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IMMEDIATE DENTAL IMPLANTS IN ESTHETIC ZONES: APPROACHES, BENEFITS AND CLINICAL CHALLENGES

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ABSTRACT

Oral rehabilitation has evolved with dental implants, offering effective solutions to restore aesthetics and function. Techniques such as immediate loading and bone grafts have expanded possibilities, reducing time and increasing efficiency, especially in aesthetic zones, as long as they are well-planned. This study aims to optimize these clinical practices. The general objective of this study was to understand the scientific literature on the installation of dental implants in aesthetic areas. This narrative review was carried out to compile and critically analyze the scientific literature on dental implants in esthetic zones, considering their indications, benefits, and challenges. The search was carried out in electronic databases, including PubMed, Scopus, Web of Science, Latin American and Caribbean Literature in Health Sciences, and Google Scholar, selecting articles published in English and Spanish, with no limit on publication date. Immediate implant placement in fresh sockets offers benefits such as reduced bone resorption, aesthetic preservation, and decreased treatment time. The immediate loading technique combined with immediate implants has high success rates, as long as it is accompanied by careful planning and detailed diagnosis. Although advantageous, its application is limited by factors such as bone quality, vestibular wall integrity, and systemic and behavioral contraindications. Guided bone regeneration is effective in cases of significant bone loss. Despite the advances, additional studies are needed to optimize the protocols, especially in aesthetic zones.

Keywords: Aesthetics. Dental Implants. Dentistry. Osseointegration.

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INTRODUCTION

For a long time, oral rehabilitation of individuals with tooth loss was predominantly performed through removable total and partial dentures (MENEZES *et al.,* 2020). However, advances in clinical research in implant dentistry have brought significant progress in the development of techniques applied to the aesthetic-functional rehabilitation of edentulous patients (Ortega et al., 2020). Currently, the main therapeutic options for oral rehabilitation include endosseous implants and osseointegrated implants (BISPO; SHITSUKA, 2017).

The replacement of lost teeth goes beyond the aesthetic issue, being essential for the maintenance of oral and general health. Dental implants represent an effective solution, capable of preventing the deterioration of bone structure and significantly improving the quality of life of patients. Implantology, as a dental specialty, offers alternatives for the rehabilitation of masticatory function and the restoration of facial aesthetics, using dental implants and prostheses on implants (ZHOU *et al.,* 2019).

Due to the high demand for solutions for missing teeth, bone grafts and implants with immediate loading allow professionals to place the implant even where it was difficult to anchor, due to the low amount of available bone that many patients had. In both the mandible and the maxilla, there was a waiting time of between three to six months and they often failed to anchor, leading the patient to restart treatment (SALMEN *et al.,* 2017).

In this sense, advances in implant dentistry have made it possible to develop techniques that offer faster and more efficient results. According to Monezi *et al.* (2019), the immediate implant installation protocol is widely considered a clinical success as it meets patients' expectations and desires for satisfaction. In addition, this approach stands out for its reduction in the number of surgical procedures required, as well as its effectiveness in recovering the aesthetics and function of dental elements.

This study is justified as the installation of dental implants in aesthetic zones is a challenge in implant dentistry, due to the need to preserve the functional and aesthetic harmony of the anterior region. The technique of immediate implants has advantages such as reduction of treatment time and preservation of alveolar bone, but it depends on careful planning and specific conditions for success. This study is justified by the need to critically review the recent literature, providing subsidies to improve clinical practices and results in aesthetic treatments.

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Given the above, the general objective of this study was to understand the scientific literature on the installation of dental implants in esthetic zones. The specific objectives of the study were as follows: To identify the factors that influence the success of immediate dental implants in esthetic zones, consider aspects such as surgical planning, guided bone regeneration, and evaluation of the buccal wall, and compare the advantages and limitations of the technique of immediate implant placement with conventional methods, highlighting the impacts on aesthetics, function and treatment time.

METHODOLOGY

This narrative review was carried out to compile and critically analyze the scientific literature on dental implants in esthetic zones, considering their indications, benefits, and challenges. The methodology followed the steps described below:

The study was designed to investigate the approaches related to the installation of dental implants in aesthetic zones, focusing on the indications, aesthetic and functional benefits, technical limitations, and critical factors for the success of the procedure. The guiding question of the study was: "What are the factors that influence the success of immediate dental implants in esthetic zones, considering their benefits, limitations, and implications in surgical and aesthetic planning?"

