SUCCESS AND FAILURE OF REMOVABLE PROSTHETIC TREATMENT IN EXTENSIVE PARTIAL EDENTULISM

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Abstract

Objectives. The aim of this narrative review was to evaluate the current evidence regarding the factors influencing the success and failure of removable prosthetic treatment in patients with extensive partial edentulism, focusing on clinical performance, patient satisfaction, oral function, and long-term treatment outcomes. **Materials and Methods.** A structured literature search was conducted in PubMed/MEDLINE, PubMed Central, Scopus, and Web of Science. Systematic reviews, meta-analyses, randomized controlled trials, and clinical studies published between 2000 and 2025 were included. The review examined factors affecting treatment outcomes, including prosthesis design, retention and stability, residual ridge conditions, periodontal status of abutment teeth, masticatory efficiency, oral hygiene, patient adaptation, maintenance requirements, and quality-of-life measures. Due to methodological heterogeneity, the evidence was synthesized narratively. **Results.** The success of removable prosthetic rehabilitation in extensive partial edentulism depends on a combination of biological, mechanical, and patient-related factors. Adequate prosthesis design, favorable support and retention, healthy abutment teeth, and regular maintenance contribute to improved function, comfort, and patient satisfaction. In contrast, poor stability, progressive residual ridge resorption, inadequate oral hygiene, periodontal deterioration, and limited patient compliance are commonly associated with treatment failure, increased complications, and reduced prosthesis longevity. Recent advances in prosthodontic materials and digital technologies have enhanced treatment predictability and clinical outcomes. **Conclusions.** Long-term success of removable prosthetic treatment in extensive partial edentulism requires comprehensive diagnosis, individualized treatment planning, appropriate prosthetic design, and continuous follow-up care. Addressing both clinical and patient-related factors is essential for minimizing complications, improving oral function, and enhancing quality of life.

Keywords: *partial edentulism; removable prostheses; prosthetic treatment; success; failure*

INTRODUCTION

Extensive partial edentulism represents one of the most frequent and complex problems encountered in dental practice, with significant implications for the functionality of the dento-maxillary apparatus, aesthetics, and patients' quality of life. Edentulism can lead to functional, physical, and physiological limitations, as well as social disabilities and even handicap [1]. Local and regional changes occur as a consequence of the dynamic processes that take place following dental extractions. The longer the interval between the onset of edentulism and prosthetic treatment, the more pronounced and difficult to compensate these changes become. Functional insufficiency, to varying degrees, leads patients to become aware of their need for treatment and represents an important reason for seeking dental care [2]. In the case of extensive partial edentulism, the impact of missing teeth depends on their location and type, with the absence of molars having a lesser impact on oral functions compared to the absence of anterior teeth [3]. Edentulism in the anterior

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zone causes, in addition to significant changes in facial appearance, alterations in phonation and a decrease in food-cutting efficiency, while lateral edentulism can lead to cheek collapse and inefficient mastication, with consequences for digestion, such as gastritis or even gastroduodenal ulcers. These conditions can affect nutrient absorption, leading to anemia and weight loss. The loss of posterior occlusal contacts can lead to degenerative changes in the temporomandibular joint that are difficult to compensate. In any type of edentulism, swallowing is affected, the degree of impairment being directly proportional to the extent and location of the edentulous area [4].

In extensive partial edentulism treatment options are classified according to their nature into emergency, interim, and definitive prostheses, and according to the material used, they are divided into conventional acrylic removable partial dentures, flexible dentures, and cast removable partial dentures [4]. Removable partial prosthetic rehabilitation, with tooth or implant support, is a frequently used therapeutic solution for extensive partial edentulism. Its advantages include a favorable cost-effectiveness ratio for both clinician and patient, while its disadvantages relate to lower clinical efficiency compared to fixed restorations on natural teeth and/or implants, and a higher frequency of repair needs [5,6].

The aim of this narrative review was to evaluate the current evidence regarding the factors influencing the success and failure of removable prosthetic treatment in patients with extensive partial edentulism, focusing on clinical performance, patient satisfaction, oral function, and long-term treatment outcomes.

MATERIALS AND METHODS

Search Strategy

The identification of relevant studies was carried out by consulting the electronic databases PubMed/MEDLINE, PubMed Central (PMC), Scopus, and Web of Science.

