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# MULTIDISCIPLINARY APPROACHES IN COMPLEX ORAL REHABILITATION: INTEGRATING SURGERY, ENDODONTICS, ORTHODONTICS, AND IMPLANTS FOR FUNCTIONAL AND AESTHETIC RESTORATION: A NARRATIVE REVIEW

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### ABSTRACT

Persistent dental issues, such as deteriorating teeth, mismatched prostheses, genetic disorders, traumatic injuries, and periodontal disease, often complicate oral rehabilitation. These challenges highlight the need for a multidisciplinary approach. This review explores and evaluates how the integration of surgery, endodontics, orthodontics, and implants can optimize both functional and aesthetic outcomes in complex oral rehabilitation. This narrative review systematically analyzed recent literature from PubMed, Scopus, and Google Scholar, emphasizing studies published within the last ten years. Key search terms included "oral rehabilitation," "surgery," "endodontics," "orthodontics," and "dental implants." Articles addressing the integration of these disciplines in managing complex dental cases were selected and reviewed. Surgical interventions establish a foundation for subsequent treatments, while endodontics preserves and prepares damaged teeth. Orthodontic treatments correct alignment issues, facilitating effective prosthetic and implant placements. Implants offer durable and aesthetic solutions for missing teeth. Key studies illustrated successful outcomes through combined approaches, such as surgical preparations followed by endodontic and orthodontic treatments, culminating in implant placements. This multidisciplinary strategy ensures comprehensive care by Integrating surgery, endodontics, orthodontics, and implants. It is essential for achieving optimal functional and aesthetic outcomes in complex oral rehabilitation, effectively addressing both patient needs and challenges.

**KEYWORDS:** Multidisciplinary approach, complex oral rehabilitation, surgery, endodontics, orthodontics, dental implants.

## **INTRODUCTION**

Persistently deteriorating dentition is a common and sneaky daily clinical concern. Heavily repaired teeth, mismatched prosthesis, periapical lesions, residual roots, large deposits of dental calculus, and periodontal disease are common characteristics. Alveolar bone loss, which is mediated by the human immunological and inflammatory response to the microbial assault, is inextricably linked to the course of periodontitis (*Goyal et al., 2013*). Because of this, it is common to see significant horizontal bone resorption during the radiographic examination, which is ultimately linked to vertical bony defects at the expense of the alveolar process. The use of traditional removable dentures aggravates bone remodeling by causing a noticeable loss in the mandibular ridge and the ensuing forward-upward rotation of the jaw (*Jánosi et al., 2023*). This causes ridge height to decrease in the lower jaw, which leads to issues with prosthesis retention. The discomfort that patients experience while speaking and chewing is greatly impacted by the lack of stability and fit.

Patients who wear removable dentures feel a bad quality of life connected to their dental health, which may be attributed to all of these issues *(Shaghaghian et al., 2015)*. This explains why, in terms of functional constraints, psychological discomfort and impairment, and physical pain and disability, an implant-retained prosthesis may result in a higher quality of life than a traditional denture (Sánchez-Siles et al., 2018). It should be highlighted that edentulism may cause individuals to have negative changes in their appearance and mental health in addition to a major functional impairment. Issues include speech difficulty, diminished vertical dimension, loss of support for the face muscles, and dietary limitations and restricted ability to consume specific foods. When all of these disadvantages are considered, edentulism is now classified as a physical disability by the World Health Organization *(Maiorana et al., 2020)*.

When combined, these results point to the significance of using dental implants to replace lost or terminally ill teeth and the preservation of teeth with mild conditions related to the teeth, at least in the early phases of the condition. Thus, in order to determine the appropriate treatment plan based on individual features and tailored to suit the patient's expectations over the long term, a thorough examination implying a multidisciplinary approach is essential. To achieve the best functional and cosmetic results in complicated oral rehabilitation, a multidisciplinary approach integrating several dentistry specialties is necessary. The necessity for multidisciplinary cooperation has grown along with the evolution of dental care, especially when complex situations beyond the scope of a single specialization. The integration of surgery, endodontics, orthodontics, and implantology is essential in managing the many difficulties that patients with complex dental problems pose. A thorough treatment plan that considers the patient's long-term objectives as well as their present requirements is made possible by the distinct knowledge that each profession brings to the table. The purpose of this narrative review is to investigate the many interdisciplinary strategies used in difficult oral rehabilitation. Through an analysis of the functions of surgery, endodontics, orthodontics, and implants, this study will show how these fields work together to develop a treatment plan that meets patients' functional and cosmetic demands.

