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OVERLAY DENTURES: REDEFINING COMFORT AND FUNCTIONALITY

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Abstract

Managing partial edentulism in patients with limited interarch space presents significant challenges, particularly when dealing with anatomical and functional constraints such as tooth extrusion, alveolar ridge extrusion, and reduced vertical clearance. Overlay prosthetics, including overdentures, offer a practical solution for restoring occlusion, function, and aesthetics in such cases.

These prostheses, which rest on natural teeth, tooth roots, or implants, enhance masticatory efficiency and provide superior retention. However, the implementation of overlay prosthetics in patients with limited space requires meticulous planning, conservative approaches, and the use of advanced techniques like CAD/CAM technology, implant placement, and surgical guides.

While overlay prosthetics offer significant functional and aesthetic benefits, challenges such as maintaining occlusal vertical dimension (OVD), debonding, and patient adaptation need to be carefully managed. Ongoing research and individualized treatment strategies are crucial for achieving optimal outcomes in these complex cases.

Keywords: Overlay Prosthetics, Limited Interarch Space, Overdentures, Telescopic dentures, Coping prosthesis

Introduction

Managing partial edentulism can be particularly challenging when complicated by limited interocclusal space. The extrusion of opposing teeth, coupled with alveolar ridge extrusion in the edentulous areas, significantly reduces the available space for fabricating either removable or fixed prostheses, particularly in cases where the edentulous regions are located in the maxilla.[1]

These anatomical and functional constraints necessitate innovative solutions to achieve optimal rehabilitation outcomes. Overlay prosthetics offer a practical approach by enhancing or replacing the occlusal surfaces of teeth, addressing both functional and structural concerns.[2] An overdenture is a removable dental prosthesis designed to cover and rest on one or more natural teeth, tooth roots, and/or dental implants. This type of prosthesis, also referred to as an overlay denture, overlay prosthesis, or superimposed prosthesis, combines support from both natural structures and artificial components.[3]

Compared to conventional prostheses, overdentures provide superior chewing efficiency. To enhance retention and maintain alveolar bone integrity, mandibular canines are often preserved as strategic abutments.[4] However, implementing overlay prosthetics in patients with limited interarch space presents distinct challenges. These cases demand highly tailored strategies, meticulous planning, and advanced techniques to overcome constraints and deliver satisfactory outcomes.

The primary difficulty lies in the insufficient vertical clearance associated with limited interarch space, which directly impacts the retention, stability, and comfort of the prosthesis.[5]

Addressing these issues requires a combination of restorative approaches that focus on restoring the occlusal vertical dimension (OVD), optimizing material choices, and employing modern technologies such as CAD/CAM for precision fabrication.[6] This article provides a comprehensive overview of overlay prosthetics in patients with limited interarch space.

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Etiology of Limited Interarch Space

The etiology of limited interarch space encompasses various factors that contribute to a reduction in vertical dimension, complicating prosthetic rehabilitation. Severe tooth wear resulting from attrition, erosion, or abrasion is a primary cause, as the progressive loss of dental structures diminishes the available space for prostheses.

Additionally, congenital and acquired conditions such as micrognathia, craniofacial deformities, or trauma can significantly alter the natural alignment and spacing of the dental arches, further limiting interarch clearance. Improper prosthetic rehabilitation, particularly over-reduction during previous restorative procedures, can exacerbate these issues by unnecessarily compromising the vertical dimension, leading to challenges in achieving adequate retention, stability, and functionality in subsequent prosthetic treatments.[7] The etiology of limited dental interarch space is multifaceted, influenced by a combination of skeletal and dental factors that often result in malocclusions.

These conditions manifest as crowding, spacing irregularities, or deviations in arch form, and are commonly observed in both primary and mixed dentition, necessitating timely orthodontic intervention. Crowding is a major factor, with a prevalence of 10.8% in primary dentition and 49.7% in mixed dentition, contributing significantly to space limitations.[8]

Skeletal factors such as narrow maxillary arches and abnormal arch forms further exacerbate space deficiencies, often compounded by orofacial dysfunctions. To address these issues, orthodontic techniques like proximal stripping, molar distalization, and arch expansion are utilized to create the necessary interarch space.

