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‘Perio-Prosthodontic Relations’- A Sine qua non- for the long-time success

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Abstract

For dental restorations to achieve the best possible functional, cosmetic, and periodontal results, prosthodontics and periodontology (perio-prosthodontic interactions) must interact. The main elements and most recent developments influencing this multidisciplinary interaction are summed up in this abstract. Periodontal health is greatly impacted by prosthetic elements such as restorative contouring, margin placement, and material choice; improperly constructed prostheses can lead to bone loss, gingival inflammation, and plaque buildup. On the other hand, a stable periodontal foundation for restorations is guaranteed by pre-prosthetic periodontal evaluation, which includes measurement of gingival biotype, biological width, and clinical crown length. Perio-prosthodontic integration has been improved by recent developments, such as digital technology (CAD/CAM, 3D printing, AI), biomaterials (bioinspired scaffolds, nanoparticles), laser therapies, and regenerative techniques (3D bioprinting, stem cell therapy). These developments lessen issues like gingival recession and peri-implantitis, encourage periodontal regeneration, and increase prosthetic design precision. By coordinating prosthetic designs with periodontal health, interdisciplinary teamwork and individualised treatment planning further maximise results. This dynamic interaction emphasises the necessity of a cooperative strategy to strike a compromise between long-term periodontal stability and cosmetic and functional objectives.

Keywords: Prosthodontics, Periodontology, Perio-Prosthodontic Relations, Digital Dentistry, Biomaterials, Periodontal Health, Restorative Margins, Regenerative Therapy

INTRODUCTION

Periodontal health is greatly influenced by prosthetic factors. While well-made dental prostheses may promote periodontal stability, poorly maintained or constructed ones might worsen periodontal disease. **Key prosthetic factors and their effects on periodontal health** are described below: [1]

1. Prosthesis Design and Fit Impact: Gingivitis and periodontitis can result from poorly fitting prosthetics, like as crowns or bridges with overhanging borders, which produce plaque-retentive areas. Overly curved restorations impede oral hygiene and increase inflammation by upsetting the natural gingival architecture. On the other hand, appropriately moulded, well-fitting prostheses reduce plaque buildup and promote periodontal health. Evidence: Research indicates that higher gingival inflammation and bone loss from plaque retention are linked to subgingival edges and overhangs.[2]

2. Material Selection Impact: Plaque adhesion and biocompatibility are impacted by prosthetic materials. Rough surfaces, such those found on acrylic or some ceramics, encourage bacterial adherence and raise the possibility of periodontal disease. Biocompatible materials, like as glazed porcelain or polished zirconia, are less prone to irritate gingival tissues and less likely to accumulate plaque. Evidence: Studies show that, in contrast to rough or porous materials, highly polished surfaces inhibit bacterial colonisation.[3]

3. Occlusal Factors Impact: Improper occlusal interactions in prostheses can result in traumatic forces that cause bone loss, movement, and stress on the periodontal ligaments. In prosthetics, balanced occlusion aids in uniform force distribution, maintaining periodontal health. Evidence: Plaque-induced inflammation and occlusal trauma worsen periodontal disease. [4]

4. Margin Placement Impact: Because it is difficult to remove plaque and it irritates the biologic width, subgingival margin insertion frequently results in gingival inflammation and attachment loss. Since they make it easier to practise cleanliness, supragingival or equigingival margins are excellent for periodontal health. Evidence: Higher probing depths and gingival inflammation are substantially associated with subgingival margins. [5]

5. Maintenance and Oral Hygiene Impact: Effective oral hygiene and routine maintenance are necessary for prostheses in order to avoid periodontal issues. Poorly maintained detachable prostheses or fixed partial dentures with inaccessible pontics can harbour plaque, which can cause periodontitis or gingivitis. Professional cleanings and patient education are essential. Evidence: In patients wearing prostheses, good oral hygiene and maintenance practices slow the advancement of periodontal disease.[6]

6. Type of Prosthesis Impact: The periodontal effects of detachable prostheses, such partial dentures, and fixed prostheses, like crowns and bridges, differ. While poorly designed fixed prosthesis might lead to localised irritation, poorly designed removable prostheses can increase the risk of periodontal disease by trapping food or distributing stresses unevenly. Peri-implantitis can result from poorly designed implant-supported prostheses. Evidence: Compared to fixed restorations, removable partial dentures are linked to increased plaque buildup and periodontal disease. [7]

Role of Gingival Zenith, Biological width, Gingival biotype in prosthodontics

Because they affect the cosmetic, functional, and periodontal results of prosthetic restorations, the gingival zenith, biological width, and gingival biotype are important considerations in prosthodontics. Their functions are explained in full below:

1. Gingival Zenith

The gingival zenith, which is usually situated somewhat distal to the tooth's long axis, is the gingival margin's most apical point. It is a crucial aesthetic factor in the design of smiles.