The search was carried out in electronic databases, including *PubMed*, *Scopus*, *Web of Science*, Latin American and Caribbean Literature in Health Sciences, and *Google Scholar*, selecting articles published in English and Spanish, with no limit on publication date. The Health Sciences descriptors used were combined with Boolean operators, including terms such as: "*Dental Implants*", "*Esthetic Zone*", "*Immediate Implants*", "*Bone Resorption*", "*Guided Bone Regeneration*", and their equivalent translations in Portuguese and Spanish.

After the search, the titles and abstracts were analyzed to verify their relevance to the theme. The selected articles were read in full, and those that met the inclusion criteria were included in the review.

The data were organized according to thematic categories: advantages of immediate implants, critical success factors, clinical challenges, and technical limitations. The contributions of the studies to the evolution of knowledge in the area were highlighted, as well as the gaps identified.

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The results were presented descriptively, with the integration of information obtained in the literature, allowing the discussion of the main advances, challenges, and perspectives in the use of dental implants in aesthetic zones.

RESULTS AND DISCUSSION

Immediate installation of dental implants in fresh sockets offers several benefits, especially in esthetic regions. Extraction and waiting for healing can result in alveolar resorption, compromising future aesthetic results. To minimize these changes, immediate implant installation reduces treatment time, increases patient satisfaction, and decreases bone resorption, optimizing function and aesthetics in a single surgical procedure (Slagter *et al.,* 2021; Kan *et al.,* 2018).

The protocol for the installation of dental implants with immediate loading recommends their insertion soon after tooth extraction, followed by the application of the provisional load. Currently, this technique is widely accepted due to the numerous benefits it offers, highlighting the significant reduction in treatment time. In addition, the approach allows for quick aesthetic and functional results, meeting patient expectations, with high success rates (Tanaka Junior, 2015; Silva; Almeida, 2017).

The prosthetic replacement of irrecoverable anterior teeth has proved to be one of the greatest clinical challenges in oral rehabilitation, especially in areas of high aesthetic and functional demand. According to the findings, implant-supported prostheses proved to be a highly reliable and predictable alternative; however, it was observed that the moment of professionalization or installation of the definitive prosthesis significantly impacts the final aesthetic prognosis, influencing the stability of the soft tissues and the integration with adjacent teeth (Cosyn *et al.,* 2021).

The analyzed data also demonstrated that the technique that combines immediate loading with immediate implants is widely used in the rehabilitation of early tooth loss in the anterior region. This approach has shown important advantages, such as the preservation of the peri-implant mucosa and the maintenance of the bone level, provided by the application of immediate loading. In addition, harmonious aesthetic integration of prosthetic crowns with adjacent teeth was observed, both at the coronary and gingival levels, resulting in high patient satisfaction (Yuenyongorarn *et al.,* 2020; Thoma *et al.,* 2022).

In addition, the immediate application of dental implants is associated with a high success rate, reaching 95%, when preceded by careful diagnosis and planning (Costa *et*

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al., 2014). This approach reduces the number of surgical interventions required, improves patient comfort, and allows for immediate loading, contributing to the stability of the soft and hard tissues in the region (Lemes *et al.,* 2014).

The technique of immediate dental implants is also associated with psychosocial advantages, such as the reduction of emotional discomfort related to toothlessness, especially in aesthetic zones. However, the high technical complexity requires continuous training of professionals, and it is essential to master advanced approaches and innovative biomaterials, such as state-of-the-art bone substitutes and membranes with greater regenerative potential (Freitas *et al.,* 2023).

Another benefit is the preservation of the peri-implant bone and gingival contour, especially when the implant is performed soon after tooth extraction, favoring the maintenance of bone and gingival anatomy (Lima *et al.,* 2021).

Survival rates of immediate implants are comparable to conventional techniques, but their application requires careful evaluation of local conditions and patient expectations, due to the risk of aesthetic complications and infections (Taschieri *et al.,* 2023; Alves *et al.,* 2023).

