MANAGEMENT OF EXTENSIVE DISTAL EXTENSION EDENTULISM: A SYSTEMATIC REVIEW ON IMPLANT-SUPPORTED REMOVABLE PARTIAL DENTURES VS. CONVENTIONAL REMOVABLE PROSTHESES

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ABSTRACT

Aim of the study. The objective of this comprehensive review was to evaluate the clinical, biomechanical, and patient-reported outcomes of implant-supported removable partial dentures (ISRPDs) compared to conventional distal extension removable partial dentures (DERPDs) in patients with Kennedy Class I and II mandibular configurations.

Material and methods. A systematic review of current literature was performed across databases including PubMed, Cochrane Library, Embase, and Web of Science. Although multiple clinical trials and comparative papers were initially screened, exactly 3 studies met the strict inclusion parameters perfectly and were retained for final analytical synthesis based on a precise PICO framework. The reviewed sample involved a pooled total of 334 patients and 581 strategic implants. Key parameters extracted included Patient-Reported Outcome Measures (PROMs) via OHIP-14 and Visual Analogue Scales (VAS), maximum occlusal force alterations, marginal bone loss (MBL), and prosthetic maintenance requirements over mid-to-long-term follow-up intervals.

Results. The structural transition from traditional mucosa-borne prostheses to implant-stabilized designs demonstrated a statistically significant global reduction in OHIP scores (30.5 ± 1.8), highlighting a drastic improvement in oral health-related quality of life. Subjective patient satisfaction scales (VAS) exhibited substantial shifts, particularly across prosthesis stability and chewing comfort domains. Objective mechanical assessments showed a mean increase in maximum occlusal force exceeding 120% due to the establishment of a rigid posterior vertical stop. Biologically, the pooled implant survival rate remained highly predictable between 92% and 100%, with a weighted mean marginal bone loss of 0.98 mm, within physiological norms. Prosthetic maintenance, predominantly involving the replacement of retentive nylon inserts every 12 to 18 months, represented the primary technical intervention.

Conclusions. Strategic implant placement under a distal extension removable framework significantly optimizes biomechanical stability, doubles masticatory parameters, and maximizes patient satisfaction, establishing a highly cost-effective and minimally invasive alternative to complex fixed rehabilitation.

Key words: implant-supported removable partial denture, Kennedy classification, patient satisfaction, occlusal force, marginal bone loss.

INTRODUCTION

The prosthetic rehabilitation of extensive partial edentulism, specifically categorized under Kennedy Class I and Class II configurations, remains an ongoing dilemma in contemporary prosthodontics. For decades, conventional distal extension removable partial dentures (DERPDs) have served as the primary clinical modality for restoring posterior occlusal support without resorting to highly invasive bone augmentation procedures (Jensen et al., 2023).

However, traditional tissue-borne configurations are fundamentally limited by a stark biomechanical discrepancy: the physiological resilience of the residual

alveolar ridge mucosa is up to 100 times greater than the viscoelastic compressibility of the periodontal ligament anchoring the remaining natural abutment teeth (Buda et al., 2024).

Consequently, functional occlusal forces exerted during mastication inevitably trigger a rotational movement and base displacement, functioning as a destructive Class I lever arch. This continuous displacement leads to localized mucosal ulcerations, rapid resorption of the underlying residual alveolar ridge, and detrimental tipping forces transmitted to the remaining abutment teeth, frequently culminating in high patient dissatisfaction and prosthetic abandonment (Zancope et al., 2020).

To overcome these structural limitations, the incorporation of strategic dental implants beneath the distal extension base—yielding an implant-supported removable partial denture (ISRPD)—has emerged as a predictable hybrid standard (Shahmiri & Atieh, 2020). By introducing a rigid implant fixture in the posterior edentulous span, the hazardous distal extension is structurally converted into a bounded, tooth-implant supported span, resembling a Kennedy Class III framework (Buda et al., 2024). This conversion significantly limits rotation and unloads force vectors from both the mucosa and the natural pillars (Gates et al., 2022).

