Review Article

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Prostho Perio Endo Interdisciplinary Clinical Approach - A Review

Abstract:

Before commencing the prosthetic phase of therapy, it is necessary to involve many specializations in the patient's entire rehabilitation process, either to remove pathologically active tissues or to change anatomically deficient areas. Rehabilitation of orofacial defects in accordance with the surrounding anatomical, physiological, and biological tissues necessitates the involvement of various disciplines ranging from diagnosis to better treatment outcomes, including oral radiology, periodontics, endodontics, orthodontics, and pedodontics, etc. Through this paper, we would like to review the clinical interrelationship between prosthodontics and periodontics, endodontics that dictates the interdisciplinary treatment.

Key-words: Prosthodontics, Periodontics, endodontically treated teeth, biological width, pulp and periodontium

Introduction:

All disciplines in modern dentistry are interconnected, and teamwork is the foundation of complete dental care. To get effective outcomes, all prosthetic and rehabilitative procedures require a healthy periodontium. Periodontists might help with soft and hard tissue management as well as inflammation control to prepare sites for effective prosthesis procedures. To correct the current ridge abnormalities, surgical treatments such as ridge and bone augmentation, as well as sinus elevation, might be undertaken for future implant locations.[1]Prior to Prosthodontic construction, active periodontal/ peri-implant disorders and related variables should be eradicated or treated. If periodontal infections are not treated, after delivery the function and longevity of the prosthesis will be jeopardised. Furthermore, periodontal inflammation causes changes in soft tissue texture, colour, size, and gingival consistency. It then has a negative impact on aesthetic consequences by degrading the harmony between periodontium and prosthesis.[2]

The restoration of endodontically treated teeth is one of the most challenging situations of the dentist's clinical practice, because it involves procedures related to several areas, such as endodontics, operative dentistry, and prosthetic dentistry. Most endodontically treated teeth require a post and core build-up for restoring the teeth to optimum health and function. Some factors may directly influence on the option for the restoration type, e.g., the amount of coronal remnant after endodontic treatment and patient's prosthetic need. Also, the clinician should verify whether the tooth would be used as a removable or fixed partial denture abutment.

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I. Relationship Between Prosthodontics and Periodontics:

A. Periodontal Therapy and Fixed Prosthodontics:

Prosthodontic therapy should promote patient comfort while also improving function, health, and aesthetics. The prosthesis must be meticulously constructed and implanted,

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as well as be perfectly adapted to the surrounding periodontal tissue.[2] Periodontal inflammation can be caused by incorrect cervical adaptation of fixed prostheses, excessive subgingival placement of fixed edges, abrasive surface of the prosthesis, and bigger surfaces of the restorations, according to studies. Fixed denture prognosis is greatly dependent on their interaction to periodontium tissue, which is called as a "symbiotic relationship" or "mutual protection relationship."[3]

1) Biological Width:

BW is made up of junctional epithelium and connective tissue connection. (Diagram -1) The epithelium and connective tissue mean distances are 0.97mm and 1.07mm, respectively. However, the dimension, particularly the epithelial attachment, is dynamic and varies across people. A constant width of peri-implant mucosa was seen adhering to the surface of the implant abutment, similar to natural teeth. Histologically, it inhibits further supragingival plaque development by isolating the inflammatory cell infiltration from the alveolar bone crest with a zone of healthy connective tissue.[4]

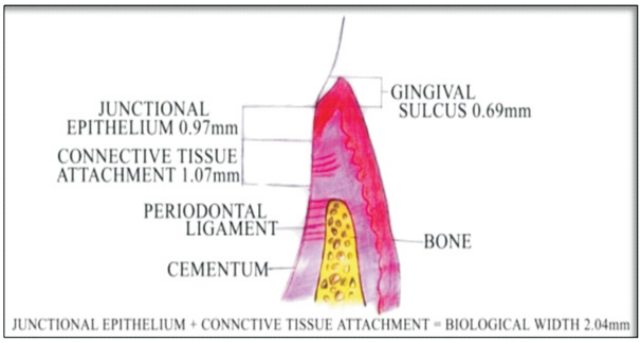

Diagram -1 Biological width

Clinical Importance:

Intracrevicular tooth preparation can result in either a low or high crest dentogingival complex (DGC). While low crest DGC are prone to recessions, high crest (DGC) are more prone to biological width violation when the margin is located more apically below the free gingival margin. Thus, from the perspective of both the periodontist and the prosthetic dentist, the placement of the osseous crest in respect to the gingival margin and eventual restorative margin is the most essential reference point.[5]

Biologic width and implants:

The term biologic width was coined when Gargiulo et al. documented the measurements of the dentogingival junction in human cadavers.[6] It has been proposed that a similar bone-to-overlying soft-tissue interaction exists surrounding implants, and that alterations in this relationship may be one of the causes of early crestal bone loss. According to the results of the 3rd European symposium on periodontology and implant dentistry, the role of the peri-implant seal is "to maintain homeostasis of the implant."[7]

The biologic width's stability around the implant is mostly determined by the kind of implant, implant insertion procedure, mucosal thickness, Macrostructure of the neck of the implant etc ,.

2) Proximal Relationship:

Loss of the interproximal papilla impairs aesthetics and promotes food impaction, exacerbating periodontal deterioration. Despite the fact that there is an indirect association between open contact and periodontal inflammation, findings suggest that food impaction adds to increased pocket depth and clinical attachment level. As a result, physicians should avoid making open interactions between fixed prostheses. Patients should be addressed in the meanwhile with proximal cleansing.

3) Restoration Contours:

Adequate crown shapes may preserve gingival edges, enable musculature cleaning, and ease access for dental hygiene. Over contouring can be harmful to the periodontium because it promotes plaque retention. Removal of overhang may also benefit pocket depth decrease and clinical attachment gain. Meanwhile, in order to prevent the over contoured crown, insufficient crown reduction for the restorative material should be avoided.

4) The Location of Restorative Margins:

The gingiva should be healthy and free of irritation prior to prosthesis replacement. Supragingival restorations are the finest design for periodontal health since they are easy to clean. Restoration of the subgingival margins can result in a tissue biotype that is detrimental to periodontal tissue (Diagram -2) because it increases the chance of biologic width invasion, resulting in severe periodontal damage. To prevent periodontal disease, supra gingival restoration margins are strongly advised in regions where aesthetics are less important. Patients are advised to provide proper home care as well regular professional treatment as needed.

Diagram :2 - Gingival inflammation due to errors in determining the position of the gingival margins.
(A) Appear gingival inflammation at the subgingival margin with Porcelain Fuse to Metal (PFM) crown on the maxilla.
(B) Gingival inflammation at the margin of the knife edge

5) Trauma From Occlusion:

The tooth and its supporting structures bear the brunt of occlusal stresses on the crown as a functional unit. Occlusal overloading contributes to biomechanical implant difficulties as well as marginal bone loss around dental implants. Miyata and colleagues explored the effect of occlusal loading on peri-implant tissue in a series of investigations using supra-occlusion. It demonstrated that excessive occlusal force might cause marginal bone resorption even in the presence of healthy peri-implant tissue. Furthermore, once the condition has developed, it may not be reversible.[8] Excessive force can lead to osseointegration failure and implant failure if used repeatedly. Other clinical signs of biomechanical implant problems include prosthetic component fracture and attachment or abutment screw loosening.

6) Gingiva Retraction and Impression Procedures:

Retraction techniques are often debated, but the use of retraction cords has proven to be an effective method of soft tissue management during the impression phase. If the impression materials accidentally left in the periodontal tissue after impression removal, severe periodontal reactions have been reported with significant loss of adhesion after the use of elastic impression materials. Minimal force should be used to place the cord so no penetrate the sub epithelial connective tissue. Most importantly, moisten the cord prior to removal to avoid tripping over the sulcus epithelium.