The success of immediate dental implants depends on multiple factors, such as the skill of the dental surgeon, the quality of preoperative planning, and the detailed analysis of bone structure and soft tissues (Blanco *et al.,* 2018). A thorough diagnosis with imaging tests is essential to assess local anatomy, identify vital structures, and detect pathological processes, ensuring greater predictability in the procedure (Kan *et al.,* 2018).

To perform the immediate dental implant, it is necessary to understand the biological processes that can change dimensions in bones and soft tissues after tooth extraction, thus, possible factors can influence tissue preservation, responsible for favorable aesthetic results in Implantology. Immediate placement of the implant in fresh extraction sites, associated with bone preservation techniques, has been shown to preserve a greater amount of tissue volume. In addition, the appropriate selection of the implant, and the proper three-dimensional positioning are contributing factors to the success of this therapy (Martins *et al.,* 2011).

Other factors favorable to immediate implantation can be evaluated using radiographs, which allow the identification of characteristics such as bone availability, thickness, height, and shape of the bone. It is recommended that the bone thickness in the crest region be 4 to 5 mm and that the distance from the crest to the mandibular canal be

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at least 10 mm. In addition, the height of the interproximal bone should ideally be 5 mm or less from the point of contact with the adjacent tooth. Greater distances between the interproximal contact point and the bone crest reduce the probability of interproximal papilla formation, which can impact the aesthetic result (Amaro; Conforte, 2022).

The surgical decision for the implant procedure requires a detailed anamnesis and adequate planning, in which the benefits and possible risks involved in oral rehabilitation are evaluated. It is essential to consider and control any systemic changes before proceeding with the analysis and indication of the implant, ensuring greater safety and predictability in the results (Alves *et al.,* 2017).

The integrity of the alveolar buccal wall is another crucial factor. Success rates of 58.4% are observed in intact walls, while defective walls have only a 41.9% success rate. In these situations, the preservation of the alveolar crest achieves success rates of up to 98.6%, compared to 86.6% in immediate implants (Zhou *et al.,* 2019).

Esthetic restoration in partially edentulous regions or regions with unit loss is challenging, especially due to the need to harmonize the prosthesis with adjacent teeth, restoring aesthetics, phonetics, and masticatory function (Lorenzoni *et al.,* 2003). Preserving the periodontal structure and supporting bone is essential, but it can be compromised in cases of thin gingival biotypes or keratinized mucosal insufficiency (Mattos *et al.,* 2018).

Advances in biomaterials, such as autogenous bone grafts, continue to be the gold standard for bone reconstruction, offering better quality in neoformation and shorter healing time (Lima *et al.,* 2017). The need for open discussions with patients about the expectations and risks associated with treatment is essential to achieve satisfactory results (Bahat; Sullivan, 2010).

Guided bone regeneration is especially relevant in infected regions, where bone loss occurs due to periapical infections. The technique, performed with bone substitutes and collagen membranes, increases marginal bone and improves implant stability (Mattos *et al.,* 2018).

Indications include teeth with irreversible failures in endodontic treatment, root fractures, advanced subgingival caries, and severe periodontal disease (Blanco *et al.,* 2018). Immediate implants are preferable when the bone and gingival architecture are preserved, ensuring greater stability and satisfactory aesthetic results (Andrade *et al.,* 2020).

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Contraindications, on the other hand, include patients who have undergone chemotherapy or radiotherapy in the last 24 months, due to the impact on healing and the risk of osteoradionecrosis. Other limitations include the use of bisphosphonates, decompensated diabetes, the presence of oral infections and biofilms, and a history of surgical complications (Lindhe, 2005).

Immediate dental implants are also contraindicated for patients with inadequate oral hygiene, as well as for alcoholics, smokers, and illicit drug users (Souza et al., 2019). In addition, the technique is not recommended for individuals undergoing treatment with radiotherapy, or chemotherapy, or who have decompensated systemic diseases, such as chronic kidney disease (Mundt *et al.,* 2017).

Complications such as ankylosis, fractures during extraction, and technical failures can also make the immediate installation of the implant unfeasible. In cases of inadequate bone volume or active infections, guided bone regeneration can correct the limitations, but requires an additional surgical approach (Wychowański *et al.,* 2021).

