The tissue-first prosthodontic concept: A biological maintenance strategy for long-term provisionalization

Abstract

In fixed and implant prosthodontics, the provisional restoration phase is an important stage before delivery of the final prosthesis. It plays a key biological role in maintaining gingival health, peri-implant tissue stability, and emergence profile development. The interaction between provisional restorations and periodontal tissues is influenced by factors such as marginal adaptation, oral hygiene, restoration contour, surface roughness, and material biocompatibility. However, maintenance of soft tissue health during prolonged provisionalization remains inadequately addressed. Patients often wear provisional restorations for extended periods because of complex rehabilitation protocols, implant osseointegration, financial constraints, or multidisciplinary treatment planning. During this time, biofilm accumulation may cause gingival inflammation, bleeding on probing (BOP), and attachment loss if uncontrolled. Inflamed tissues can interfere with critical prosthodontic procedures and reduce treatment predictability.

While periodontal literature provides strong evidence for the importance of professional biofilm removal and supportive periodontal therapy, there is a clear gap in prosthodontic literature regarding structured prophylaxis protocols specifically during the provisional stage. Current guidelines focus mainly on final restorations or general periodontal maintenance, without defining standardized approaches for patients undergoing long-term provisionalization.

This concept paper introduces a novel "tissue-first" prosthodontic approach focused on maintaining soft tissue health throughout the provisional phase. The proposed protocol combines frequent professional maintenance with low-abrasive air-polishing and gentle ultrasonic instrumentation to disrupt biofilm, prevent microbial maturation, and preserve a healthy gingival environment. In addition, a 0.12% chlorhexidine mouthwash is recommended before the final impression to promote a clean clinical environment and improve impression predictability. The biological rationale is supported by evidence on biofilm maturation, gingival inflammation, and the influence of soft tissue conditions on impression accuracy, although direct clinical studies on high-frequency maintenance during provisionalization are currently lacking.

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Authors

Phophi Kamposiora[1*]
George Papavasiliou[2]
Ioanna Kontouli[3]
Ioannis Papathanasiou[4]
Anna Tasakou[3]
Angeliki Lamprinoudi[4]
Marco Ferrari[5]

1
Assoc. Professor, Chair of Department of Prosthodontics, School of Dentistry, National and Kapodistrian University of Athens, Greece

2
Asst. Professor, Department of Prosthodontics, School of Dentistry, National and Kapodistrian University of Athens, Greece

3
Dentist, Postgraduate Student, Department of Prosthodontics, School of Dentistry, National and Kapodistrian University of Athens, Greece

4
Prosthodontist, Research Associate, Department of Prosthodontics, School of Dentistry, National and Kapodistrian University of Athens, Greece

5
Professor, Department of Medical Sciences, Surgery and Neurosciences, University of Siena, Siena, Italy

* Corresponding author

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INTRODUCTION

During the provisional phase in prosthodontic treatment, especially in extensive full-mouth rehabilitation cases, patients often need to remain with provisional restorations for a prolonged period of time (1). The relationship between provisional restorations and the periodontal tissues is dynamic and can be affected by several factors, such as marginal fit, contour, surface roughness, and the biocompatibility of the materials used (2). According to the literature, such situations are associated with accelerated dental plaque accumulation, which is associated with the development of gingival inflammation (3). This inflammation may negatively affect several stages of prosthodontic treatment and compromise clinical outcomes.

Despite this, in clinical practice, the maintenance of soft tissue health during prolonged provisionalization remains insufficiently addressed. While periodontal literature provides strong evidence for the importance of professional biofilm removal and supportive periodontal therapy (4-6), there is still a clear lack of prosthodontic studies that describe structured prophylaxis protocols specifically during the provisional phase. Current guidelines focus mainly on final restorations or general periodontal maintenance, without defining standardized approaches for patients undergoing long-term provisionalization. For this reason, there is a need to introduce a biologically driven, 'tissue-first' prosthodontic concept that integrates frequent professional maintenance into the provisional period.

