical, affecting the longevity, esthetics and to prevent unsatisfactory treatment outcomes. The present article addresses and summarizes the current knowledge of Prosthetic and Periodontic clinical procedures that play a role in any clinician's attempt to create biologically acceptable and aesthetically pleasing long-lasting restorations.

Keywords: Interdisciplinary dentistry, Esthetics, Biologic width, Implants, Crown lengthening, Restorative margin, Gingival contour, Gingival Biotype, Soft-tissue augmentation.

Introduction

Interdisciplinary dentistry can be described as mutual permeation of various specialities in dentistry that goes hand in hand for the complete well-being of thepatient. Periodontology and Prosthodontics hold one of the powerful and close connections of all disciplines of modern dentistry where healthy periodontium is vital for long term success of restorations. On the other hand, defective prosthesis may lead to progression of periodontal disease.[1]

A sound periodontium provides a firm foundation for an esthetic and functional prosthesis. Conversely, when restorations are designed to be self-cleansing and promote gingival health, the tissues present a harmonious esthetic blend at the restorative-gingival interface.[2] Periodontal therapy has developed beyond the scope of the treatment of periodontal pathoses and consists of the reconstructive procedures that enhance both function and esthetics which can be broadly categorised under:[3]

1. Anatomical Considerations.
2. Biologic Considerations.
3. Esthetic Considerations.
4. Peri-implant soft tissue Considerations.

Anatomical Considerations

The relationships among the tooth-supporting soft and hard tissues, the junctional epithelium, the connective tissue attachment, and the bone crest have been clarified in the landmark histological study by

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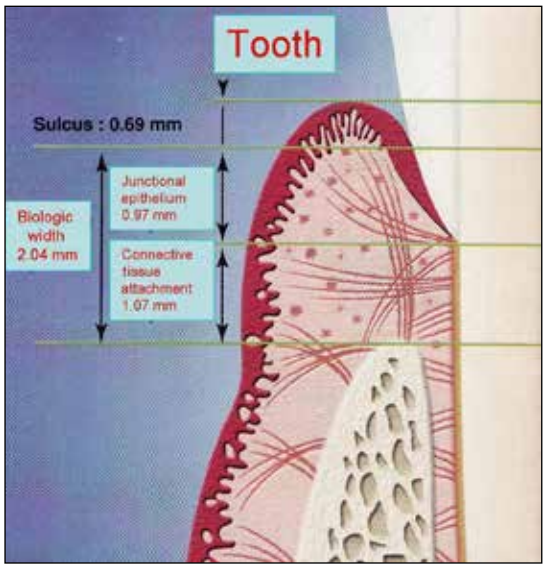
Gargiulo et al.[4] The dimensions of dento-gingival complex called as "Biologic Width" is present around the natural teeth in a protective cuff- like barrier which has the tendency to self-restore and adapt dynamically. **(Figure 1)**

The suggested physiological function of the biologic width is that of a protective barrier for the subjacent periodontal ligament and the supporting alveolar bone from the attack of a pathogenic biofilm present in the oral cavity. Hence, subgingival placement of crown margins mayaffect the homeostasis of the periodontal tissues.[5]

Figure 1: Diagrammatic representation of Biologic



Width

Violation of Biologic Width:It leads to difficult impressioning and hygiene procedures and unacceptable coronal contours of the restoration. The reasons for the violation include an attempt to access sound tooth structure, increased preparation length, previous restorations, existing caries, resorption defects, traumatic injury, iatrogenic insults, and improper identification of sulcus depth.[6] However, treatment modalities to re-establish biological width and modify the gingival contour can be classified under the Subtractive and Additive Methods.

Subtractive methods are used more commonly than additive methods as they are more predictable. They re-establish a physiological biologic width by performing Crown Lengthening procedures. Crown lengthening is a surgical procedure aimed at the removal of periodontal tissue to increase the clinical crown height.[7] The presence of sufficient sound tooth structure coronal to the bone crest is essential to satisfy the placement of the restorative marginson sound tooth structure and preservation of biologic width together with a healthy periodontium.[8]Furthermore, crown lengthening procedures can be done with:[9]**(Figure 2)**

- Gingivectomy.
- An Apically Positioned Flap (APF) with osseous reduction.
- Forced eruption combined with surgery or combined with fiberotomy.