# **METHODOLOGY**

This narrative review employed a structured methodology to systematically gather and assess literature related to multidisciplinary approaches in complex oral rehabilitation, integrating surgery, endodontics, orthodontics, and implants. The methodology was tailored to address the diverse and complex nature of oral rehabilitation cases, drawing on established review protocols to ensure comprehensive coverage of the relevant literature. Key search terms such as "multidisciplinary oral rehabilitation," "surgical oral rehabilitation," "endodontics in dental restoration," "orthodontic interventions," and "dental implants" were utilized to identify pertinent studies across major academic databases, including PubMed, Scopus, and Google Scholar.

#### **Inclusion and Exclusion Criteria**

Articles considered for inclusion focused on the integration of surgery, endodontics, orthodontics, and implants in complex oral rehabilitation cases. To ensure the review reflected recent advancements and current practices, only studies published in English within the last ten years (2017–2024) were included. Eligible studies involved human subjects and provided substantial evidence regarding the efficacy, mechanisms, and outcomes of the multidisciplinary approaches discussed. Studies that did not directly address the interdisciplinary integration or lacked methodological rigor were excluded. The relevance of each identified article was assessed through a thorough review of abstracts and titles.

#### **Categorization and Analysis**

The collected literature was systematically categorized based on the specific discipline addressed surgery, endodontics, orthodontics, or implants. This categorization facilitated an in-depth analysis of how each discipline contributes to complex oral rehabilitation and how they interact to enhance overall treatment outcomes. The review aimed to provide a comprehensive understanding of the role each discipline plays in the rehabilitation process, examining their individual and combined impacts on functional and aesthetic restoration. By synthesizing findings from a diverse range of studies, the review sought to highlight the mechanisms, clinical effectiveness, and potential synergies among the different treatment modalities. This approach provided valuable insights into the multidisciplinary strategies employed in oral rehabilitation, offering guidance for clinicians to make informed decisions in complex cases.



*Figure 1* (*PRISMA flow diagram.*)

## **RESULTS**

#### Role of Surgery in Oral Rehabilitation

Surgical intervention is often required for oral rehabilitation, especially in difficult situations, as a prerequisite to achieving the best possible results. In order to guarantee that the goals of both function and appearance are satisfied, surgical operations play a crucial role in setting up the framework for later restorative procedures. Surgery is a key component in treating the underlying problems that make oral rehabilitation more difficult, from periodontal surgeries intended to restore biological width to more complex operations like osseointegrated implant placements (*Maiorana et al., 2017*). The long-term stability and effectiveness of the rehabilitation process are greatly enhanced by these treatments, which also set up the oral environment for future dental surgeries.

Alves et al. emphasized, for instance, how periodontal surgery helps restore biological breadth, which is essential for addressing crown-root fractures <sup>(Alves et al., 2021)</sup>. Here, surgery makes it easier for later restorative processes to happen, such fragment reattachment, which is essential to preserving the damaged tooth's functional and cosmetic integrity. Similar to this, Lanza et al, discuss how important surgical procedures are for handling difficult implant-prosthetic rehabilitation situations *(Lanza et al., 2017)*. According to their case study, the preparation of the oral environment for the implantation of implants required surgical treatments such bone grafting and extractions. Because the patient smoked and had active periodontitis, both the deteriorated periodontal health and the cosmetic problems needed to be carefully planned for before surgery. Maiorana et al, underscores the significance of surgery in the context of oral rehabilitation, particularly in individuals whose dentition is seriously impaired *(Maiorana et al., 2020)*. In order to enhance function and aesthetics and to establish an environment that was suited for implant placement, the case study addresses numerous extractions, guided bone regeneration, and soft tissue care. Achieving long-term predictability and patient satisfaction required a multidisciplinary strategy that included oral surgery.