In more severe cases, surgical interventions such as posterior maxillary segmental osteotomy can effectively increase the space, enabling restorative or prosthetic options. Genetic and developmental influences also play a pivotal role, with hereditary factors like mandibular crowding contributing to progressive space reduction due to a decrease in arch perimeter over time Together, these factors underscore the importance of accurate diagnosis and meticulous planning in managing cases of limited interarch space.[9]

Coping

According to GPT-10 Coping is defined as a thin covering or crown made of metal alloy or ceramic that is luted to an abutment supporting an overdenture, fixed partial denture, or fixed complete denture; Editorial note for usage: the metal casting for a metal-ceramic crown or fixed partial denture is referred to as a framework. Copings in prosthodontics serve to cover and protect prepared teeth or abutments, offering support for various dental prostheses such as crowns, bridges, and overdentures.

Based on material, they can be metal (gold alloys, cobalt-chromium), zirconia (high-strength ceramic), porcelain (layered for aesthetics), or hybrid (combining strength and appearance). By design, copings are classified as short (minimal height for streamlined overdentures), long (extended height for stability), conical (tapered for precise retention), parallel-walled (uniform walls for frictional retention), or custom-designed for specific needs. Functionally, protective copings shield weakened tooth structures, retention copings enhance prosthetic stability, and telescopic copings act as primary components in double crown systems for added retention.

In overdentures, bar copings distribute occlusal forces via connected structures, while ball attachments provide retention with removable prostheses. The choice of coping depends on clinical requirements, prosthetic goals, and patient-specific factors to ensure optimal aesthetics, functionality, and durability. Short-coping overdentures involve covering the remaining natural teeth with short, rounded gold copings, offering a streamlined design for support and protection. In contrast, long-coping overdentures enhance stability by utilizing greater tooth height. However, this approach should be carefully considered, as the increased height may interfere with the proper placement of artificial teeth or disrupt the desired denture contour.

Both techniques aim to preserve the underlying natural teeth while providing a functional and aesthetically acceptable solution, with the choice between them depending on individual anatomical and prosthetic requirements.

Short Coping:

Short coping are 2-3mm length and should be in Dome form as coronal tooth reduction can expose the pulp, it needs endodontic treatment.

Long Coping:

Long cast copings are normally 5-8 mm long, conservative reduction of coronal tooth structure is done. The end result is long ellipsoidal shaped coronal coping and a larger crown root ratio. Consequently, long cast coping requires a greater level of osseous support

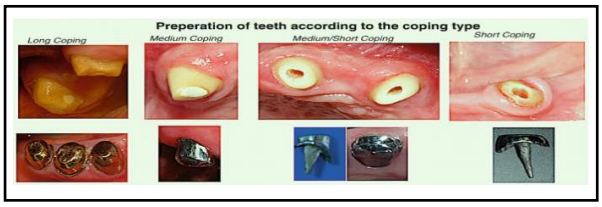

Figure1: Types of Coping

Figure 2: Dome shaped preparation

Abutment are endodontically treated & reduced to 1-2 mm above gingival margin. Metal dome shaped cast coping constructed to cover abutment.

The metal coping has a short post cemented into root canal to retain the coping

Clinical Aspects and Considerations for Overlay Prosthetics in Patients with Limited Interarch Space

When designing the occlusion for an overlay denture opposing natural teeth, fixed partial dentures (FPD), removable partial dentures (RPD), or implant-retained prostheses, several considerations are critical for functional efficiency, stability, and patient comfort. For overlay dentures opposing natural teeth, a balanced occlusion is typically used to distribute masticatory forces evenly and prevent excessive wear on the overlay prosthesis.

In cases where the overlay opposes an FPD, anterior guidance is preferred to ensure disocclusion of posterior teeth during lateral and protrusive movements, with even posterior contacts to avoid damage to the FPD. When opposing an RPD, the occlusion should ensure shared load distribution between the overlay and the RPD, with careful attention to avoid direct occlusal stress on RPD components like clasps or denture bases.