The additive methods correct gingival level and contour by augmenting the gingival tissues. They improve the esthetics by increasing the width of attached gingiva with a primary aim of achieving an even band of attached gingiva and maintaining root coverage. These procedures should be completed before the prosthodontic treatment using Free gingival graft, Connective tissue graft, Coronally positioned flap.[10]

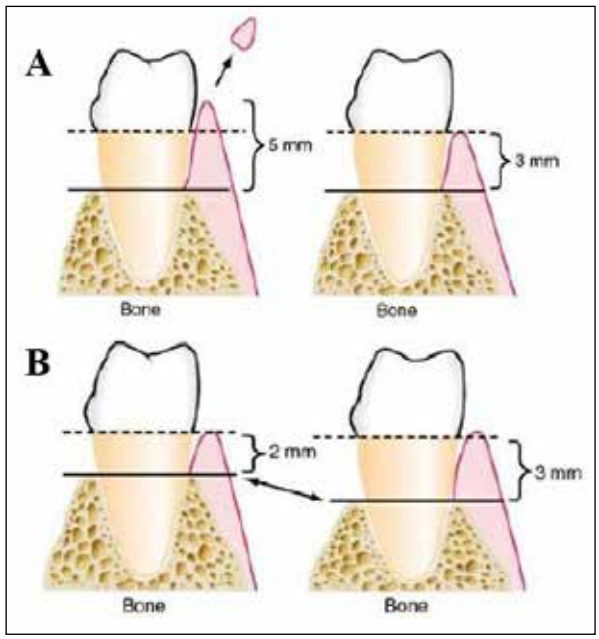


Figure 2: A: Greater than 3mm soft tissue between bone and gingival margin, with adequate attached gingiva, allowing crown lengthening by gingivectomy.

B: Less than 3mm soft tissue between bone and gingival margin, inadequate attached gingiva, flap procedure and osseous recontouring for crown lengthening.

Restorative margin placement: The effect of the location of an artificial crown margin on plaque accumulation and gingival health were well documented by Flores-de-Jacoby et al.[11] According to the evaluation, interactions between dental restorations and periodontal tissues, it was stated that restorative margin with a supragingival location was the most beneficial restoration type in terms of periodontal health. In contrast, restorations with equigingival and subgingival margin terminations resulted in increased plaque accumulation.[5]

Despite better esthetics, subgingival restorations were also associated with greater periodontal inflammation in the sites with keratinized gingiva less than 2 mm. With respect to periodontal health, the supragingival restoration is the most favourable design since it is easy to be cleaned.[12]

Richter & Ueno[13] stated that marginal fit and finish may be more significant to gingival health than its location. Ideally, the margin of a prosthetic restoration should be easily accessible for the facilitation and fabrication of the provisional restoration and impression taking. The most critical factor in margin location seems to be the relationship to the supracrestal fibre attachment. A margin placed apical to the base of the periodontal pocket into the zone of biological width, specifically, into connective tissue attachment, violates important biological principles with adverse consequences on long-term gingival health.

Therefore, the most important consideration for intracrevicular restorative dentistry is locating the base of the gingival sulcus or periodontal pocket. The dentogingival complex comprises of three components namely connective tissue fibrous attachment, junctional epithelium,and gingival sulcus.

The histological sulcus depth ranges from 0.5 to 1 mm, whereas the clinical sulcus depth measures from 1 to 4 mm in health. The biological width follows the osseous scallop. Therefore, the inappropriate use of a more horizontal tooth preparation margin as opposed to a scalloped margin on anterior teeth will often violate the biological width in the interproximal area.

Thus,it is important to know the total dentogingival complex measurement when preparing a tooth. Assuming the normal 3 mm from the alveolar bone crest to the free gingival margin. The intracrevicular margins might be located 0.5-1 mm apical to the free gingival margin or 2-2.5 mm coronal to the osseous crest. When the total dentogingival complex has a length of less than 3mm, a high alveolar crest occurs and caution must be used. Margin location should be at the level of the free gingival margin or no more than 0.5 mm apically, to avoid the risk of violating the biological width.[14]

Margin placement must respect the attachment apparatus and allow some degree of error during the high-speed instrumentation. The clinical steps of tooth preparation consist of facilitation of the gingival margin and placement of an extra-thin knitted retraction cord that displaces the gingiva outward and apically.The preparation designs for full-coverage restorations can be classified into four distinct types. (**Figure 3**)

1. **Feather-edge (vertical preparation)**
2. **Chamfer (''hybrid'' preparation)**
3. **Shoulder (horizontal preparation)**
4. **Shoulder with bevel preparation**

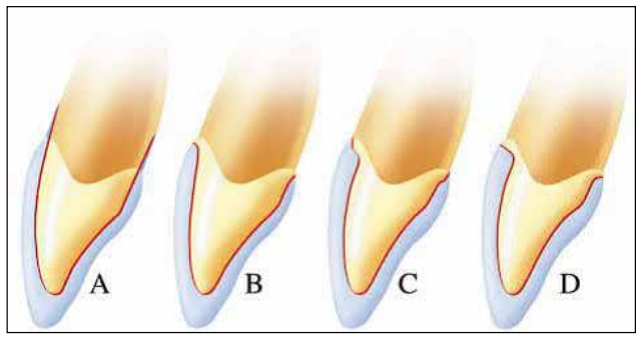


Figure 3: Preparation designs.