Prosthodontics role: Beauty: In order to create a harmonious gingival outline, which is essential for anterior restorations, the gingival zenith directs the sculpting of prosthetic crowns. An odd appearance caused by improper zenith placement might upset the symmetry of a grin.

Design for Restoration: When the zenith is properly aligned, the prosthesis's emerging profile resembles that of real teeth, improving the appearance of soft tissue and avoiding food impaction.

Clinical Aspects to Take into Account: Before placing a prosthetic, the zenith may need to be adjusted through soft tissue treatment (such as gingivectomy or grafting) in cases of gingival recession or asymmetry.[8]

2. Biological Width

The biological width, which is usually about 2 mm (about 1 mm of epithelium and 1 mm of connective tissue), is the measurement of soft tissue (junctional epithelium and connective tissue attachment) between the base of the gingival sulcus and the alveolar crest.

Prosthodontics role: Health of the Periodontal System: When subgingival edges or too contoured restorations breach the biological width, the body tries to restore it, which can result in gingival irritation, attachment loss, and bone resorption.

Placement of the Margin: In order to prevent intruding on the biological breadth, prosthetic margins should ideally be positioned supragingivally or equigingivally. Subgingival placement must be carefully designed to respect this dimension if it is required (for example, for aesthetics).

Restorative Planning: To guarantee enough room for the restoration without endangering periodontal health, crown lengthening or orthodontic extrusion may be necessary prior to prosthetic therapy in cases of insufficient biological width. [9]

3. Gingival Biotype

The term gingival biotype describes the thickness and condition of the gingiva, which can be classified as thin (scaloped, translucent, delicate) or thick (flat, dense, fibrotic). It is evaluated either clinically or by imaging. **Prosthodontics role: Aesthetic Results:** Thin biotypes compromise aesthetics by displaying underlying restorations (such as metal borders) and being more susceptible to gingival recession. Thick biotypes offer superior masking of restorative margins and are more resilient to recession. **Restorative Planning:** In order to prevent trauma, thin biotypes must be handled carefully throughout impression-taking, preparation, and

temporisation. Prior to prosthodontic therapy, soft tissue augmentation could be required to improve biotype thickness. Implant prosthodontics: Thick biotypes are linked to improved peri-implant stability and aesthetics in restorations supported by implants, whereas thin biotypes raise the risk of mucosal recession and peri-implantitis. Material Selection: To prevent the greyish appearance of metal-based prostheses, all-ceramic or zirconia restorations are recommended for thin biotypes.[10]

4.Integrated Clinical Implications Aesthetic Harmony

The aesthetic effectiveness of prosthodontic restorations, especially in the front zone, is determined by the gingival zenith, gingival biotype, and biological width taken together. A thin biotype with an incorrectly positioned zenith, for instance, can make recession worse by revealing edges and detracting from aesthetics.

Periodontal Stability: In order to reduce inflammation and promote long-term periodontal health, prosthetic designs should be tailored to the gingival biotype while also respecting the biological width (for example, avoiding deep subgingival edges in thin biotypes).

Multidisciplinary Approach: In order to regulate gingival tissues (such as crown lengthening and soft tissue grafting) to maximise zenith position, biological width, and biotype prior to restoration insertion, prosthodontic therapy frequently necessitates cooperation with periodontists.

Implant Considerations: These criteria are even more important in implant prosthodontics since thin biotypes and insufficient biological width around implants raise the chance of aesthetic failures and peri-implant illnesses. [11]

The role of Restorative contours, location of restorative margins and gingival retraction on periodontal health

Because they have a direct effect on periodontal health, restorative shapes, the positioning of restorative margins, and gingival retraction procedures are crucial in prosthodontics. A thorough description of their functions and impacts can be found below:

1. Restorative Contours

Restorative contours refer to the shape and profile of prosthetic restorations, including the emergence profile, axial contours, and contact areas.

Role in Periodontal Health: Plaque Accumulation: Over contoured restorations (e.g., bulky crowns or bridges) create plaque-retentive areas, leading to gingival inflammation and periodontitis. Under contoured restorations may cause food impaction, also compromising periodontal health.

Gingival Response: Properly contoured restorations mimic natural tooth anatomy, supporting gingival health by facilitating oral hygiene and preventing trauma to the periodontal tissues. Emergence Profile: A smooth, gradual emergence profile from the gingival margin to the coronal portion of the restoration minimizes plaque retention and supports gingival adaptation.