Biological Background: Biofilm and Microbial Succession

The development of biofilm occurs rapidly and follows a specific microbial sequence. In the early stages, it is mainly dominated by Streptococcus spp., then in the intermediate stages by Actinomyces spp., and finally in the later stages by more pathogenic species such as Porphyromonas, Prevotella, Tannerella, and Treponema. This microbial succession is associated with gingival inflammation, increased bleeding tendency, and crevicular fluid exudation. Biofilm accumulation is considered the main etiological factor for gingival inflammation and the progression of periodontal disease (7). Dental plaque biofilms undergo rapid structural and compositional changes within the first week, becoming increasingly dense and complex over time, with reduced internal oxygen levels and altered microbial composition, which may compromise both biofilm removal and tissue health (8). Within approximately 10 days, the biofilm shifts toward a more anaerobic and pathogenic composition, leading to increased inflammation, and at the same time it becomes more organized and more difficult to remove. Provisional restorations are associated with increased plaque accumulation, surface roughness, and marginal discrepancies, which promote the establishment and maturation of complex microbial biofilm. In addition, microorganisms like Candida albicans may also be detected, especially in cases where provisional restorations are used for a longer period. Conventional oral hygiene measures performed by patients are often insufficient to control subgingival biofilm, especially in areas with complex prosthetic morphology or subgingival margins of provisional restorations. Professional biofilm control may therefore be beneficial, particularly in high-risk prosthodontic situations (9). Air-polishing using low-abrasive powders such as erythritol or glycine has been extensively studied as an alternative to conventional mechanical debridement (10-12). Low-abrasive air-polishing powders are significantly more effective in reducing subgingival bacterial counts compared to curettes. This is particularly important in areas of limited access, such as interproximal surfaces. More recent randomized clinical trials suggest that the additional use of subgingival air-polishing may help shift the subgingival microbiome towards a more balanced (eubiotic) state, with a reduction in important periodontal pathogens such as Tannerella forsythia and Treponema denticola. This microbial shift plays an important role in maintaining periodontal stability over time. Importantly, most of these studies are focused on periodontal therapy or maintenance in patients with periodontitis or peri-implantitis (13). There is still no structured evidence that examines the use of these protocols during the provisional prosthodontic phase (14), where proper tissue conditioning is critical for the success of the final restoration.

Provisional Restorations as a Risk Factor

It has been shown that provisional restorations are more prone to faster biofilm accumulation. They often exhibit greater surface roughness and marginal discrepancies, which create favorable conditions for easier and more rapid microbial adhesion (15-17). Provisional restorative materials, especially polymethyl methacrylate and bis-acryl resins, tend to show higher surface roughness, some degree of porosity, and possible marginal discrepancies, which can favor the rapid formation and maturation of a more complex microbial biofilm. All these factors affect soft tissues, leading to inflammation, bleeding, and an increase in gingival crevicular fluid. In addition, provisional restorations often show significant marginal leakage, which allows micro-penetration of microorganisms beneath the restorations. When this persists for a prolonged period, especially in extensive provisionalization, secondary caries are frequently formed in the abutment teeth (18-21). At the same time, gingival recession has also been reported in the literature during the period of provisional restorations (22, 23). Additionally, there may be an association with halitosis during long-term provisionalization, due to

increased biofilm accumulation and the production of volatile sulfur compounds which are mainly responsible for the oral malodor (24).

Prosthodontic Implications

The biofilm associated with the material of provisional restorations leads to gingival inflammation, causing increased blood flow, easier bleeding, and more crevicular fluid production. All these factors can affect the overall prosthodontic procedure, especially during the final impression and the final cementation of the restorations, since both are very sensitive steps where the presence of moisture, blood, or inflammation is not acceptable. In conventional impression techniques, the presence of blood can negatively affect the performance of impression materials, particularly polyvinyl siloxanes, which are mainly hydrophobic. This contamination compromises the accurate capture of preparation margins, resulting in distortions in the definitive impression and reduced precision of the final prosthetic restoration (25). In contrast, intraoral scanning (IOS) systems depend on optical data acquisition and therefore require a clean, dry, and contamination-free field for accurate capture of tooth morphology and finish lines. The presence of blood disrupts light reflection and interferes with image stitching, resulting in artifacts, loss of detail, and diminished accuracy. Unlike conventional impression materials, which may partially displace fluids, intraoral scanners cannot tolerate bleeding or crevicular fluid, and this is why IOS is particularly sensitive to gingival inflammation. These conditions may also compromise the final cementation procedure, since adhesive systems are sensitive to moisture and their proper function is compromised when any humidity is present (26, 27).