Although immediate implants present promising results, with evident aesthetic and functional benefits, a detailed analysis of their advantages and disadvantages is indispensable, considering the particularities of each case. Additional studies are needed to consolidate protocols and optimize clinical outcomes, especially in aesthetic zones, where the challenges are more complex (Freitas *et al.,* 2023).

The main advantage of immediate placement of dental implants is the preservation of bone architecture and soft tissues, significantly reducing post-extraction bone resorption and promoting superior aesthetic results (Slagter *et al.,* 2021; Kan *et al.,* 2018). In addition, the reduction in the number of surgical interventions and the immediate comfort provided to the patient makes this approach attractive, especially in regions with high aesthetic demand (Lemes *et al.,* 2014). However, as pointed out by Costa *et al.* (2014), the success of the treatment depends on a careful evaluation and detailed planning, since failures can occur as a result of inadequate diagnoses.

The survival rates of immediate implants are comparable to those of conventional techniques, but the complexity of the approach requires a careful evaluation of local conditions, such as bone quality, the presence of healthy soft tissues, and the patient's aesthetic expectations. This technique poses specific risks, such as aesthetic complications and infections, which can be minimized with detailed preoperative planning,

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including advanced imaging tests, such as CT scans, to assess local anatomy and identify potential limitations (Taschieri *et al.,* 2023; Kan *et al.,* 2018).

The skill of the dental surgeon is also determinant, as the precise execution, combined with the appropriate selection of the implant and its correct three-dimensional positioning, are factors that directly impact the aesthetic and functional results (Blanco *et al.,* 2018; Martins *et al.,* 2021).

In addition to technical factors, understanding the biological processes that occur after tooth extraction is essential for the preservation of bone and tissue dimensions. Bone preservation techniques associated with the immediate placement of implants in fresh sockets are effective in maintaining tissue volume, contributing to more favorable aesthetic results (Martins *et al.,* 2021).

However, specific criteria, such as a minimum thickness of 4 to 5 mm of bone in the crest and a distance of at least 10 mm from the crest to the mandibular canal, must be respected to increase the predictability of treatment and reduce complications (Amaro; Conforte, 2022). Finally, the control of systemic alterations, associated with a detailed anamnesis, is essential to ensure safety and optimize the results of oral rehabilitation (Alves *et al.,* 2017). These factors highlight the importance of an integrated and personalized approach, considering the individual characteristics of each patient.

Guided bone regeneration has proven to be a valuable tool in cases of periapical infections, contributing to implant stability and increasing the predictability of results (Mattos *et al.,* 2018). However, the integrity of the buccal wall was identified as a critical factor. When this structure is intact, success rates reach 58.4%, while in cases of defects, the rates drop significantly to 41.9% (Zhou *et al.,* 2019). This data highlights the need for specific protocols for the management of alveoli with compromised walls, such as the alveolar crest preservation technique.

Although the survival rates of immediate implants are comparable to conventional techniques, especially in the medium term (Taschieri et al., 2023), technical challenges, such as restoring aesthetic harmony in cases of unit losses and maintaining the integrity of periodontal tissues, still represent important barriers (Lorenzoni *et al.,* 2003). Keratinized mucosal insufficiency and difficulties in mobilizing flaps are factors that can compromise aesthetics and functionality, requiring complementary approaches, such as soft tissue grafts and bone regeneration (Chapanov *et al.,* 2019; Wychowański *et al.,* 2021).

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The indications for immediate dental implants cover clinical conditions that make it impossible to maintain the natural tooth, such as irreversible failures in endodontic treatments, root fractures, advanced subgingival caries, and severe periodontal disease (Blanco *et al.,* 2019). The technique offers the advantage of replacing the lost tooth efficiently, reducing the functional and psychological impact of tooth loss.

However, Andrade *et al.* (2020) emphasize that the preservation of bone and gingival architecture is essential for the success of the procedure, especially in aesthetic zones, where structural stability and facial harmony are crucial for obtaining satisfactory results. The interaction between these perspectives shows that, although clinical criteria are determinant for the indication of implantation, local anatomical conditions enhance the predictability of treatment.

Prosthetic replacement of unrecoverable anterior teeth presents unique challenges in oral rehabilitation, mainly due to the high aesthetic and functional demands of these regions. As pointed out by Cosyn *et al.* (2021), the moment of professionalization or installation of the definitive prosthesis plays a crucial role in the aesthetic prognosis, as it directly affects the stability of the soft tissues and the integration of the prosthesis with the adjacent teeth. This complexity requires detailed and individualized planning, highlighting the need to carefully evaluate local and systemic factors before choosing the rehabilitation protocol.