7) The Provisional Restoration:

Gingival recession is associated with improperly contoured temporary crowns, and rough surfaces have been shown to promote plaque accumulation. After cementing the provisional restoration, it is important to remove all traces of provisional cement from the gingival crevice to prevent unfavorable gingival healing.

8) Pontic Design and Crown Contour:

The ideal design should have point pressure-free contact on the face so the ridges and all Surfaces should be convex, smooth and highly polished or polished. This configuration is calleda " modified Ridge lap" pontic. This pontic design offers the best balance of comfort, support and hygiene.

Insufficient crown reduction of the restorative material should be avoided in order to prevent the crown contour from becoming too large. The facial or lingual surface of the restoration should not have a bulge of more than 0.5 mm adjacent to the gingival margin. This Is because it can interfere with proper plaque removal.

A. Periodontal Therapy and Removable Prosthodontics:

Periodontitis causes resorption of alveolar bone, reducing the quantity and quality of the tissue supporting the teeth. Partial dentures area associated with increased mobility of the abutment teeth, which may be due to increased forces on the abutment teeth or plaque buildup. A rigid metal direct connector exerts less force on the abutment than a non-rigid polymer direct connector.[9]

Effect of removable partial denture components on abutment periodontal status:

a) Direct retainer design:

Direct retainers are considered to cause gingival recession and increase caries of abutment teeth. Newer composite materials have comparable retentive and mechanical properties as compared to cobalt chromium clasp.[10] Clasps made out of PEEK (Polye there ther ket one) were found to have less flexural strength than cobalt chromium clasps.[11]

b) Major and Minor connector design:

The basic design principle for removable partial dentures is to extend the denture over the supporting tissue and to minimize marginal gingival tissue coverage. As a design principle, a minimum distance of 4-6 mm should be maintained between the marginal gingiva and the edge of the major connector.[12]

c) Denture Framework materials:

Traditionally, metals have been used for the prosthetic frame work of RPD's, but with the advent of new materials, variousnon-metallic materials such as PEEK have also been used for prosthetic frame works. The advantage of PEEK over metal prosthesis framework materials is that its elastic modulus is very close to that of alveolar bone (however the for ces on mucosa were increased specially in the distal extension bases. Thus for patients with poor periodontal status of remaining teeth, PEEK may be used as a denture frame work but for distal extension bases it is not recommended.[13])

d) Abutments plint effect

Few invitro photo elastic studies suggest that atleast two abutments should be splinted to distal extension bases to reduce stress, especially when periodontal support is compromised.[14] Carlson reported that inaddition to abutments plinting, other important factors for successful RPD are denture hygiene and gingival relief.[15]\

I. Prosthodontic Considerations of Endodontically Managed Teeth

Endodontically treated tooth restoration is an essential element of dentistry practise that involves a variety of treatment techniques of different complexity. The clinician must be able predict the likelihood of effectively repairing such teeth. Endodontic therapy has generally resulted in severe coronal damage as well as radicular dentin loss in endodontically treated teeth.

1) Coronal versus apical seal:

In restorations with poor coronal sealing, saliva, bacteria and endotoxins can enter the root canal and invade its entire length, causing peri-root periodontitis. Since endotoxin alone can predictably migrate through an obstructed root canal, it is theoretically possible that bacteria around a defective coronary restoration could cause peri-root inflammation.

2) Supra-Bony Tooth Structure:

Supra-osseous tooth structure is the most important factor in the restorative prognosis of the tooth. There is evidence that teeth treated with endodontic therapy are somehow more "brittle" than living teeth.

3) Biologic Width

Gargiuro et al. [16] found that the biologic width dimensions ranged from 1.77 mm to 2.43 mm. This means that there must be an absolute minimum distance of 2.5 mm between the repair margin and the bone crest. Fugazot et al.[17]recommends a margin of at least 3 mm.

The amount of coronal tooth structure and the position of the tooth within the arch determines, the type of structure specified, whether preformed pins or cast pins and cores are specified and whether a crown is needed.