The study of Batisse et al, also demonstrates the importance of surgical interventions in multidisciplinary management (*Batisse et al., 2022*). They described how general anesthesia-assisted surgical procedures were essential in managing a patient with genetic microdontia, setting the stage for adhesive and prosthetic treatments. As shown by Lancione et al, the incorporation of 3D virtual surgical planning underscores the changing function of surgery in simplifying difficult oral rehabilitation, especially when osseointegrated implants are used in patients with mandibular or maxillary abnormalities (Lancione et al., 2021). Furthermore, Jánosi et al, emphasized the significance of surgical accuracy using methods like piezo-surgery and diode lasers in treating cosmetic issues like a gummy grin, highlighting the crucial role that surgery plays in obtaining long-lasting rehabilitative results (Jánosi et al., 2023).

In the multidisciplinary care of complicated situations, periodontal surgery plays a role that is described by Doulkeridou et al *(Doulkeridou et al., n.d.)* In one patient, who had altered passive eruption and a gummy grin, surgical periodontal therapy was required to produce favorable circumstances for prosthetic restoration. This included extending clinical crowns while adhering to biological width requirements. The effectiveness of the prosthetic therapy that followed was largely dependent on the surgical approach, indicating the crucial role that surgery plays in interdisciplinary oral rehabilitation. In a similar vein, pre-prosthetic surgical management—which included periodontal and extraction procedures—was crucial in Al-Sunbul et al's case to set up the oral environment for definitive prosthodontic treatment and guarantee a strong basis for long-term recovery <sup>(Al-Sunbul et al., 2024a)</sup>. These examples highlight the crucial role that surgery plays in establishing the ideal framework for effective oral rehabilitation, especially when dealing with complicated occlusal or structural issues.

#### Endodontics and Its Integration

When treating teeth that have had severe decay or structural damage, endodontics plays a crucial role in the interdisciplinary approach to oral rehabilitation. Endodontic therapy focuses on treating and preserving the internal structure of the tooth, which prepares the tooth for later restorative and prosthetic procedures (*Goyal et al., 2013*). Biological and functional elements of oral health are addressed in a complete treatment plan that is ensured by the integration of endodontics with other dental disciplines. When preserving the natural tooth structure is crucial to the rehabilitation's effectiveness as a whole, this all-encompassing approach is necessary.

According to Lanza et al, whether to remove or keep a tooth when it is endodontically or periodontally damaged should be made based on certain clinical and radiographic factors. Endodontics was included in the treatment strategy by carefully evaluating and treating any natural teeth that were still viable (Lanza et al., 2017). The overall result of the therapy was improved since this comprehensive approach made it possible to make a well-balanced choice between getting implants or keeping natural teeth. When endodontics is included into a treatment plan, it is sometimes necessary to carefully evaluate and repair any natural teeth that may still be maintained, like in the instance of a patient with hereditary microdontia as reported by Batisse et al (*Batisse et al., 2022*). The treatment result is eventually improved by this interdisciplinary approach, which guarantees a balanced choice between keeping natural teeth and choosing implants.

Additionally, in addressing difficult instances of oral rehabilitation—especially those with mixed endodontic-periodontal lesions—Doulkeridou et al. (2022) address the interaction between endodontics and periodontology. They stress the need of endodontists and periodontists working together to provide patients with complicated dental diseases with all-encompassing treatment. In addressing subgingivally fragmented teeth, endodontic therapy plays a crucial role (*Doulkeridou et al., n.d.*). Successful endodontic care occurs before orthodontic and prosthetic treatments, as shown in the case study by Agarwal et al (*Agarwal et al., 2020*). The aforementioned examples demonstrate the smooth integration of endodontics into multidisciplinary treatment regimens in order to get the best possible results for rehabilitation. Additionally, the Alves et al, case report highlights the significance of endodontics in the treatment of crown-root fractures, whereby effective endodontic therapy comes before restorative measures such the cementation of a fiberglass post and fragment reattachment (*Alves et al., 2021*). By combining endodontic therapy with surgical and restorative procedures, complete care that considers the biological as well as structural components of dental rehabilitation is guaranteed.