Although the clinical survival of single dental implants is widely validated, aggregate scientific consensus regarding long-term functional shifts, aesthetic integration, and structural maintenance patterns is critical for standardizing clinical protocols (Al-Zubair & Al-Harthi, 2025). Therefore, this review aims to analyze the quantitative and qualitative outcomes of ISRPD interventions against conventional frameworks.

MATERIAL AND METHODS

The methodology utilized in compiling this review follows a strict synthesis of validated clinical data. Quantitative parameters were pooled from systematic databases (including PubMed, Cochrane Library, Embase, and Web of Science) utilizing data filtration patterns established in peer-reviewed clinical trials. During the initial comprehensive screening stage, a large body of literature and comparative clinical trials concerning hybrid partial frameworks was evaluated.

However, following the implementation of strict selection standards, exactly 3 milestone publications (Bandiaky et al., Murakami et al., and de Freitas et al.) corresponded best to the specific inclusion guidelines and were isolated for absolute data pooling. The rigorous inclusion criteria used to screen these core studies were based on a strict PICO strategy: (1) Population: Adult patients presenting with extensive maxillo-mandibular edentulism classified under Kennedy Class I or Class II patterns; (2) Intervention: The utilization of implant-supported or implant-assisted removable partial dentures (ISRPDs) leveraging resilient elements such as Locator abutments or ball attachments; (3) Comparison: Conventional tissue-borne or mucosa-borne distal extension removable partial dentures (DERPDs); (4) Outcomes: Explicit documentation of subjective data (OHIP-14/49, VAS), objective mechanics (maximum occlusal force mapping, chewing test sieves), or biological safety parameters (implant survival, MBL, prosthetic complications). Only prospective cohorts, randomized controlled trials (RCTs), cross-over designs, or multi-center meta-analyses with an active clinical follow-up tracking interval of at least 12 months post-loading were selected.

The collective cohort generated from these 3 main papers resulted in an extensive sample size tracking 334 individual patients and 581 loaded implant fixtures. Primary variables extracted for analysis were subdivided into subjective and objective parameters. Subjective parameters consisted of validated Oral Health Impact Profile questionnaires (OHIP-14 and OHIP-49) and multi-parameter Visual Analogue Scales (VAS) focusing on stability, comfort, and aesthetics (Kim et al., 2022).

Functional objectives comprised measurements of maximum occlusal force obtained via computerized foliar pressure sensors (Dental Prescale System) and spectrofotometric masticatory efficiency assays (Gonçalves et al., 2019). Biological and technical safety data were quantified using pooled implant survival rates, marginal bone loss (MBL) measured via standardized intraoral radiographs (Shahmiri & Atieh, 2020), and documented prosthetic complication frequencies over a clinical tracking period exceeding 12 months (Chorev et al., 2021; Telles et al., 2021).

RESULTS AND DISCUSSIONS

The synthesis of the included clinical trials demonstrates a profound and statistically significant advantage of the hybrid ISRPD configuration over traditional mucosa-borne alternatives. Upon conversion of the conventional RPD to an implant-supported framework via resilient attachment systems (such as Locator or ball attachments), a sharp drop in aggregate OHIP scores was consistently recorded. The definitive mean difference between the treatment modalities reached 30.5 ± 1.8 ($p < 0.001$), signifying a major clinical reduction in physical pain, psychological discomfort, and social functional limitations (Bandiaky et al., 2022).

Subjective patient satisfaction ratings evaluated via 100-mm Visual Analogue Scales (VAS) mirrored these findings, indicating substantial positive shifts (Jensen et al., 2023). The most distinct enhancements were reported within the specific domains of "Prosthesis Stability" and "Chewing Capacity" (Gates et al., 2022). By anchoring the distal portion of the acrylic base to a rigid titanium fixture, horizontal shifting and vertical lifting during speech, laughter, and deglutition were effectively eliminated. In addition, a noted aesthetic enhancement was achieved; shifting the retentive focus posteriorly allowed clinicians to simplify the anterior metal design, frequently minimizing or entirely removing unesthetic buccal clasp arms on highly visible canines or premolars (Kim et al., 2022).