Identification of the Clinical Gap

In the prosthodontic literature, the focus is mainly on the importance of provisional restorations in shaping soft tissues, guiding the emergence profile, and improving esthetics and function. However, most studies are centered on design-related factors such as contour, marginal fit, and occlusion, rather than on maintenance protocols during this phase. Currently, there is no evidence defining the optimal frequency of professional maintenance during the provisional stage, and no prosthodontic protocol that integrates biofilm control as part of the overall treatment strategy. In addition, there are no specific guidelines for the follow-up and management of patients with extensive or long-term provisional restorations. As a result, clinicians often rely on general periodontal maintenance recommendations, which may not be adequate for cases with increased plaque-retentive factors and long provisional periods. This gap is important, since provisional restorations usually present higher surface roughness and marginal discrepancies, which favor biofilm accumulation. This leads to soft tissue inflammation and may compromise the predictability of subsequent prosthodontic procedures. Therefore, a tissue-first prosthodontic approach seems necessary, where soft tissue health is actively maintained throughout the provisional phase. Supportive periodontal therapy is usually performed at intervals of 3–6 months and is based on professional mechanical plaque removal using ultrasonic instruments and air-polishing systems. Although this combined approach has been shown to be effective in controlling biofilm and maintaining periodontal stability, its systematic use during the provisional prosthodontic phase has not been sufficiently investigated.

PROPOSED CONCEPT: TISSUE-FIRST PROSTHODONTIC APPROACH

The following protocol is proposed at the Postgraduate Clinic of Prosthodontics and Implant Prosthodontics, Dental School, National and Kapodistrian University of Athens, for maintaining periodontal tissue health during the provisional phase:

1. Patient recall every 10–15 days, where a combined approach is applied using supragingival and subgingival air-polishing with low-abrasive powders (erythritol, trehalose, glycine), followed by a very gentle use of ultrasonic instrumentation. Both procedures aim at disrupting the biofilm and preventing the development of inflammation (28). At this point, it should be mentioned that an initial evaluation of each patient is performed in order to decide whether the recall interval will be every 10 or 15 days. In patients with very good oral hygiene and short span provisional restorations, recall is set at 15-day intervals, while patients who have some difficulty maintaining effective oral hygiene and present with long span provisional restorations, a 10-day recall schedule is preferred. At the same time, patients are provided with oral hygiene instructions, with particular emphasis on the use of interdental cleaning methods. Professional maintenance was performed using a Vector® Paro Pro ultrasonic system (DÜRR DENTAL SE, Bietigheim-Bissingen, Germany) combined with a MyLunos® Pro powder jet handpiece (DÜRR DENTAL SE, Bietigheim-Bissingen, Germany).
2. In addition, we recommend the use of 0.12% chlorhexidine mouthwash 7 days prior to the scheduled appointment for the final impression. As a detail, we prefer chlorhexidine products that do not cause staining, since provisional restorations tend to accumulate pigments more easily due to their porosity (29).

When chlorhexidine use is recommended, patients should be advised to use toothpaste free of sodium lauryl sulfate (SLS). If they are already using an SLS-con-

taining toothpaste, it is preferable to instruct them to perform chlorhexidine rinsing 30–45 minutes after toothbrushing, as evidence shows that the immediate interaction between SLS and chlorhexidine can significantly reduce its effectiveness (30-32). This proposed protocol emphasizes frequent professional biofilm control through scheduled air-polishing and ultrasonic instrumentation, supported by adjunctive antimicrobial measures such as chlorhexidine use and reinforced patient oral hygiene.