The literature search was performed using combinations of keywords and MeSH terms such as: „edentulism”, „removable prostheses” „removable implant-supported restorations” "implant-supported overdenture", „implant-supported hybrid restorations”, "prosthetic rehabilitation". Search terms were used both individually and in Boolean combinations (AND/OR) to maximize retrieval of relevant records. Priority was given to studies available in full text via PMC Open Access, in order to ensure complete data extraction.

Selection Criteria

Studies were considered eligible when they met the following criteria: original research articles, including randomized controlled trials, prospective and retrospective observational studies, cohort studies, case-control studies, and clinical investigations evaluating the outcomes of removable prosthetic treatment in patients with extensive partial edentulism; systematic reviews and meta-analyses addressing factors associated with treatment success, failure, patient satisfaction, prosthesis performance, oral function, and long-term maintenance; narrative reviews from recognized textbooks and authoritative sources in prosthodontics, removable prosthodontics, and oral rehabilitation; and original studies reporting quantitative clinical outcomes,

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such as prosthesis survival rates, patient-reported outcome measures, masticatory efficiency, retention and stability assessments, complication rates, maintenance requirements, and quality-of-life indicators over defined follow-up periods. Studies were excluded if they fulfilled one or more of the following criteria: non-human studies without direct clinical applicability; articles published before 2000; studies not directly addressing removable prosthetic rehabilitation in extensive partial edentulism; investigations focused exclusively on dental materials, laboratory procedures, or technical aspects without reporting clinical outcomes; studies examining implant-supported fixed rehabilitations without relevance to removable prostheses; publications lacking sufficient outcome data; and articles not available in English.

Data Extraction and Quality Assessment

Two independent reviewers systematically extracted data from each included article. The following variables were documented for every study: (1) study design and level of evidence; (2) sample size and patient characteristics; (3) extent and classification of partial edentulism; (4) type and design of removable prosthetic rehabilitation; (5) duration of follow-up; (6) clinical and patient-reported outcome measures; and (7) reported indicators of treatment success and failure, including prosthesis survival, retention and stability, masticatory performance, patient satisfaction, biological and mechanical complications, maintenance interventions, and oral health-related quality of life. Whenever available, statistical measures, effect estimates, confidence intervals, and significance levels were also extracted and analyzed to facilitate comparison among studies.

LITERATURE REVIEW

1.General context

High-quality removable dentures, designed according to individual biological factors, can alleviate the problems caused by the loss of a large number of teeth, even in complex and difficult-to-rehabilitate cases [7].

Flexible dentures represent a simple and cost-accessible option for oral rehabilitation. They are indicated in cases where dental support does not allow for the correct placement of cast clasps for aesthetic reasons, such as gingival recession, or in patients with bony prominences, prominent tuberosities, or monomer allergies. Among their advantages are flexibility in retentive areas, reduced weight and thickness, superior aesthetics compared to acrylic dentures, increased hardness and superior elasticity of clasps compared to metallic ones, as well as chemical stability in the oral environment [4].

The classic metallic removable partial denture offers significant advantages over acrylic and flexible prostheses, the main ones being comfort (reduced thickness and weight), chemical stability, biocompatibility, and the possibility of achieving a varied design of the metallic major connector with variable thickness depending on its extension, as well as superior retention and stabilization through clasps and minor connectors [4]. New digital technologies, such as CAD/CAM, are used in the fabrication of superstructures for removable skeletal prostheses from conventional alloys, zirconia, and PMMA

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[8,9]. The excellent fit of these removable restorations has been demonstrated by Ahmed et al. [10]. Fully digitalized production of removable prosthetic restorations can be applied in Kennedy Class III/IV edentulism cases [11]. Removable partial dentures used in Kennedy Class I and II edentulism exhibit complex biomechanical behavior due to the supporting structures present, such as the gingiva and teeth, each with different biomechanical properties [12]. These prostheses are not rigidly fixed to the teeth, which can lead to prosthesis displacement when physiological movements generate forces on the teeth and the prosthesis. The optimal positioning and location of any element in a removable partial denture requires particular attention to the teeth adjacent to the edentulous area [4].

FEA studies allow for the investigation of the biomechanical behavior of prostheses and retentive elements under imposed loads and stress distribution areas, contributing to a better understanding of the biomechanical characteristics of special retention systems in removable partial dentures [13,14].

For the long-term success of prosthetic treatments in extensive partial or complete edentulism, it is essential to address in the treatment plan the biomechanical aspects, the condition of the dento-osseous support, aesthetic requirements, fibromucous resilience, the extent of terminal edentulism, masticatory forces, financial costs, extensive bone loss, or the presence of systemic conditions. Neglecting these variables in planning the prosthetic solution increases the risk of compromising the prosthetic field and/or the removable partial prosthetic restoration. The degree of patient acceptance of the prosthesis is closely linked to a series of biological, mechanical, aesthetic, and physiological factors [15].