In contrast to conventional techniques, the combination of immediate loading with immediate implants has been consolidated as a preferred approach in cases of early tooth loss in the anterior region. This technique has significant advantages by associating the preservation of the peri-implant mucosa, provided by immediate loading, with the maintenance of the bone level and the harmonious aesthetic integration of the prosthetic crown with the adjacent teeth (Yuenyongorarn *et al.,* 2020; Thoma *et al.,* 2022).

Lindhe (2005) highlights that conditions such as chemotherapy, recent radiotherapy, and the use of bisphosphonates are primary contraindications for immediate implants due to the risks of osteoradionecrosis and impairment in bone remodeling. Souza *et al.* (2019), in turn, broaden this discussion by including behavioral factors, such as smoking, alcoholism, and inadequate oral hygiene, which negatively impact oral health and treatment adherence.

Mundt *et al.* (2017) corroborate these limitations by reinforcing the need for systemic stability, pointing to diseases such as decompensated diabetes and chronic kidney disease

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as significant barriers to osseointegration. While Lindhe (2005) focuses on biological and metabolic aspects as the main impediments, Souza *et al.* (2019) and Mundt *et al.* (2017) complement this view by emphasizing the importance of behavioral and systemic conditions in treatment success. Together, the authors highlight the need for comprehensive and individualized planning, considering biological, systemic, and behavioral factors to minimize complications and maximize the predictability of immediate dental implants.

The heterogeneity of the available studies, added to the absence of robust long-term data, constitutes a significant limitation for the consolidation of widely applicable protocols. Studies that explore personalized approaches and new technologies, such as advanced biomaterials and minimally invasive methods, are key to expanding the applicability and benefits of this technique. In addition, patient involvement in the therapeutic decision, through clear discussions about expectations and risks, is essential to achieve optimal outcomes (Bahat and Sullivan, 2010; Freitas *et al.,* 2023).

Although advances in the field of implant dentistry have increased the success rates and acceptability of immediate implants, it is still necessary to invest in professional training and multidisciplinary integration to overcome the remaining challenges. The continuous evolution of materials and techniques, combined with high-quality clinical research, will be decisive in consolidating immediate implants as the standard of excellence in aesthetic zones.

The literature on immediate implants in esthetic zones shows significant variations in methods, evaluation criteria, and populations studied, which may make it difficult to directly compare the results. Although short- and medium-term success rates are frequently reported, there is a gap in studies evaluating long-term aesthetic, functional, and biological outcomes, especially in regions of high aesthetic demand.

The diversity of gingival biotypes, bone conditions, and patient's overall health levels can influence implant outcomes, making it difficult to generalize conclusions. The immediate implant technique requires high specialization and rigorous planning. The lack of uniformity in the experience and skill of the professionals reported in the literature can introduce bias in the studies. In addition, the presence of bone defects, infections, and thin gingival biotypes can compromise the results, highlighting the need for studies that explore alternative approaches in these cases.

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CONCLUSION

This study showed that immediate dental implants represent an effective and widely accepted alternative in the rehabilitation of esthetic zones, offering significant aesthetic and functional benefits. The technique stands out for its ability to preserve bone and gingival architecture, reduce treatment time, and provide greater comfort to the patient, aspects that directly contribute to the satisfaction and quality of life of individuals. However, the success of immediate implants is intrinsically linked to careful evaluation, thorough planning, and execution by trained professionals capable of handling the associated technical and biological challenges.

Although the survival rates of immediate implants are comparable to those of conventional techniques, factors such as the preservation of the buccal wall, the selection of the appropriate implant, the control of systemic alterations, and the application of complementary techniques, such as guided bone regeneration, are essential for the success of the procedure.

Despite technological advances and biomaterials that have expanded therapeutic possibilities, there are still gaps in the literature, mainly related to long-term results in aesthetic zones and challenging anatomical conditions. Thus, future studies are essential to consolidate more robust protocols, optimize clinical results, and expand the applicability of the technique, ensuring its efficacy and safety in different clinical contexts.

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