Clinical Rationale

The biological and prosthetic rationale of this approach is based on the need for continuous control of microbial biofilm and maintenance of periodontal tissue stability throughout prolonged provisionalization. By performing a recall interval of 10–15 days (adjusted according to the individual patient, the extent of the restorations, and their ability to maintain effective oral hygiene) the protocol aims to prevent the maturation of pathogenic biofilm, maintain periodontal stability, and preserve epithelial attachment. From a prosthodontic perspective, these conditions could potentially facilitate impression procedures, support gingival margin stability, and contribute to a more predictable emergence profile. However, these assumptions require validation through clinical studies. The proposed recall interval is intended to provide regular professional biofilm control and support periodontal tissue health throughout the provisional phase. By scheduling professional intervention within this timeframe, it becomes possible to disrupt the biofilm before full maturation occurs, thereby preventing the onset of gingival inflammation. Additionally, more effective removal of excess provisional cement is achieved, further supporting periodontal health and minimizing localized inflammatory responses. Furthermore, regular professional biofilm control could potentially reduce factors associated with secondary caries development and gingival recession. Nevertheless, this hypothesis has not yet been clinically validated in the context of prolonged provisionalization. Regarding the proposed use of chlorhexidine, evidence indicates that a 0.12% solution used twice daily is effective in reducing microbial plaque and biofilm, as well as significantly decreasing periodontal pathogenic bacteria. Additionally, there are reports suggesting that such supplementary measures may facilitate the optimal process of the final impression taking (29).

DISCUSSION

This concept links prosthodontic treatment with the long-term maintenance of periodontal health, emphasizing the preservation of therapeutic outcomes over time. It represents a shift from a restoration-driven approach toward a biologically oriented prosthodontic philosophy, in which soft tissue health is considered a fundamental factor for prosthetic success, rather than a secondary outcome. While conventional prosthodontics primarily focuses on mechanical and esthetic parameters, this approach prioritizes the stability and health of the periodontal tissues during long term provisionalization. Although current evidence supports the effectiveness of air-polishing and ultrasonic instrumentation in periodontal maintenance (33-38), a gap remains in the literature regarding their systematic application during the provisional phase of prosthodontic treatment. One possible explanation for the lack of prosthodontic maintenance protocols is that provisional restorations have traditionally been considered temporary treatment stages rather than active biological phases requiring dedicated maintenance strategies. This highlights the need for further investigation into structured biofilm control protocols specifically for patients with interim restorations. In particular, the accumulation and maturation of microbial biofilm on provisional materials (38,39), together with their increased surface roughness and possible marginal discrepancies, create favorable conditions for the development of gingival inflammation. From a prosthodontic point of view, the condition of the soft tissues at the time of the final impression is very important. The presence of blood and gingival crevicular fluid is well known to negatively affect the accuracy of both conventional and digital impressions. The proposed protocol was developed to address this issue by introducing more frequent professional biofilm control during the provisional phase, combined with antimicrobial support and individualized oral hygiene instructions. By targeting the biofilm–inflammation relationship, this approach aims to disrupt microbial maturation, reduce gingival inflammation, and create a more stable soft tissue environment without bleeding. The suggested recall interval of 10–15 days was selected to provide frequent professional maintenance and continuous control of plaque accumulation during prolonged provisionalization. However, it should be emphasized that this interval is based on biological rationale rather than clinical consensus and may require adjustment based on individual patient risk factors, including oral hygiene status, periodontal condition, and the duration of provisionalization. The supplementary use of chlorhexidine as part of the proposed protocol is supported by its well-established antiplaque and anti-inflammatory properties (33,40). A potential limitation of the proposed approach is the increased number of maintenance visits, which may affect patient compliance and treatment costs. Consequently, the protocol may not be applicable to all patient groups and should probably be individualized according to risk profile and treatment complexity.

Regarding the limitations of the protocol, the present concept is mainly based on biological rationale and indirect evidence rather than direct clinical validation.

Additionally, the use of chlorhexidine before the final impression day is supported by its well-known anti-plaque and anti-inflammatory effects but there is still limited evidence showing that it can specifically reduce bleeding at the time of impression. Moreover, other limitations should be considered, including the lack of randomized clinical trials specifically in prosthodontic patients and the absence of long-term comparative data.

In conclusion, the integration of microbiological and periodontal principles into prosthodontic treatment planning appears to be a promising approach for improving clinical outcomes especially during provisionalization period. Considering the provisional phase as an active stage of soft tissue conditioning, the proposed concept highlights a potential strategy for optimizing both conventional and digital prosthodontic workflows. Future prospective clinical studies should evaluate the optimal recall interval, patient compliance, cost-effectiveness, periodontal outcomes, and the influence of maintenance protocols on definitive restorative procedures. This tissue-first concept reflects a shift toward a more biologically driven approach, where soft tissue health is considered an essential part of prosthodontic treatment.

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