The success of removable prostheses in extensive partial edentulism depends on a multitude of factors: the health of the supporting tissues, the degree of bone resorption, the position and resistance of the remaining teeth, the design and materials used in fabricating the prostheses, as well as the degree of patient adaptation and compliance. Limits of removable prostheses in extensive partial edentulism include functional and aesthetic discomfort, insufficient retention and stability, the occurrence of mucosal lesions, compromise of abutment teeth, or difficulties in psychological adaptation.

2. Removable prosthetic solutions in partial extensive edentulism

In patients with extensive partial edentulism, factors influencing the pre-prosthetic plan are as follows: the number and position of missing teeth, occlusal relationships, periodontal health of the abutment teeth, as well as intermaxillary relationships. The systemic factors to be considered in the therapeutic plan are: neuromuscular control, psychological status, and general health resilience. When the complications of edentulism lead to temporo-mandibular disorders, therapeutic approaches must not only restore joint function but also adapt to the ongoing changes occurring within it [16], while various treatment strategies should focus on addressing potential etiologies from different perspectives [17]. Although residual ridge resorption remains the primary intraoral complication of

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edentulism, treatment planning for the edentulous patient who is a candidate for hybrid prosthetic treatment must address complications such as the need for grafting of severely resorbed alveolar bone, occlusal rehabilitation, and rehabilitation of craniomandibular relationships [4]. To improve treatment planning for edentulous patients in the pre- and pro-prosthetic stages, as well as in the pro-implant stage, the following clinico-biological indices must be assessed: systemic status, dental support, periodontal support, mucosal support, alveolar bone support, occlusion, and craniomandibular relationships [4]. Given the interconnection of the components of the stomatognathic system, any pathological alteration of one component frequently leads to the impairment of other components, or at least some of them. Successful hybrid prosthetic treatment requires an effective approach in managing the complications of partial and complete edentulism in the pre-prosthetic and pro-implant stages [4]. Prosthetic treatments are challenging for clinicians in patients with malocclusion, lateral mandibular deviations, temporomandibular joint disorders (pain, muscular disturbances), and disturbed craniomandibular relationships. Temporo-mandibular disorders may arise prior to hybrid prosthesis placement due to the absence of stable and multiple dental contacts, which reduces the vertical dimension of the lower face and leads to muscular contractions in the elevator muscles [17]. Alveolar bone resorption and irregular residual ridges remain the primary intraoral complications of edentulism; however, the complications of edentulism also include malocclusion and craniomandibular malrelationships [4]. Treatment planning must therefore take into account the loss of occlusal relationships and the pathology of the stomatognathic system components. Bone augmentation techniques are necessary in cases of atrophic mandible and maxilla, given the high survival rate of dental implants in grafted implant sites, regardless of the bone augmentation procedure used [18,19,20]. Management of the partially edentulous arch requires a thorough understanding of the vertical and horizontal space required for different types of hybrid prostheses. The space specific to each type of hybrid restoration must be carefully considered during treatment planning in order to avoid lack of stability, aesthetic compromise, and inadequate contours of the future prosthesis [21]. Treatment options are classified according to their nature into emergency, interim, and definitive prostheses, and according to the material used, they are divided into conventional acrylic removable partial dentures, flexible dentures, and cast removable partial dentures [4].

Removable partial prosthetic rehabilitation, with tooth or implant support, is a frequently used therapeutic solution for extensive partial edentulism. Its advantages include a favorable cost-effectiveness ratio for both clinician and patient, while its disadvantages relate to lower clinical efficiency compared to fixed restorations on natural teeth and/or implants, and a higher frequency of repair needs [5,6]. High-quality removable dentures, designed according to individual biological factors, can alleviate the problems caused by the loss of a large number of teeth, even in complex and difficult-to-rehabilitate cases [7]. The classic cast removable partial denture offers significant advantages over acrylic and

