MAXILLARY SINUS LIFT: COMPARISON BETWEEN THE LATERAL WINDOW TECHNIQUE AND THE TRANSCRESTAL TECHNIQUE

LEVANTAMENTO DE SEIO MAXILAR: COMPARAÇÃO ENTRE A TÉCNICA DA JANELA LATERAL E A TÉCNICA TRANSCRESTAL

ELEVACIÓN DEL SENO MAXILAR: COMPARACIÓN ENTRE LA TÉCNICA DE VENTANA LATERAL Y LA TÉCNICA TRANSCRESTAL

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ABSTRACT

Maxillary sinus lift is a widely used procedure to enable dental implant placement in the posterior maxilla in cases of reduced bone height. Among the available techniques, the lateral window approach and the transcrestal technique stand out, presenting differences regarding invasiveness, bone gain, and postoperative morbidity. This study aimed to perform an integrative literature review comparing these two techniques in terms of indications, advantages, limitations, and clinical outcomes. The search was conducted in PubMed, SciELO, and ScienceDirect databases using specific descriptors combined with Boolean operators. Clinical studies, randomized trials, systematic reviews, and observational studies published between 2012 and 2025 were included. The results showed that both techniques present high implant survival and success rates. The lateral window technique demonstrated superior bone gain, especially in cases of severe atrophy, whereas the transcrestal technique showed lower morbidity and greater patient comfort. It is concluded that the choice of technique should be individualized, considering anatomical factors, residual bone height, and case complexity.

Keywords: Maxillary Sinus Lift. Dental Implants. Lateral Window Technique. Transcrestal Technique. Bone Graft.

RESUMO

O levantamento de seio maxilar é um procedimento amplamente utilizado para viabilizar a instalação de implantes dentários na região posterior da maxila em casos de altura óssea reduzida. Dentre as técnicas disponíveis, destacam-se a abordagem pela janela lateral e a técnica transcrestal, que apresentam diferenças quanto à invasividade, ganho ósseo e morbidade pós-operatória. O presente estudo teve como objetivo realizar uma revisão integrativa da literatura, comparando essas duas técnicas quanto às suas indicações, vantagens, limitações e resultados clínicos. A busca foi realizada nas bases de dados PubMed, SciELO e ScienceDirect, utilizando descritores específicos combinados por operadores booleanos. Foram incluídos estudos clínicos, ensaios randomizados, revisões sistemáticas e estudos observacionais publicados entre 2012 e 2025. Os resultados demonstraram que ambas as técnicas apresentam elevadas taxas de sucesso e sobrevivência dos implantes. A técnica da janela lateral mostrou-se superior em termos de ganho ósseo, especialmente em casos de atrofia severa, enquanto a técnica transcrestal apresentou menor morbidade e maior conforto ao paciente. Conclui-se que a escolha da técnica deve ser individualizada, considerando fatores anatômicos, altura óssea residual e complexidade do caso clínico.

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Palavras-chave: Levantamento de Seio Maxilar. Implantes Dentários. Janela Lateral. Técnica Transcrestal. Enxerto Ósseo.

RESUMEN

El levantamiento de seno maxilar es un procedimiento ampliamente utilizado para permitir la colocación de implantes dentales en el maxilar posterior en casos de altura ósea reducida. Entre las técnicas disponibles, destacan el abordaje por ventana lateral y la técnica transcrestal, que difieren en cuanto a invasividad, ganancia ósea y morbilidad postoperatoria. Este estudio tuvo como objetivo realizar una revisión bibliográfica integradora, comparando estas dos técnicas en cuanto a sus indicaciones, ventajas, limitaciones y resultados clínicos. La búsqueda se realizó en las bases de datos PubMed, SciELO y ScienceDirect, utilizando descriptores específicos combinados con operadores booleanos. Se incluyeron estudios clínicos, ensayos aleatorizados, revisiones sistemáticas y estudios observacionales publicados entre 2012 y 2025. Los resultados demostraron que ambas técnicas presentan altas tasas de éxito y supervivencia de los implantes. La técnica por ventana lateral demostró ser superior en términos de ganancia ósea, especialmente en casos de atrofia severa, mientras que la técnica transcrestal mostró menor morbilidad y mayor comodidad para el paciente. Se concluye que la elección de la técnica debe individualizarse, considerando factores anatómicos, altura ósea residual y la complejidad del caso clínico.

Palabras clave: Elevación del Seno Maxilar. Implantes Dentales. Ventana Lateral. Técnica Transcrestal. Injerto Óseo.