Clinical Considerations: Contours should be designed to avoid excessive convexity, especially sub gingivally, and ensure tight, well-placed interproximal contacts to prevent food trapping. [12]

2. Location of Restorative Margins

The interfaces between the restoration and the tooth, which may be positioned sub gingivally, Equi gingivally, or supragingival, are known as restorative margins. The part it plays in periodontal health

Supragingival margins: Because they make plaque removal simple and create little irritation to the gingiva, these are the least prone to result in periodontal problems. When aesthetics allow, they are favoured.

Equi gingival Margins: Located at the gingival crest, these margins strike a balance between periodontal health and appearance, but they must fit precisely to prevent plaque buildup.

Subgingival Margins: Frequently employed for aesthetic purposes or to conceal margins, subgingival placement raises the risk of bone resorption, attachment loss, and gingival irritation, particularly if margins are poorly fitting or encroach on the biological width (e.g., overhangs).

Violation of the Biological Width: When subgingival edges are positioned too near the alveolar crest, the biological width may be disturbed, leading to long-term inflammation and periodontal disease.

Clinical Considerations: The biological breadth should be respected and the margins should be smooth and well-adapted. Patients with thin gingival biotypes or poor dental hygiene should not have subgingival edges. [13]

3. Gingival Retraction

Using mechanical (such as retraction cords), chemical (such as astringents), or surgical (such as laser) techniques, gingival retraction entails momentarily shifting gingival tissues to reveal restorative margins for cementation, impression-taking, or margin assessment. The part it plays in periodontal health

Gingiva Trauma: Gingival damage, recession, or attachment loss can result from improper or forceful retraction. Excessive force applied to retraction cords, for instance, can harm the junctional epithelium, resulting in irritation or irreversible gingival recession.

Chemical Effects: When employed in retraction, astringents such as ferric sulphate or aluminium chloride can irritate or necrotise tissue if they come into contact with it for an extended period of time, especially in thin gingival biotypes. repair and Recovery: To maintain periodontal health, gentle retraction procedures (such as foam-based systems or non-impregnated cords) reduce damage and encourage quick gingival repair.

Clinical Considerations: Gingival biotype and periodontal health should be carefully taken into account during minimally invasive retraction. Gentler methods are needed for thin biotypes since they are more prone to recession. In order to avoid plaque accumulation in the healing sulcus, post-retraction hygiene guidelines are essential.[14]

4. Integrated Clinical Implications Synergistic Effects

Gingival retraction, restorative shapes, and margin location all influence periodontal results. For example, traumatic retraction and an over contoured restoration with a subgingival margin greatly raise the risk of gingival recession and inflammation.

Factors Particular to the Patient: The choice of margin placement and retraction technique is influenced by gingival biotype, periodontal health, and oral cleanliness. To reduce the danger of recession, thin biotypes need supragingival borders and mild retraction.

Content and Methodology Choosing: Periodontal problems are decreased by accurate margin adaptation and smooth, biocompatible materials (such polished zirconia). In order to maintain gingival health, digital imprints may lessen the requirement for forceful retraction.

Long-Term Maintenance: Appropriate margin location and shape promote long-term periodontal stability by facilitating dental hygiene and reducing the need for frequent invasive retraction during maintenance. [15]

Assessment of Pre-prosthetic evaluation of periodontal health, COL in various prosthodontic treatments

To guarantee periodontal stability, cosmetic results, and the long-term viability of restorations, pre-prosthetic evaluation of periodontal health and the measurement of the clinical crown length (COL) are essential phases in prosthodontic treatment planning. A thorough discussion of these factors, along with how they apply to different prosthodontic procedures, is provided below:

1. Pre-Prosthetic Evaluation of Periodontal Health : In order to ascertain whether the periodontium is suitable to sustain prosthetic restorations and to detect any issues that require resolution prior to treatment, the pre-prosthetic evaluation of periodontal health evaluates the periodontal status.

Key Components of Evaluation Periodontal Probing Depth (PPD): Measures the depth of the gingival sulcus or periodontal pocket. Depths >3 mm may indicate active periodontal disease, requiring treatment before prosthodontic intervention. [16,17]

Clinical Attachment Level (CAL): Assesses the loss of periodontal attachment by measuring the distance from the cemento-enamel junction to the base of the pocket. Significant attachment loss may contraindicate certain restorations or necessitate periodontal therapy.

Bleeding on Probing (BOP): Indicates gingival inflammation. Persistent BOP suggests active disease, which must be resolved to prevent complications with restorations.