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flexible prostheses, the main ones being comfort (reduced thickness and weight), chemical stability, biocompatibility, and the possibility of achieving a varied design of the metallic major connector with variable thickness depending on its extension, as well as superior retention and stabilization through clasps and minor connectors [4]. New digital technologies, such as CAD/CAM, are used in the fabrication of superstructures for removable skeletal prostheses from conventional alloys, zirconia, and PMMA [8,9]. The excellent fit of these removable restorations has been demonstrated by Ahmed et al. [10]. Fully digitalized production of removable prosthetic restorations can be applied in Kennedy Class III/IV edentulism cases [11]. Hybrid prostheses, whether supported by natural teeth (tooth-periodontal support) or dental implants, play a crucial role in restoring the function and aesthetics of the oral cavity. These advanced prosthetic solutions are designed to rehabilitate partially or completely lost teeth, with the aim of restoring masticatory efficiency and improving dental aesthetics. The biomechanical behavior of these hybrid prostheses is strongly influenced by the type of support — whether from the remaining natural teeth and periodontal tissues, or from dental implants.

3. **Hybrid Prosthetic Therapy with Tooth-Periodontal Support**

Hybrid prostheses with tooth-periodontal support rely on the remaining natural teeth to bear the forces generated during mastication. From a biomechanical standpoint, this approach can be beneficial, as natural teeth, together with the surrounding periodontal ligaments, provide a certain degree of flexibility and shock absorption. The periodontal ligament allows small, controlled tooth movements under pressure, which helps reduce the stress transmitted to the surrounding bone. This natural cushioning effect ensures a balanced distribution of forces, contributing to the maintenance of stability. However, the success of this type of prosthesis depends on the health and stability of the supporting teeth; compromised teeth may lead to excessive mobility or deterioration of the periodontal tissues.

Hybrid removable prostheses can be retained by tooth-periodontally supported dental bridges or by special attachment systems and cast copings. Hybrid prosthetic therapy through tooth-periodontally supported overdentures represents an effective alternative to conventional complete and removable dentures, particularly when additional retention systems are required, allowing the progressive reduction of the residual ridge to be delayed, improving prosthesis stability and making mastication more efficient [22]. A tooth-periodontally supported overdenture (removable dental prosthesis) can be fabricated with support on either the remaining natural teeth or their roots [23], given that the preservation of natural teeth and roots offers several advantages. Retaining natural teeth can have a positive psychological effect, helping patients maintain a sense of normalcy by keeping their remaining teeth [24]. Preserving the last remaining teeth helps minimize alveolar bone resorption and maintain the desmodontal fibers, which are essential for proprioception — crucial for sensing the dimensions and texture of food, thereby improving comfort during mastication [24,25]. Reducing the height of the supporting teeth can extend their longevity

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[23]. Supporting teeth can be protected using restorative materials such as glass ionomer cement or composite, or can be covered with cast telescopic copings that may be integrated with attachment systems, improving prosthesis retention [26]. Overdentures can be equipped with various types of attachments, such as bars, balls, or magnets [27]. Hybrid prostheses with special attachment systems have significantly increased patient satisfaction and improved quality of life across all domains compared to the pre-treatment period, while the incorporation of attachments (ball, bar, telescopic) further improved functional limitation, psychological discomfort, and physical limitation for all attachment types [28].

4.Hybrid Prosthetic Therapy with Implant Support

The majority of implant-supported hybrid prostheses consist of implant-retained removable prostheses using special attachment systems such as ball, stud, bar, telescopic, or magnetic types. The choice between retention systems remains at the clinician's discretion, depending on the individual requirements and preferences of each case [29].

Implant-Supported Overdentures — Ball Attachment System

In prosthetic treatment by implant-supported overdentures, two or four implants are most commonly inserted in the anterior mandibular region. Implants are placed in the anterior mandibular region due to the superior bone quality as well as to avoid important anatomical structures such as the mandibular nerve. Implant placement at the premolar level is less common, but may be considered in certain cases, such as when additional stability is desired or when sufficient bone resources exist at the premolar level to support a more uniform distribution of masticatory loads. In the case of implant-supported overdentures the decision to use mixed support (both implant and mucosal) or exclusively implant support depends on several factors, such as the type of prosthesis used and the specifics of the clinical case. In the case of mixed support (implants + mucosa), this approach implies that the removable prosthesis has direct contact with and distributes a portion of the masticatory forces to both the implants and the alveolar mucosal tissue. In this case, there is no space between the prosthetic saddle and the mucosa, meaning that part of the masticatory pressure is borne by the mucosa. This can be advantageous in certain situations, but also comes with some disadvantages.

The advantages of mixed support are:

- force distribution — the masticatory forces can be evenly distributed between the implants and mucosa, reducing the risk of implant overloading;
- increased prosthesis retention due to mucosal contact, particularly when implant stability is reduced or when bone density is not optimal.