4) Remaining coronal tooth tissue - creating the ferrule:

Preserving as much of the coronal or supra gingival tooth tissue as possible is of paramount importance as it significantly improves the prognosis of the tooth and restoration. 1-2 mm of coronal tooth tissue to the end of the crown preparation significantly improves the fracture resistance of the tooth.

5) Posterior and Anterior Teeth Requiring Crowns

Almost without exception, the posterior teeth (distal to the canines) treated with endodontics benefit from cuspal coverage with some form of crown. Additionally, many anterior teeth require crowns for aesthetic, structural, or occlusal reasons. Successful restoration of such a tooth requires atleast 4.5 mm of solid tooth structure on the crest. However, the biological widths hould be atleast 2.5 mm and the effective ferrule atleast 2 mm for an effective ferrule.

It is essential to consider the functional load that the tooth has to bear. Singl eabutments supporting precision attachment RPD's, distal extension RPD's, or cantilever FPD's that have been or may be treated with endodontic therapy should be avoided. Prior to restoration, occlusal requirements and other loads (such as fixed or removable partial dentures) should be carefully evaluated.

II. Interrelationships of the Pulp and Periodontium:

Periodontal tissue and pulp are interdependent and have embryonic, anatomical, and functional relationships. Turner and drew (1919) first described the relationship between periodontitis and pulp.

Pulpal-periodontal communications :

i. Dentinal tubules
ii. Lateral canals and accessory canals
iii. Apical foramen
iv. Palatogingival groove
v. Root perforations
vi. Vertical root fractures

Pulpal diseases and the periodontium:

Pulp lesions are accompanied by inflammatory changes. Necros is of the pulp causes an inflammatory reaction of the periodontal ligament at the opening of the apical foramen and accessory canal. (Diagram -3) Signs and symptoms include periodontal pocket formation, purulent inflammatory discharge, and angular bone loss, swollen and bleeding gum tissue, and increased tooth mobility.

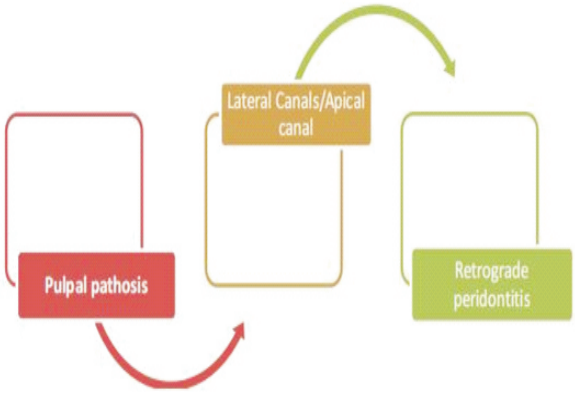

Diagram -3 Chart showing the flow of infection from necrosed pulp to the periodontium

Periodontal diseases and the pulp:

It has been proposed that the pulp will not be affected by periodontal diseases unless the disease affects the apex of the tooth or an accessory canal has been exposed to the environment of the oral cavity.

Etiology:

Endo-perio lesions are caused by both living (bacteria, fungi, and viruses) and nonliving diseases. Along with these variables, trauma, root resorptions, perforations, and dental abnormalities all have a part in the development and evolution of such lesions.

Classification of perio-endo lesions:

A close relationship exists between the dental pulp and periodontal disease. According to classification given by Simon, Glick, and Frank, in 1972 perio-endo lesions can be classified into:

1. Primary endodontic lesion
2. Primary periodontal lesion
3. Primary endodontic lesion with secondary periodontal involvement
4. Primary periodontal lesion with secondary endodontic involvement
5. True combined lesion.

I. Perio-endo-prostho Interactions :

Management of clinical short crowns :

Fixed prosthodontic therapy has become a crucial aspect of dentistry practise when patient comfort and aesthetics are critical. The success of a fixed partial denture is heavily dependent on how well the biological width is saved. Violation of biological width by placing a restoration inside its zone may affect in gingival irritation, pocket development, abscess formation, and alveolar bone loss. As a result, in a tooth with a short clinical crown, periodontal intervention, namely crown lengthening following endodontic care, is critical for the abutment tooth's long- term prognosis.