Plaque and Calculus Assessment: Poor oral hygiene or calculus deposits increase the risk of periodontal breakdown under prostheses, necessitating scaling, root planing, or patient education. **Gingival Biotype:** Thin biotypes (1 mm) are more resilient but may pose aesthetic challenges.

Mobility: Tooth mobility due to periodontal bone loss or trauma may affect the prognosis of abutment teeth for fixed or removable prostheses.

Bone Levels: Radiographic evaluation of alveolar bone height and quality is essential, particularly for implant-supported prostheses or when assessing abutment teeth stability.

Soft Tissue Health: Recession, keratinized tissue width, and gingival inflammation are evaluated, as they influence margin placement, aesthetics, and tissue response to restorations.

Occlusal Analysis: Occlusal trauma can exacerbate periodontal disease, requiring adjustment before prosthetic treatment.

Clinical Implications Periodontal Stabilization: Active periodontal disease (e.g., periodontitis) must be treated with non-surgical (scaling and root planing) or surgical interventions before prosthodontic treatment to ensure a stable foundation.

Impact on Treatment Planning: Poor periodontal health may limit the use of fixed prostheses, favoring removable options or necessitating extraction and implant placement.

Patient Compliance: Oral hygiene practices and patient motivation are assessed, as poor compliance increases the risk of prosthetic failure due to periodontal complications.

Interdisciplinary Approach: Collaboration with periodontists is often required for procedures like crown lengthening, soft tissue grafting, or guided bone regeneration to optimize periodontal health before prosthodontics.

2. Clinical Crown Length (COL) in Prosthodontic Treatments

The clinical crown length (COL) refers to the visible portion of the tooth from the gingival margin to the incisal edge or occlusal surface. Its assessment is crucial in prosthodontics for aesthetic, functional, and periodontal considerations across various treatments. [18-22]

Role of COL Assessment Aesthetic Considerations: Adequate COL ensures a balanced smile design, particularly in anterior restorations. Short clinical crowns may require crown lengthening for aesthetic harmony.

Retention and Resistance Form: Sufficient COL is necessary for adequate tooth preparation to ensure retention and resistance of restorations (e.g., crowns, bridges). Inadequate COL may necessitate adjunctive procedures like crown lengthening or orthodontic extrusion.

Ferrule Effect: A minimum COL of 1.5–2 mm above the restorative margin (ferrule) is critical for the structural integrity of endodontically treated teeth restored with crowns.

Biological Width Preservation: COL assessment ensures that restorative margins do not encroach on the biological width, preventing gingival inflammation and bone loss.

Implant Prosthodontics: In implant cases, COL assessment of adjacent teeth guides implant positioning and crown design to achieve aesthetic and functional harmony.

COL in Various Prosthodontic Treatments Single Crowns:

Assessment: COL is evaluated to ensure sufficient tooth structure for retention and aesthetics. Short COL may indicate gingival overgrowth, caries, or fracture, requiring crown lengthening or restorative margin adjustment.

Impact: Inadequate COL compromises crown retention, while excessive COL due to recession may expose margins, affecting aesthetics. **Management:** Crown lengthening (surgical or orthodontic) may be performed to increase COL, ensuring a 2–3 mm ferrule and respecting biological width.

Goodacre CJ, Campagni WV, Aquilino SA. Tooth preparations for complete crowns: an art form based on scientific principles. *J Prosthet Dent.* 2001;85(4):363-76.

Fixed Partial Dentures (FPDs): **Assessment:** COL of abutment teeth is critical for retention, resistance, and occlusal load distribution. Uneven COL among abutments may lead to aesthetic or functional issues. **Impact:** Short COL on abutment teeth increases the risk of FPD failure due to inadequate retention or periodontal stress from improper force distribution.

Management: Periodontal surgery or orthodontic extrusion may be needed to equalize COL and ensure adequate preparation height.

Removable Partial Dentures (RPDs): **Assessment:** COL of abutment teeth determines clasp placement and retention. Short COL may limit clasp engagement, while excessive COL due to recession may expose clasp arms, affecting aesthetics.

Impact: Inadequate COL can lead to RPD instability, increasing plaque accumulation and periodontal stress on abutments.

Management: Restorative build-ups or crown lengthening may be used to optimize COL for clasp retention and periodontal health.

Implant-Supported Prostheses: **Assessment:** COL of adjacent natural teeth guides implant crown design to match the aesthetic and functional profile. Peri-implant soft tissue levels are assessed to ensure symmetry with natural teeth COL.

Impact: Discrepancies in COL between implants and adjacent teeth can lead to aesthetic failures or peri-implant tissue recession. **Management:** Soft tissue augmentation or customized abutments may be used to align implant COL with adjacent teeth, ensuring aesthetic harmony and periodontal health.