For overlay dentures opposing implant-retained prostheses, a stable, centric occlusion aligned with the implants' axes is essential, ensuring that the implants bear the majority of the occlusal load while minimizing lateral or

tipping forces that could cause implant overload. In all scenarios, occlusal adjustments are key to achieving a stable, comfortable bite that ensures long-term durability and patient satisfaction.[10]

Overlay prosthetics, including tooth-supported overdentures, play a critical role in managing cases with limited interarch space, particularly in patients with a few remaining natural teeth.

These prostheses are indicated for individuals with periodontally healthy teeth or reversible periodontal conditions and are especially beneficial in cases of reduced alveolar ridge height, xerostomia, high palatal vaults, or unfavourable tongue and muscle positions that compromise prosthetic stability and retention.[11]

Limited interarch space can further complicate treatment by reducing the vertical clearance required for prosthetic components, leading to thinner denture bases and an increased risk of fracture. Teeth unsuitable for conventional fixed or removable prostheses due to unfavorable positions or structural compromises can be adapted as abutments to support overlay prosthetics, providing functional and aesthetic restoration even in challenging cases.[12]

Overlay prosthetics are particularly advantageous in complex scenarios, such as patients who have undergone head and neck radiation therapy or are on bisphosphonates or anti-angiogenic medications, where maintaining devitalized roots can help avoid complications like osteoradionecrosis.

However, the limited interarch space necessitates precise planning and careful abutment selection to ensure optimal outcomes.[13] Criteria for abutments include healthy periodontal support, ease of endodontic treatment, adequate tooth structure for restoration, and strategic distribution to support the prosthesis.

While offering significant benefits, such as alveolar bone preservation, enhanced proprioception, and better adaptation for future edentulism, overlay prosthetics in these patients require meticulous design to address space limitations and avoid thin or compromised acrylic bases. The use of advanced techniques and materials can overcome these challenges, ensuring functional stability and patient satisfaction.[14]

Strategies for Overlay Prosthetics

Overlay dentures are an essential solution for managing partial edentulism, particularly when limited interarch space complicates the fabrication of traditional removable or fixed prostheses. These prostheses are designed to rest on natural teeth, tooth roots, or implants, offering enhanced retention, stability, and masticatory efficiency. (Fig3) When opposing natural teeth, overlay dentures benefit from the proprioception provided by the natural structures and help preserve alveolar bone integrity.

In cases where(Fig4) fixed partial dentures (FPD) or removable partial dentures (RPD) (Fig3) are used as the opposing prostheses, overlay dentures can complement these restorations, improving function and aesthetics by distributing masticatory forces evenly.

Implant-retained overlay dentures (Fig5) provide superior support and stability, especially in cases where there is insufficient vertical clearance or bone loss. However, successful implementation requires careful planning to ensure the supporting teeth or implants have healthy periodontal support, and the overlay is designed to fit within the limited interarch space.

Figure3: Overlay denture opposing natural tooth & RPD

Figure 4: Overlay denture opposing FPD

Figure 5: Implant retained Overdenture

In managing overlay prosthetics, particularly in cases with limited interarch space, conservative approaches are essential to ensure the preservation of natural tooth structure. Minimally invasive preparations are employed to maintain as much of the original tooth as possible, while adhesive systems are utilized to enhance the bond between the overlay and the tooth, ensuring better retention and stability. CAD/CAM technology plays a crucial role in these strategies by enabling precise design and fabrication of the prostheses, allowing for the optimal utilization of available space and ensuring a more accurate fit. This advanced technology helps overcome the challenges posed by limited vertical clearance, reducing the risk of prosthetic failure.[15]

Effective management of limited interarch space requires a combination of innovative techniques and careful planning. Implant placement is a key strategy, with deeply positioned implants utilized to maximize vertical space, allowing for the integration of screw-retained fixed partial dentures that address both occlusal function and aesthetics.[16]