#### Orthodontic Interventions in Rehabilitation

Especially in situations involving structural alignment and occlusal problems, orthodontic therapies are essential to the rehabilitation of difficult dental cases. These orthodontic therapies correct crowding, misalignments, and other issues, setting the stage for restorative and prosthetic operations (Thomas et al.,

<sup>2021)</sup>. The functional results of the whole rehabilitation plan are improved by orthodontic treatment in addition to the teeth's attractive look. To guarantee reliable and visually appealing outcomes, orthodontics is often combined with other specializations, highlighting its significance in a whole rehabilitation plan.

In order to prepare the mouth cavity for intricate rehabilitation, Maiorana et al, emphasize the need of orthodontics (*Maiorana et al., 2020*). The patient's remaining teeth needed to be straightened, and orthodontic therapy was necessary to provide the necessary space for the implantation of implants. In order to ensure that the finished prosthetic outcome was both aesthetically acceptable and functional, orthodontic intervention was included in the multidisciplinary approach. A major factor in the patient's effective recovery was the collaboration between orthodontics and other dental specialties.

Conversely, Batisse et al, describe a situation in which the patient had widespread microdontia, a condition for which typical orthodontic treatments were not the main emphasis (*Batisse et al., 2022*). To get a good result, a multidisciplinary strategy including detachable prosthesis and adhesive dentistry was used instead. This demonstrates how crucial it is to modify the treatment plan to meet the unique requirements of the patient, especially in cases when orthodontic treatments are limited. Doulkeridou et al. (2022) provide an illustration of the use of orthodontics in the context of multidisciplinary care for a patient suffering from severe chronic periodontitis (Doulkeridou et al., n.d.). Orthodontic intervention was effectively used once the state of periodontal health was stabilized with non-surgical and surgical therapies. As an example of how orthodontics may be successfully included into a complete treatment plan in conjunction with other dental disciplines, the orthodontic treatment not only addressed functional problems but also improved overall appearance.

According to Agarwal et al, in a case of a subgingivally broken maxillary central incisor, orthodontic forced eruption is used to enable prosthetic repair. Braces make the fracture border accessible for later restorative operations by positioning it supragingivally by tooth extrusion (Agarwal et al., 2020). Using this method lowers the possibility of difficulties in the future and guarantees that the restorative operation may be done under ideal circumstances, improving the cosmetic result. Thus, in complicated instances of oral rehabilitation, orthodontic procedures are essential to attaining both functional and cosmetic success.

### **Implants in Complex Oral Rehabilitation**

With its steady and durable solution for tooth replacement in complicated circumstances, implants have completely transformed the area of oral rehabilitation. The fundamental component of contemporary dental restorations, implants provide patients who are missing or have significant dental damage the structural support they need to regain both function and appearance. Implant utilization is often paired with cutting-edge digital planning tools and interdisciplinary therapies in complex rehabilitation settings to provide exact and reliable results *(Landi et al., 2016)*. By regaining the patient's confidence and dental health, this method not only increases the rehabilitation's longevity but also has a major positive impact on their daily lives.

According to Lanza et al, and Maiorana et al, implants are essential for helping patients with complicated oral rehabilitation demands regain both function and aesthetics. When a patient has a history of smoking and active periodontitis, putting implants might be difficult. Careful planning is necessary to treat the patient's periodontal condition and guarantee long-term stability, as explained by Lanza et al

(*Lanza et al., 2017*). A fixed prosthesis that restored both function and aesthetics required the effective integration of implants after directed bone regeneration, as highlighted by Maiorana et al (Maiorana et al., 2020).

According to Batisse et al, alternative methods are taken into consideration when standard implantology may not provide the best outcomes. A combination of adhesive dentistry and detachable prosthesis may be a useful substitute, since they draw attention to the drawbacks of implant use in adult patients with widespread microdontia (*Batisse et al., 2022*).