Complete Dentures Assessment: While COL of natural teeth is irrelevant, the vertical dimension of occlusion (VDO) and soft tissue support are evaluated to mimic natural COL aesthetics.

Impact: Improper VDO or flange design can cause soft tissue irritation or bone resorption, affecting periodontal and mucosal health.

Management: Careful flange contouring and VDO adjustment ensure mucosal health and prevent pressure-induced resorption.

Techniques for COL Modification Crown Lengthening: Surgical removal of gingival tissue and/or bone to increase COL for restorative or aesthetic purposes. It ensures adequate tooth structure and preserves biological width.

Orthodontic Extrusion: Forced eruption to increase COL non-surgically, particularly in cases of deep caries or fractures. **Soft Tissue Grafting:** Used to manage excessive COL due to recession, improving aesthetics and protecting restorative margins.

Integrated Clinical Considerations Periodontal-Prosthodontic Interface:

Pre-prosthetic periodontal evaluation ensures a stable periodontal foundation, while COL assessment guides restorative design to balance aesthetics, function, and periodontal health.

Treatment Sequencing: Periodontal therapy (e.g., scaling, root planing, or surgery) precedes prosthodontic treatment to stabilize the periodontium. COL modifications, if needed, are performed before final restorations.

Patient-Specific Factors: Gingival biotype, bone support, and oral hygiene influence both periodontal health and COL management. Thin biotypes and poor hygiene necessitate conservative margin placement and minimal COL alteration.

Long-Term Prognosis: Proper periodontal evaluation and COL optimization reduce the risk of gingival inflammation, recession, or prosthetic failure, enhancing restoration longevity.

Recent advancements in perio-prostho relations

Through the application of cutting-edge technology, biomaterials, and interdisciplinary approaches, recent developments in periodontology-prosthodontics (perio-prostho) interactions have improved the integration of periodontal health with prosthetic outcomes. These developments are intended to improve prosthesis repair longevity, cosmetic outcomes, and periodontal stability. A thorough summary of significant advancements, arranged by topic, is provided below:

1. Digital Technologies in Perio-Prostho Integration : Digital dentistry has revolutionized perio-prostho relations by improving precision in diagnosis, treatment planning, and prosthetic fabrication, ensuring better periodontal outcomes.[23]

Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM): Crowns, bridges, and implant abutments may all be precisely customised with CAD/CAM technologies, guaranteeing a perfect fit and minimising damage to periodontal tissues. These technologies lessen contouring and margin placement errors, which are crucial for maintaining periodontal health. For instance, supragingival or equigingival

margins can be achieved with CAD/CAM-fabricated restorations, reducing gingival irritation and plaque retention.

3D printing: Rapid prototyping of surgical guides, periodontal scaffolds, and prosthetic components is made possible by the development of 3D printing. This technology facilitates exact restoration designs that honour gingival architecture and biological width, as well as minimally invasive methods. Additionally, it improves customisation for difficult instances and minimises material waste.[24]

Digital Imaging and Optical Coherence Tomography (OCT): OCT helps with precise pre-prosthetic periodontal assessment by offering non-invasive, high-resolution imaging of periodontal tissues and sulcular depths. Without using invasive probing, it assists prosthodontists in planning margin placement and assessing gingival health.

Artificial Intelligence (AI): AI-powered instruments, such as convolutional neural networks, help with result prediction, prosthesis planning, and periodontal diagnosis. By evaluating periodontal factors (such as bone levels and gingival biotype) and suggesting the best prosthetic designs, artificial intelligence (AI) improves decision-making and improves the harmony between the periodontal and prosthetic systems.

Effect on Prosthodontic-Periodontal Relations: By reducing plaque-retentive regions, digital technologies promote periodontal health, minimise gingival stress during preparation, and guarantee exact restorative margins. Additionally, they help prosthodontists and periodontists communicate across disciplinary boundaries. [25]

2. Biomaterials and Tissue Engineering Advances in biomaterials have enhanced periodontal regeneration and prosthetic integration, particularly in implant prosthodontics and periodontal tissue management. [26-28]

Bioinspired Scaffolds: Hydrogels and nanofibrous microspheres are examples of advanced scaffolds that are intended to restore the cementum, periodontal ligament, and alveolar bone complex. Prior to the installation of a prosthetic, these scaffolds encourage the regeneration of periodontal tissue by including biocompatible materials such as collagen, hydroxyapatite, and bioactive glass.