A. Feather-edge. B. Chamfer. C. Shoulder with bevel. D. Shoulder.

Biologic considerations

The important biological parameters that decide the success of Periodontic-Prosthetic treatment is dependent on the accumulation of plaque forming bacteria upon the restorations and the resultant gingival inflammation. Also, marginal integrity of restoration and contour are another pivotal aspect.

Bacterial Plaque Accumulation: Patient susceptibility to gingival inflammation is not based solely on the mere quantity of dental plaque but also on the virulence of the resident plaque microorganisms. The bacterial biota of dental plaque is dynamic, and its pathogenicity tends to change over time.[6]Adamczyk and Spiechowics[17] evaluated plaque accumulation on crowns of various materials and inferred that rougher

material experiences a statistically greater incidence of plaque accumulation.

Mechanical insults such as placing cords, copper bands and retraction clamps create a wound that may disrupt the junctional epithelium and connective tissue attachment.The gingival health around restorations can be managed by initial Periodontal therapy.[18]

Gingival level and Contour: It seem logical that the most predictable gingival response will occur when the artificial crown portion mimics the original shape of the tooth as much as possible.The location of the proximal surfaces of adjacent teeth also seems to be a critical factor in gingival health. With close root proximity, even slight deviations from the original contour may compromise the complex relationship of the interproximal gingival tissue. The initial tooth anatomy should be evaluated to determine the impact of treatment on esthetic, hygiene, and biomechanical requirements.

Esthetic Considerations

From an esthetic perspective, the intra-oral assessment involves evaluating the periodontal structures of the bone, gingiva, interdental papillae, the teeth,and the biologic space. To obtain a good esthetic outcome, scrupulous attention to detail and an accurate diagnosis should be established.

Gingival Biotype: Clinically, assessing gingival biotypes translates into observing gingival thickness. Accordingly, two biotypes can be identified:

- A thick-flat type.
- A thin-scalloped type.

Patients with thin biotype differ from patients with a thick/average biotype as they present with a thinner labial plate and an alveolar crest position that is located more apical in relation to the CEJ. Periodontal biotype can be diagnosed by the ability to visualize the periodontal probe through the gingival sulcus in thin biotype and the inability to visualize the probe in a thick biotype.[19] It has been shown to affect soft tissue esthetic outcomes around anterior implants.

Patients with a thin biotype have more interproximal and midfacial recession postimplant placement than in patients with a thick biotype and they may require additional therapy such as hard and soft tissue augmentation. Numerous research indicated predictable results after root-coverage procedures in the case of the thick-flat biotype and regrowth of gingival height after resective osseous surgery.[20]

Gingival Zenith: Harmony and symmetry are key factors that need to be assessed when planning esthetic restorations. The zenith point orientation is distal to the long axis of central incisors and cuspids and is coincident with the long axis of the lateral incisors. As a general guideline, the height of the gingival margins of central incisors and canines should be at the same level. Correct orientation of the zenith and gingival height contour following therapeutic manipulationhelps avoid gingival level disharmony and aids in establishing correct tooth proportions.

Importance of Attached Gingiva: Attached gingiva around teeth minimizes the risk of gingival recession when preparing esthetic margins and to increase patient comfort when performing oral-hygiene procedures. Lang & Loe[21] claimed that gingival inflammation accompanied in cases in which less than 2 mm of attached gingiva was present. It was believed that the band of attached gingiva is important to dissipate the muscular pull forces and is capable of withstanding trauma from mastication and toothbrushing.

Edentulous Area: It includes assessment of the location, height, width, and contour of the residual ridge. When a fixed dental prosthesis is planned,the prosthesis components to be considered are the pontic and the connectors because they influence the esthetics, durability of the prosthesis and the health of the soft tissue. Biologically, it has been proposed that pontics should exhibit pressure-free contact on keratinized attached tissue,prevent food accumulation and facilitate plaque control.Regarding an ideal pontic design "Modified ridge lap" in the posterior region and a "lap facing" in anterior region has been found ideal in maintaining Pontic-Ridge relationship.