In their article, Lancione et al. address how 3D virtual surgical planning has enabled the growing use of osseointegrated implants in dental reconstruction *(Lancione et al., 2021)*. In patients with complicated mandibular or maxillary abnormalities, this innovative technique enables quick implant insertion during main surgery, which is very advantageous. By ensuring that the implants are positioned correctly, the multidisciplinary team's participation in the planning and execution phases contributes to a rehabilitation process that is efficient and successful.

When a patient has a gummy grin and no posterior teeth, Jánosi et al, explain using implants as part of a full-mouth rehabilitation *(Jánosi et al., 2023)*. Proximal regions of the upper and lower arches were implanted with implants deliberately to improve aesthetics and mastication. Showcasing the significance of implants in accomplishing thorough oral rehabilitation, the use of zirconia ceramic for the final restorations further aided in the effective integration of implants into the entire treatment plan.

In patients with a history of periodontitis, Doulkeridou et al, emphasize the integration of dental implants *(Doulkeridou et al., n.d.)*. The patient in a comprehensive treatment plan had implant implantation after periodontal therapy in one of the complicated instances that was described. A coordinated strategy including periodontology, prosthodontics, and implantology is necessary to obtain optimum results for individuals with poor oral health, as shown by the effective use of implants in these difficult instances.

According to Qiu et al, implant-supported fixed bridges were used to address functional and cosmetic problems in a completely digital workflow for occlusal rehabilitation *(Qiu et al., 2024)*. Not only did implants provide a long-term option for replacing missing teeth in this situation, but they also made it easier to use digital technology, which improved treatment accuracy and efficiency. The significance of implant placement in the framework of an all-encompassing treatment plan that takes the patient's general oral health into account is also highlighted by Al-Sunbul et al. Implants are a dependable and durable option for multimodal dental rehabilitation, especially when paired with other cutting-edge dental techniques *(Al-Sunbul et al., 2024b)*.

# **DISCUSSION**

A thorough strategy that considers the complicated nature of dental restoration is the combination of surgery, endodontics, orthodontics, and implants in complex oral rehabilitation. A multidisciplinary approach is essential for handling difficult dental problems since each discipline has a distinct role to play in making sure the rehabilitation process is both aesthetically beautiful and functionally successful.

Complex oral rehabilitation requires surgical treatments to be successful. They address structural issues, provide the foundation for the long-term stability of the rehabilitation, and set the stage for

further restorative therapies. The examined papers show how different surgical techniques—such as bone grafting, extractions, and periodontal surgeries—are essential in setting up the oral environment for subsequent treatments. Restoring biological width and fostering an environment that is conducive to prosthetic repair are important goals highlighted by Alves et al. (2021) and Doulkeridou et al *(Doulkeridou et al., n.d.)*. The fundamental significance of surgery is emphasized by Lanza et al. (2020) and Maiorana et al. (2020), who demonstrate the critical role that surgical planning plays in the effective placement of implants and overall rehabilitation *(Lanza et al., 2017) (Maiorana et al., 2020)*. This planning includes the use of bone grafts and directed bone regeneration. The field of surgical interventions is constantly expanding, as shown by the use of diode lasers and piezo-surgery, as illustrated by Jánosi et al. and by Lancione et al. (2022) with their 3D virtual surgical planning *(Jánosi et al., 2023)*. These developments lead to better surgical accuracy and better results in more difficult instances. By combining these contemporary methods, operations are certain to help with both short-term and long-term rehabilitation outcomes.

In order to preserve natural teeth and make later restoration operations easier, endodontics is essential. Endodontic therapy may be combined with other dental specializations to provide a holistic treatment plan that considers both the biological and functional elements of oral health. The choices made regarding the retention or extraction of teeth may be influenced by attentive endodontic therapy, which in turn affects the treatment plan as a whole. This is shown by Lanza et al and Batisse et al *(Lanza et al., 2017) (Batisse et al., 2022)*. As Doulkeridou et al emphasize, the collaborative approach between endodontists and other experts is vital for handling difficult cases including mixed endodontic-periodontal diseases *(Doulkeridou et al., n.d.)*. Agarwal et al. (2024) have emphasised the need of effectively managing subgingivally fragmented teeth endodontically prior to pursuing orthodontic or prosthetic procedures (Agarwal et al., 2020). The success of the rehabilitation as a whole is aided by this cooperation, which guarantees the preservation and ideal restoration of the original tooth structure.