Nanoparticles (NPs): Because of their antibacterial qualities, silver nanoparticles (AgNPs) and gold nanoparticles (AuNPs) are utilised in periodontal therapy to lower the bacterial load surrounding prosthetic restorations. L-cysteine-anchored AuNPs, for instance, promote tissue regeneration and periodontal ligament cell differentiation, hence promoting a stable periodontal environment for prostheses.

Bone Grafts and Guided Tissue Regeneration (GTR): Synthetic bone grafts (such as tricalcium phosphate or biphasic calcium phosphate) and contemporary GTR membranes promote periodontal regeneration in deficiencies, enhancing the bone support for implants or abutment teeth. For either fixed or detachable prostheses, these materials guarantee a strong periodontal base.

Stem cell therapy in conjunction with growth factors: Stem cell therapies, bone morphogenetic protein-2 (BMP-2), and platelet-rich plasma (PRP) promote the regeneration of periodontal tissue, improving the stability of both soft and hard tissue around restorations. These treatments are especially helpful for supporting implant prosthodontics and treating peri-implantitis.

Effect on Prosthodontic Relations: Through tissue regeneration, inflammation reduction, and improved tissue integration with restorations, biomaterials enhance periodontal health. In implant prosthodontics, where peri-implant tissue stability is crucial, they play a crucial role.

3. Laser Therapy and Minimally Invasive Techniques Laser-based and minimally invasive approaches have improved periodontal management in prosthodontic cases, reducing trauma and enhancing outcomes. [29-31]

Laser-Assisted Periodontal Therapy: Lasers like Nd:YAG (LANAP) and diode lasers like SiroLaser Blue and Gemini 810+980 are used for crown lengthening, soft tissue ablation, and sulcular debridement. These methods create a stable periodontal environment for restorations by minimising gingival damage, lowering the bacterial burden, and accelerating healing.

Videoscope-Assisted Minimally Invasive Surgery (VMIS): VMIS minimises tissue damage and maintains periodontal health during prosthetic preparation by using high-magnification videoscope technology for precise periodontal debridement and regeneration. By targeting periodontal pathogens with lasers and photosensitisers, antimicrobial photodynamic therapy (aPDT) lowers inflammation and promotes prosthetic success, especially in the treatment of peri-implantitis.

Impact on Perio-Prosthodontic Relations: By lowering inflammation and gingival recession, these methods safeguard prosthetic margins with healthy periodontal tissues while also enhancing patient comfort during pre-prosthetic preparation.

4. Implant-Prosthodontic Advancements Implant prosthodontics has seen significant perio-prosthodontic advancements, focusing on peri-implant tissue health and prosthetic integration. [32,33]

Peri-Implantitis Management: By lowering inflammation and encouraging bone repair, immunomodulatory techniques and biomaterials (such as AgNPs and bioactive scaffolds) treat peri-implantitis. For prosthesis supported by implants, these developments guarantee durable peri-implant tissues.

Personalised Prosthetics and Abutments: Customised implant crowns and abutments that match the clinical crown length (COL) and gingival shape of neighbouring teeth can be made thanks to CAD/CAM and 3D printing, enhancing both periodontal health and appearance.

Biomimetic Materials: By improving osseointegration and soft tissue adaptability, bioceramics and zirconia-based materials lower the risk of peri-implant mucosal recession and guarantee long-term prosthetic success.

Effect on Perio-Prosthodontic Relations: By enhancing the stability of soft and hard tissues around implants, these developments guarantee that prosthetic restorations are maintained by a healthy periodontal environment.

5. Interdisciplinary Collaboration and Systemic Approaches Recent perio-prosthodontic advancements emphasize interdisciplinary teamwork and a systemic approach to treatment planning, integrating periodontal and prosthetic goals. [34-36]

Team-Based Care: In order to provide restorations that respect periodontal health, periodontists work with prosthodontists to determine periodontal limits (such as bone loss and gingival biotype). Prosthodontists, for instance, modify shapes and margin location in response to periodontal evaluations.

Periodontal Medicine: The idea of periodontal medicine emphasises how systemic health and periodontal inflammation are correlated, which affects how prosthetic treatment is planned. Prosthetic longevity is supported by healthy periodontal tissues, which lower systemic inflammation.

Optimisation of Pre-Prosthetic Periodontal Health: In order to ensure proper COL and periodontal stability, periodontal conditions are optimised prior to prosthetic therapy using techniques like as crown lengthening, soft tissue grafting, and guided bone regeneration.

Effect on Prostho-Perio Relations: In order to minimise issues like gingival inflammation and attachment loss, interdisciplinary teamwork guarantees that prosthetic restorations are created with periodontal health as a priority.

6. Regenerative Therapies and Personalized Medicine Regenerative approaches and personalized diagnostics have advanced perio-prostho relations by tailoring treatments to individual periodontal and prosthetic needs.