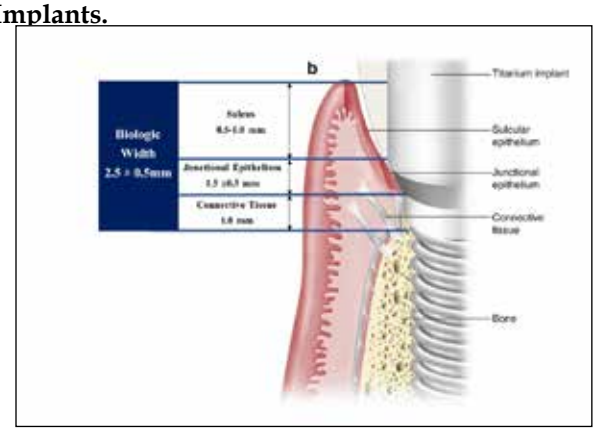
Peri- implant soft tissue Considerations

The development process of the tooth includes the formation of a biologic connection between the living tissues. For a dental implant, this connection must be created during the healing process after implant placement. The resulting attachment, although similar in function, has biologic differences that must be comprehended to design surgical techniques and biomaterials that will surround the implant with biologically functional and esthetic soft tissue.[22]

Soft tissue interface: The implant–soft-tissue bone

interface is like that of natural teeth.The epithelium around the implants undergoes morphologic and functional changes and the junctional epithelium is formed. This attachment is facilitated by the basal lamina and the formation of hemidesmosomes which prevents the apical movement of the epithelium. **(Figure 4)**

Figure 4: Soft tissue considerations around Implants.



Unlike tooth, the collagen fibres around implants do not insert into the titanium surface. Instead, they form a cuff, making it less mechanical resistance than natural teeth. Surfacecharacteristics of the implant influence the orientation of the fibres, which are mostly parallel to the implant surface when thesurface is smooth. Surface roughness allows connective tissue to embed into the surface. When implants are loaded, fibre orientation is more transverse hence the success of implant is dependent on the establishment of a soft tissue barrier that can shelter the underlying osseous structure.

Keratinised attached mucosa: The stability of the mucosa provides better support to underlying connective tissue, and junctional epithelium which creates a seal around the implant.The challenges to the soft tissue during the prosthodontic phase are better absorbed by keratinized tissue and the esthetics of implant prosthesis also depends on the health and stability of the peri implant tissue.

Implant placement: Specific placement guidelines have been developed to accomplish soft-tissue stability around implants that are applicable when bone is sufficient and of good quality:

1. The apicocoronal placement of the dental implant platform should be positioned 3 mm below the facial marginal tissue. The 3-mm rule was created for the following reasons:
    a. The 3-mm space is needed on the prosthetic abutment for formation of biologic width.
    b. An emergence profile of implant restorations needs room for a smooth transition from the circular implant platform to triangular or square abutment and crown.
    c. There should be space available for restorative margin below marginal soft tissue.
    d. The possibility of peri-implant marginal soft tissue recession increases as the patient ages.
2. Buccolingually, the implant placement from its outer aspect of platform is 1 mm palatal from the anticipated facial margins of the restoration.
3. The implant platform is located on same axis with the gingival zenith and 3 mm lower than the free soft-tissue margin.[23]

Soft tissue augmentation around implants: Peri-implant soft-tissue management can be regarded as a category of mucogingival procedures analogous to reconstructive procedures around teeth including Root coverage, Papilla reconstruction, Ridge augmentation and preservation. Prosthetic treatment of uncorrected ridge defects with a fixed restoration may lead to esthetic as well as functional complications such as open interdental spaces forming black triangles, difficult pontic design causing inadequate emergence profile, unesthetic gingival texture, whereas functional problems which may comprise food impaction.[3] The augmentation procedures can be accomplished during extraction, before or during implant placement, or when the implant is uncovered, or even post restoration. Therefore, soft tissue augmentation techniques that provide better esthetic outcomes includes:

- Pedicle full- or split-thickness palatal flaps
- Free gingival grafts
- Soft tissue allografts
- Combination Hard- and Soft-tissue Grafting

An appreciation of the relationship between periodontal health and restoration longevity remains a key factor in ensuring a good function, form, and

esthetic of the dentition. Consequently, achieving a successful restorative outcome necessitates that the final restoration is planned and integrates well with the surrounding periodontium. Thus, for obtaining a good esthetic outcome clinician should establish a correct diagnosis and evaluate the prognosis to carry out appropriate treatment plan that proceeds according to the biologic as well as clinical evidence.[24]

Conclusion

Predictability and success in esthetic dentistry are largely dependent on the health and stability of the periodontal tissues. Also, emphasis should be placed on the control of bacterial plaque, the marginal integrity ofrestoration, its contourandlocation.[6]Although, patient cooperation is yet another aspect. Since it is a multidisciplinary approach, multiple appointments and patient compliance are required to complete and maintain the long-term success of treatment.[25]

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Conflict of Interest - Nil.

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