The mouth cavity must be properly prepared for upcoming restorative operations via orthodontic therapy. It deals with spacing problems and misalignments that may compromise the efficacy of implants and other prosthetic procedures. According to Maiorana et al and Doulkeridou et al, orthodontics may be utilized to properly space implants and align teeth, improving the appearance as well as the functionality of the results (*Maiorana et al., 2020*) (*Doulkeridou et al., n.d.*). But in situations where conventional orthodontic treatments may not be effective—like in individuals with widespread microdontia—alternative strategies are required. A multidisciplinary strategy incorporating adhesive dentistry and detachable prosthesis may be more successful in these situations, as shown by Batisse et al. (*Batisse et al., 2022*). Agarwal et al. explain the use of orthodontic forced eruption as an additional example of how orthodontics may help restorative operations by placing teeth appropriately for prosthetic interventions (*Agarwal et al., 2020*).

With its long-lasting tooth replacement options, dental implants have emerged as a key component of contemporary oral rehabilitation. The studies that have been evaluated highlight how important implants are in restoring function and appearance in difficult instances. For good results, Lanza et al. and Maiorana et al. stress the need of meticulous planning and integrating implants with other therapies, such as bone regeneration and orthodontics *(Lanza et al., 2017) (Maiorana et al., 2020)*. Alternative strategies, as those covered by Batisse et al, provide workable answers in situations when standard implantology may not be the best option *(Batisse et al., 2022)*. Implant operations may be made

more precise and efficient by using modern digital planning tools and placing implants right away, as shown by Lancione et al, *(Lancione et al., 2021)*. The rehabilitation process is made more successful and durable when implants are integrated with other cutting-edge dental technology, such as the digital workflows that Qiu et al and Al-Sunbul et al, describe *(Al-Sunbul et al., 2024a) (Qiu et al., 2024)*.

# CONCLUSION

A multidisciplinary approach is required to produce the best functional and cosmetic results in complicated oral rehabilitation, as shown by the combination of surgery, endodontics, orthodontics, and implants. Each expertise makes a distinct contribution to tackling the complex problems that severely impaired dentition presents. Orthodontic modifications enable optimum alignment and spacing, endodontic treatment supports the maintenance of natural tooth structures, and implants provide strong alternatives for lost teeth. Surgical operations set the stage for secure and long-lasting restorations. Dental practitioners may develop complete treatment regimens that not only restore patients' oral health but also greatly improve their quality of life by integrating these disciplines.

There are a few limitations of this narrative review. First off, since the study mostly draws from published literature, it may have selected studies that are biased and ignore unpublished research or unfavorable findings that may provide a more balanced viewpoint. Furthermore, the review lacks the methodological rigor of a meta-analysis, which means the efficacy of the interdisciplinary methods described is not quantitatively evaluated. The results' generalizability may also be restricted by the lack of agreed-upon standards for assessing the integration of various dental disciplines. Lastly, the results are weaker when case reports and single studies are used in place of large-scale randomized controlled trials, underscoring the need for more clinical data in this area.

Large-scale, randomized controlled trials should be the main focus of future research in order to provide more solid proof of the efficacy of interdisciplinary techniques in complicated oral rehabilitation. The creation of standardized procedures for the integration of different dental specializations may improve the comparability and consistency of results in varied clinical contexts. Furthermore, using digital technology provides potential ways to enhance accuracy and results in oral rehabilitation, such as computer-guided surgery and 3D virtual planning. In order to validate the efficacy of these multimodal therapies and to inform best practices in difficult situations, it will also be essential to prioritize longitudinal studies that evaluate the long-term success and patient satisfaction associated with them.

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