Objective functional evaluations provided empirical validation for the subjective improvements reported by the patients. Computerized occlusal force mapping demonstrated that the introduction of a posterior implant vertical stop resulted in a mean increase in maximum occlusal force exceeding 120% (Murakami et al., 2021). Under a conventional tissue-borne RPD, the force threshold is strictly capped by the patient's pain tolerance relative to mucosal compression. The rigid support of the implant intercepts vertical vectors, preventing mucosal trauma and allowing complete physiological activation of the masseter and temporalis muscle groups without inducing discomfort (Gonçalves et al., 2019). Spectrofotometric and optical sieve analysis of test boluses confirmed that this stabilization directly translates to superior masticatory performance, effectively halving the time required to break down and homogenize challenging food textures.

Biologically, the long-term behavior of the surrounding hard and soft tissues

confirms the safety and predictability of this hybrid configuration. Meta-analytical data tracking a cumulative total of 581 implants under active partial removable loading established a pooled implant survival rate ranging tightly between 92% and 100%, with a weighted average exceeding 96% (de Freitas et al., 2021). This high survival rate debunks historical assumptions that the complex dynamic movements of a removable base could jeopardize osseointegration. Radiographic evaluation of the peri-implant architecture revealed a stable mean Marginal Bone Loss (MBL) of 0.98 mm to 1.0 mm during the initial year of functional loading, which subsequently leveled off within safe physiological bounds below 0.2 mm per annum (Shahmiri & Atieh, 2020).

Moreover, this structural unloading provides significant periodontal protection to the remaining natural dentition; by dissipating horizontal and vertical stresses through the implant fixture, the natural abutment teeth are spared from chronic mobility-inducing torque, significantly prolonging their safe retention on the dental arch (Zancope et al., 2020). Soft tissue complications were minor, consisting primarily of transient peri-implant mucositis closely tied to suboptimal oral hygiene compliance, which was fully managed through professional prophylaxis (Telles et al., 2021). Furthermore, when compared directly with multi-unit fixed implant restorations, the strategic ISRPD approach presents an immensely superior economic cost-effectiveness ratio, making it a powerful minimally invasive treatment alternative (Al-Zubair & Al-Harthi, 2025).

Despite these biological successes, clinicians must prioritize long-term technical maintenance. The dynamic nature of a removable prosthesis subjects the retentive components to continuous frictional wear during daily insertion and removal cycles. The primary technical intervention documented across all trials was the routine replacement or activation of the elastic retentive matrix elements (such as nylon Locator inserts) at regular intervals ranging from 12 to 18 months (Chorev et al., 2021; Gates et al., 2022). Less frequent complications included the structural loosening of attachment abutment screws or micro-fractures within the localized acrylic resin bordering the attachment housing matrix, which were easily repaired chairside.

CONCLUSIONS

1. Implant-supported removable partial dentures (ISRPDs) deliver a statistically superior and clinically profound improvement in oral health-related quality of life and patient satisfaction profiles when contrasted directly with traditional tissue-borne removable frameworks.

2. The strategic introduction of a posterior implant vertical stop successfully modifies the biomechanical lever arch, doubling objective maximum occlusal forces and masticatory efficiency, while offering critical periodontal protection to the remaining natural dentition.

3. This hybrid configuration demonstrates high biological predictability, maintaining an exceptional implant survival rate alongside stable marginal bone levels, rendering it an ideal, minimally invasive, and highly cost-effective treatment standard for extensive distal extension edentulism.

4. Long-term prosthetic success requires strict patient compliance and structured recall programs, given that technical maintenance—specifically the replacement of retentive nylon inserts every 12 to 18 months—represents a routine operational necessity

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