Customized treatment planning further enhances outcomes, with the use of a 3D caramel spacer technique helping to improve stability in cases with abnormal jaw relations or high restorative space, facilitating the creation of hollow dentures. Additionally, surgical guides play a crucial role in restoring acceptable interarch distances by controlling bone reduction during procedures, thereby ensuring sufficient space for prosthetic fabrication.[7] These strategies collectively enable successful prosthetic restoration, even in cases with limited interarch space, by optimizing available space and maintaining both function and aesthetic outcomes.[10]

Additionally, a combination of removable or fixed prostheses may be used depending on the specific needs of the case, allowing for greater flexibility and adaptability in treatment planning. This approach ensures that patients receive the most effective and comfortable prosthetic restoration while addressing the complexities associated with limited interarch space.[17]

Outcomes of Overlay Prosthetics

Overlay prosthetics offer significant outcomes in both functional and aesthetic restoration, especially in cases with limited interarch space. Functional restoration is one of the primary benefits, as fixed prostheses can effectively restore occlusal planes and improve overall functional outcomes.

Even in situations where there has been considerable loss of prosthetic space, these prostheses can help maintain or regain proper occlusion, enhancing masticatory efficiency and improving the patient's ability to chew and speak. Aesthetic considerations are also crucial in overlay prosthetics, and customized designs play a vital role in meeting these requirements.[18]For example, anterior bars for partial overdentures can be designed to support the esthetic needs of patients, providing a natural appearance while also fulfilling functional demands. These tailored designs ensure that both the functional and cosmetic needs of patients are met, leading to improved overall satisfaction.

In challenging scenarios with limited interarch space, overlay prosthetics can significantly improve both functional and aesthetic outcomes. Functional improvement is achieved by restoring occlusal function and enhancing masticatory efficiency, allowing patients to regain their ability to chew and speak comfortably.[18] Aesthetic results are equally important, as the tailored design of the prosthesis

can enhance the patient's appearance, leading to increased confidence and satisfaction.

Additionally, patient acceptance is generally higher due to the minimally invasive nature of these protocols, which involve less discomfort and quicker recovery compared to traditional treatments. As a result, patients are more likely to embrace the treatment plan, leading to higher overall satisfaction and improved quality of life. By addressing the challenges of limited space, overlay prosthetics offer an effective solution that combines both functional restoration and aesthetic enhancement, thereby improving the patient's quality of life.[2,11,14]

Challenges and Limitations

Despite the advantages of overlay prosthetics, several challenges and limitations can impact their long-term success. One of the primary issues is the difficulty in maintaining stable occlusal vertical dimension (OVD) over time, particularly in cases with limited interarch space where ongoing adjustments may be required to ensure proper function and comfort.[19]

Additionally, there is a risk of debonding or fracture of the prosthetic components, especially when space is severely compromised, which can lead to functional failures and the need for frequent repairs or replacements. Another significant challenge is the complexity in patient adaptation to the prosthesis.

Due to the altered occlusion and the space constraints, some patients may experience difficulty in adjusting to the new prosthetic setup, leading to discomfort, dissatisfaction, or increased treatment time. These challenges highlight the need for meticulous planning, regular follow-up visits, and close monitoring to ensure that overlay prosthetics continue to perform effectively and maintain both function and aesthetics over the long term.[19]

Conclusion

In Conclusion, while the strategies discussed for managing limited interarch space, including implant placement, customized treatment planning, and the use of surgical guides, demonstrate effective outcomes in many cases, it is important to recognize that not all situations will lead to optimal results. Patient anatomy plays a crucial role in determining the success of these treatments, as variations in bone structure, arch form, and soft tissue characteristics can significantly impact the prosthetic rehabilitation process.

Furthermore, individual responses to treatment, including healing times, tissue adaptation, and long-term stability, can vary widely. These factors underscore the importance of personalized care and the need for tailored treatment plans that address the specific needs of each patient. As such, ongoing research into innovative techniques and materials is essential to refine existing strategies and overcome the limitations posed by anatomical and clinical challenges. Continued adaptation and advancement of treatment protocols will ensure better outcomes and improved patient satisfaction in managing limited interarch space.

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