3D Bioprinting: By enabling customised regeneration of periodontal abnormalities, 3D bioprinting of periodontal tissues and scaffolds enhances the base for prosthetic restorations. This technology improves aesthetic results and lessens intrusiveness. AI and molecular diagnostics (such as salivary biomarkers) are used in personalised diagnostics to evaluate periodontal risk and direct pre-prosthetic care, guaranteeing that restorations are positioned in a stable periodontal environment. [37]

Regenerative Periodontal Therapies: These methods, which support abutment teeth or implants for prosthetic restorations, include growth factor delivery, stem cell therapies, and enamel matrix derivatives. **Effect on Perio-Prostho Relationships:** Customised regeneration treatments improve periodontal health, which strengthens the base for prostheses and leads to better long-term results. [38]

CONCLUSION

In order to achieve successful dental restorations that combine function, aesthetics, and periodontal health, the link between prosthodontics and periodontology is essential. Because they have a direct impact on plaque retention, gingival inflammation, and long-term periodontal stability, prosthetic parameters such restorative shapes, margin location, and material biocompatibility must be carefully considered for effective perio-prostho integration. In addition to resolving periodontal disease and tissue deficiencies, pre-prosthetic periodontal examination, which includes gingival biotype, biological width, and clinical crown length, guarantees a firm basis for restorations. This interdisciplinary synergy has been further improved by recent developments, such as digital technology (CAD/CAM, 3D printing, AI), biomaterials (scaffolds, nanoparticles), laser therapies, and regenerative procedures (3D bioprinting, stem cell therapy). These developments facilitate accurate prosthetic designs, encourage periodontal regeneration, and lessen issues like gingival recession and peri-implantitis. To match the objectives of prosthetics with periodontal health, interdisciplinary cooperation between periodontists and prosthodontists is crucial, as is individualised

treatment planning. In order to provide restorations that are aesthetically beautiful, functionally sound, and biologically compatible—thereby guaranteeing the best possible patient results and the longevity of the restoration—a harmonic perio-prostho connection is ultimately essential.

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References

1. Lang NP, Kiel RA, Anderhalden K. Clinical and microbiological effects of subgingival restorations with overhanging or clinically perfect margins. *J Clin Periodontol.* 1983;10(6):563-78.
2. Valderhaug J, Ellingsen JE, Jokstad A. Oral hygiene, periodontal health and need for replacement of dental restorations. *J Oral Rehabil.* 2006;33(11):811-9.
3. Quirynen M, Bollen CM. The influence of surface roughness and surface-free energy on supra- and subgingival plaque formation in man. A review of the literature. *J Clin Periodontol.* 1995;22(1):1-14.
4. Nyman S, Lindhe J. A longitudinal study of combined periodontal and prosthetic treatment of patients with advanced periodontal disease. *J Periodontol.* 1979;50(4):163-9.
5. Orkin DA, Reddy J, Bradshaw D. The relationship of the position of crown margins to gingival health. *J Prosthet Dent.* 1987;57(4):421-4.
6. Bergenholtz A, Olsson A. Efficacy of plaque removal using interdental brushes and waxed dental floss. *Scand J Dent Res.* 1984;92(2):153-9.
7. Bergman B, Hugoson A, Olsson CO. Caries, periodontal and prosthetic findings in patients with removable partial dentures: a ten-year longitudinal study. *J Prosthet Dent.* 1982;48(5):506-14.
8. Chu SJ, Tan JH, Stappert CF, Tarnow DP. Gingival zenith positions and levels of the maxillary anterior dentition. *J Esthet Restor Dent.* 2009;21(2):113-20.
9. Gargiulo AW, Wentz FM, Orban B. Dimensions and relations of the dentogingival junction in humans. *J Periodontol.* 1961;32:261-7.
11. Chu SJ, Tan JH, Stappert CF, Tarnow DP. Gingival zenith positions and levels of the maxillary anterior dentition. *J Esthet Restor Dent.* 2009;21(2):113-20.
12. Becker CM, Kaldahl WB. Current theories of crown contour, margin placement, and pontic design. *J Prosthet Dent.* 1981;45(3):268-77.
13. Orkin DA, Reddy J, Bradshaw D. The relationship of the position of crown margins to gingival health. *J Prosthet Dent.* 1987;57(4):421-4.
14. Donovan TE, Gandara BK, Nemetz H. Review and survey of medicaments used with gingival retraction cords. *J Prosthet Dent.* 1985;53(4):525-31.
15. Becker CM, Kaldahl WB. Current theories of crown contour, margin placement, and pontic design. *J Prosthet Dent.* 1981;45(3):268-77.