The disadvantages of mixed support:

- mucosal recession or bone resorption beneath the prosthesis, leading to loss of proper prosthesis fit and the need for frequent adjustments or repairs;
- patients may experience discomfort, irritation, or mucosal ulcerations due to prolonged contact with the prosthetic saddle;

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- the need for periodic adjustments due to possible bone resorption, in order to maintain adequate mucosal contact.

In the case of implant-supported prostheses (without mucosal contact) a space is created between the prosthesis and the alveolar ridge (50-150 microns) to avoid pressure on the mucosa.

Advantages of implant support (without mucosal contact):

- long-term stability — the implants bear the entire load, eliminating the risk of bone resorption beneath the prosthesis and the need for frequent adjustments;
- increased comfort due to the absence of irritation caused by friction of the prosthesis against the mucosa;
- requires fewer adjustments and less long-term maintenance.

Disadvantages of implant support (without mucosal contact):

- higher initial costs, as more implants or more rigorous planning may be required to ensure adequate force distribution across the implants;
- risk of implant overloading if the implants are not well distributed or if their number is insufficient, which may lead to complications.

Implant-Supported Overdentures — Bar Retention System

Implant overdentures may utilize either splinted implants with bar-type attachments or unsplinted implants with stud-type attachments [30,31]. The choice of attachment is influenced by several factors, including maxillary morphology, interarch distance, desired retention level, prosthesis type, implant angulation and number, patient manual dexterity, financial considerations, and the ability to attend maintenance appointments [32]. Bar-type attachments connect the implants and are associated with fewer complications in the prosthetic superstructure and greater patient satisfaction [33]. They provide stress-breaking benefits and involve cross-arch stabilization, distributing occlusal forces among the abutments [34]. The optimal length for a single bar is between 20 and 22 mm, allowing accommodation of two clips [35], and requires a minimum interarch distance of 15 mm [36]. Bars can be fabricated from metals or milled from non-metallic materials such as zirconia and PEEK (polyether ether ketone), with bar clips manufactured from PEEK or polyoxymethylene (POM) [37,38]. Retention forces for bar-type attachments decreased by 44% after five years of use, while regular bar maintenance involves activating or replacing the bar clips [39]. Retention is crucial for patient satisfaction with the prosthesis, defined as the inherent quality of the prosthesis to resist dislodging forces [40,41]. Approximately 33% of prosthetic complications are related to loss of retention [33], and the rate of attachment wear depends on their material, affecting long-term retention stability [37]. Attachment retention is essential for selecting specific retention systems for patients [42]. PEEK exhibits excellent mechanical properties, resistance to hydrolysis, chemical wear, and high temperatures [43]. PEEK is a biologically inert material with no evidence of cytotoxicity or immunogenicity, offering corrosion resistance, low plaque affinity,

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and minimal creep [44]. Bar-and-PEEK-clip overdentures result in reduced plaque accumulation and absence of gingival inflammation, with patients reporting high satisfaction regarding cleanliness and maintenance compared to full-arch fixed restorations. The PEEK clip, as an alternative to metallic ones, offers high wear resistance, reducing the number of maintenance visits and the need for clip replacement [44].

The advantages of this type of hybrid prosthetic treatment:

- comfort and functionality — patients report significant improvements in comfort and functionality, including the ability to chew and speak more efficiently;
- aesthetics — hybrid prostheses can be designed to blend naturally with oral tissues, providing a pleasing aesthetic appearance;
- durability — they effectively manage mechanical stress through their design.

This type of attachment system presents the following disadvantages:

- significantly higher costs due to the need for multiple implants and the custom fabrication of the bar;
- care and maintenance —rigorous oral hygiene and regular dental visits for peri-implant health;
- potential complications — risks of complications such as peri-implantitis, bar erosion, or implant fractures, particularly in patients with unfavorable occlusion or parafunctional habits.

CONCLUSIONS

Long-term success of removable prosthetic treatment in extensive partial edentulism requires comprehensive diagnosis, individualized treatment planning, appropriate prosthetic design, and continuous follow-up care. To ensure a high success rate, both the clinician and the dental technician must understand the forces at work and the biomechanical response of the structures involved, as well as the materials used in fabricating the prosthetic structures. It is essential to minimize prosthesis displacement caused by masticatory forces and to prevent overloading of the teeth to which clasps are attached. Addressing both clinical and patient-related factors is essential for minimizing complications, improving oral function, and enhancing quality of life.

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