The purpose of clinical crown lengthening is to lengthen the supragingival tooth structure for restoration or aesthetic purposes. Clinicians often discuss the need to lengthen crowns in the practice of dentistry. They must make treatment decisions based on the bio, functional and aesthetic requirements of each patient. The extent of tooth structure that

is exposed above the osseous crest (about 4mm) should be sufficient to provide stable dentogingival complex and biological width to allow correct tooth preparation and adequate marginal placement to ensure good marginal sealing with retention for provisional and definitive restorations

HEMISECTION -Hope for the Hopeless Teeth:

Terminal abutments with severe caries may not be suitable for restoration. In such cases, treatment options are limited and may include removable partial dentures and dental implants to replace missing teeth. If the caries is confined to one root, a hemisection can be done instead.

From the periodontal point of view, this is an option when there is significant bone loss that is limited to a single root or when there is a class III furcation and the root is stable after hemi-section.

From a restorative point of view, if a portion of the tooth can be retained as the abutment of the prosthesis, abutment failure in a fixed prosthesis will require treatment with a hemisection.

Contraindications include the presence of strong abutment teeth next to the planned hemisection that may serve as an abutment for the prosthesis. Remaining roots may prevent the necessary root canal treatment.

Dr. Buehler explained that hemisection is anexcellent absolute, biologically cost saving alternative with good long-term success and should be considered before molar extraction.[18]

Endodontic stage:

Endodontic therapy was performed first, as unilateral resection is contraindicated in the presence of non-endodontic or endodontic failure.

Periodontal stage:

Four key factors in selecting molars for hemisection[19]

Root divergence.

Root form

Location of furcation

Remaining root attachments

Prosthetic stage:

When a tooth has lost some of its root support, it requires restoration so that it can function independently or as a abutment for a fixed partial denture or splint. Therefore, it is necessary to restore function and stabilize occlusion.

Restorations can contribute to periodontal destruction if the margins are defective or if the non-occlusal surfaces do not have a physiological shape. Improperly formed occlusal surfaces translate acceptable forces into destructive forces, ultimately leading to hemisection failure. Hemisectioned abutments are tapered 6-10 degrees or more to ensure an insertion path compatible with anterior abutments. To compensate for this, buccal and lingual grooves are made in the abutment. The size of the occlusion table is reduced, resulting in less force on the bisecting root. The cusp slope is gradual to reduce lateral forces and eliminate non-functioning contacts. The preserved roots were restored as premolars and helped reduce chewing stress. Stein said, “If aesthetics permit, the best design for the posterior region is the hygienic pontic".[20]

Hemisection may be a suitable alternative to tooth extraction or implant treatment and should be discussed with the patient when evaluating treatment option.

Summary:

In contemporary advanced periods of dentistry, a multidisciplinary approach is required to obtain physiologically acceptable, aesthetic, functional, and patient satisfied treatment results. Prosthodontics and periodontics have a close and inseparable association. Solid foundations for predictable prosthetic treatment are provided by robust supporting periodontal/peri-implant tissues. Endodontists established a solid foundation for the development and management of effective prostheses.[21] Endodontics has a major effect on over dentures and fixed type prostheses prior to prosthesis fabrication on the teeth.[22]

Working cooperatively can enhance patient care and outcomes by developing an agreed treatment plan, improving coordination of care, streamlining treatment pathways, and reducing duplication of services.

Conclusion:

The possibilities for oral health care in the twenty-first century are vast. To optimise clinical outcomes, clinicians must coordinate periodontal, endodontic, and restorative therapies. Periodontal and restorative therapy is situational

and unique to each patient; thus, treatment plans must be flexible to changing conditions. Indeed, a well-planned multidisciplinary approach with accurate diagnosis and detailed treatment planning is the foundation for delivering holistic care for the patient.

Priority is given to both soft and hard tissues around teeth and implants before, during, and after restorative procedures to ensure a good outcome. It also provides the patient with complete treatment with accurate and long-lasting restorations.

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