16. Lang NP, Löe H. The relationship between the width of keratinized gingiva and gingival health. *J Periodontol.* 1972;43(10):623-7.
17. Armitage GC. Periodontal diagnoses and classification of periodontal diseases. *Periodontol* 2000. 2004;34:9-21. Kois JC. Altering gingival levels: the restorative connection part I: biologic variables. *J Esthet Dent.* 1994;6(1):3-9.
18. Bergman B, Hugoson A, Olsson CO. Caries, periodontal and prosthetic findings in patients with removable partial dentures: a ten-year longitudinal study. *J Prosthet Dent.* 1982;48(5):506-14.
19. Zitzmann NU, Berglundh T. Definition and prevalence of peri-implant diseases. *J Clin Periodontol.* 2008;35(8 Suppl):286-91.
20. Hempton TJ, Dominici JT. Contemporary crown-lengthening therapy: a review. *J Am Dent Assoc.* 2010;141(6):647-55.
21. Kois JC. Altering gingival levels: the restorative connection part I: biologic variables. *J Esthet Dent.* 1994;6(1):3-9. Goodacre CJ, Campagni WV, Aquilino SA. Tooth preparations for complete crowns: an art form based on scientific principles. *J Prosthet Dent.* 2001;85(4):363-76.
22. Hempton TJ, Dominici JT. Contemporary crown-lengthening therapy: a review. *J Am Dent Assoc.* 2010;141(6):647-55.
23. Scharf D. Revolutionizing oral health: latest advances in periodontology. *DrScharf.com.* 2023. Tribst JPM, Piva GKR, Kleverlaan CJ. Advancements in dental care: the evolving landscape of prosthetic dentistry. *Medicina.* 2023;59(8):1423.
24. Hassan SA, Bhateja S, Arora G, Prathyusha F. Latest advancement in periodontology. *IP Int J Periodontol Implantol.* 2020;5(3):97-100.
25. Shanbhag S, Dahiya M, Croucher R. Empowering modern dentistry: the impact of artificial intelligence on patient care and clinical decision making. *J Clin Med.* 2023;12(14):4712.
26. Dong J, Li M, Zhou J, et al. Recent advances in metal nanoparticles to treat periodontitis. *J Nanobiotechnology.* 2023;21:283.
27. Liang Y, Tarafder S, Lee CH. Recent advances in periodontal regeneration: a biomaterial perspective. *Bioact Mater.* 2020;5(2):297-308.
28. Woo HN, Cho YJ, Tarafder S, Lee CH. The recent advances in scaffolds for integrated periodontal regeneration. *Bioact Mater.* 2021;6(10):3328-42. 8. Special issue: recent advances in periodontics and dental implantology. *Medicina.* 2023.
29. Hassan SA, Bhateja S, Arora G, Prathyusha F. Latest advancement in periodontology. *IP Int J Periodontol Implantol.* 2020;5(3):97-100.
30. Lazăr AP, Dinulescu T, Dako T, et al. Laser in periodontology: a review of the fields of applicability and therapeutic effects. *Rom J Oral Rehabil.* 2022;14:108.
31. Harrel SK, Nunn ME, Abraham CM, et al. Videoscope assisted minimally invasive surgery (VMIS): 36-month results. *J Periodontol.* 2018;89(6):528-35.
32. Dong J, Li M, Zhou J, et al. Recent advances in metal nanoparticles to treat periodontitis. *J Nanobiotechnology.* 2023;21:283.
33. OviDentalGo. Crown-lengthening surgery can be a viable option for facilitating restorative therapy or improving esthetic appearance. X. 2025.
34. Ketterl W. The role of the prosthodontist in the treatment of periodontal disease. *Int Dent J.* 1980;30(2):114-20.
35. Karoussis IK, Kotsovilis S, Fourmouis I. Periodontics and prosthodontics: goals, objectives, and clinical reality. *J Prosthet Dent.* 1986;56(5):610-4.
36. Kinane DF, Stathopoulou PG, Papapanou PN. The future of periodontology. *Decisions Dent.* 2018;4(2):18-22.
37. Liang Y, Tarafder S, Lee CH. Recent advances in periodontal regeneration: a biomaterial perspective. *Bioact Mater.* 2020;5(2):297-308.
38. Almeida ND, Carneiro CA, De Marco AC, et al. 3D bioprinting techniques and bioinks for periodontal tissues regeneration—a literature review. *Biomimetics.* 2024;9(8):480. 21. DanielM1960. AI and 3D bioprinting unite for personalized gum regeneration. X. 2025.