1 INTRODUCTION

The present study is characterized as an integrative review of the literature, of a qualitative nature and descriptive approach, conducted according to the methodological assumptions described by Whittemore and Knafl (2005), with the objective of analyzing and comparing the techniques of maxillary sinus lifting through the lateral window and the transcrestal approach, based on available scientific evidence.

The search for scientific articles was carried out in the electronic databases PubMed, SciELO and ScienceDirect, selected for their relevance in the health area and wide indexing of national and international scientific journals. For the search strategy, the following descriptors were used: "maxillary sinus lift", "lateral window technique", "transcrestal sinus lift", "osteotome technique" and "sinus floor elevation", combined by means of the Boolean operators AND and OR, according to the structured strategy: ("maxillary sinus lift" OR "sinus floor elevation") AND ("lateral window technique" OR "transcrestal sinus lift" OR "osteotome technique").

As inclusion criteria, articles published between 2012 and 2025, available in full, in English and Portuguese, involving clinical studies in humans and that directly addressed maxillary sinus lift and the comparison between lateral and transcrestal window techniques, were selected. Clinical trials, randomized studies, systematic reviews, and observational studies were included. Exclusion criteria included duplicate articles, studies that did not have a direct relationship with the proposed theme, isolated case reports with no comparative relevance, in vitro studies, and publications with restricted access to the full text.

The study selection process was carried out in stages. Initially, the titles and abstracts of the articles identified in the databases were read, followed by the complete reading of the potentially eligible studies. After applying the eligibility criteria, the articles that made up the final sample of this review were selected.

For data extraction and analysis, the following variables were considered: clinical indications, residual bone height, bone gain obtained, implant survival rate, postoperative morbidity, associated complications, type of biomaterial used, and follow-up time of the studies.

The data were organized in a descriptive and comparative way, allowing a critical analysis of the evidence available in the literature and the construction of a discussion about the advantages, disadvantages and clinical applicability of maxillary sinus lift techniques.

2 RESULTS AND DISCUSSION

The analysis of the selected studies shows that maxillary sinus lifting, both by the lateral window technique and by the transcrestal technique, is a highly predictable and consolidated procedure in rehabilitation with implants in the posterior region of the maxilla. Such predictability is directly related to the ability of these techniques to promote vertical augmentation of the alveolar ridge, enabling the installation of implants even in conditions of severe bone atrophy, as widely described in recent literature (TSAI et al., 2020; ZHOU et al., 2020; LYU et al., 2023).

2.1 IMPLANT SURVIVAL

The data analyzed demonstrate that both techniques have high implant survival rates, with no statistically significant differences in most of the clinical studies and systematic reviews available (DEL FABBRO et al., 2012; PIJETURSSON et al., 2008; WALLACE; FROUM, 2003). These findings reinforce the predictability of maxillary sinus lift as a reliable procedure for posterior maxillary rehabilitation.

Tsai et al. (2020) reported an overall survival rate of 98.9% in severely atrophic maxillae, regardless of the technique employed, including one- and two-stage approaches. Similarly, Zhou et al. (2020) observed a clinical success rate of 100% after 24 months of follow-up, both for the transcrestal technique and for the lateral window technique, with maintenance of peri-implant bone stability throughout the period evaluated.

Additional studies corroborate these results, demonstrating that the survival rate of implants in maxillary sinus lift procedures remains high in the long term, even under unfavorable anatomical conditions (JENSEN; TERHEYDEN, 2009; POMMER et al., 2012). These data suggest that the success of osseointegration is more related to the correct indication of the technique, surgical planning, and the primary stability of the implant than to the type of approach used.

Thus, although there are differences between the techniques in terms of invasiveness and bone gain, the literature is consistent in demonstrating that both provide predictable and safe clinical results regarding implant survival. Thus, the choice of technique should not be based exclusively on the success rate, but rather on an individualized analysis that considers anatomical factors, extent of the bone defect, systemic conditions of the patient, and experience of the professional (LYU et al., 2023).

2.2 BONE GAIN

Regarding vertical bone gain, the literature shows a consistent trend towards superiority of the lateral window technique, especially in cases of greater bone involvement and lower residual bone height (DEL FABBRO et al., 2012; PIJETURSSON et al., 2008). This approach allows greater surgical access and direct control of the sinus cavity, favoring the creation of an adequate subantral space for the insertion of a larger volume of biomaterial.

Comparative clinical studies corroborate this evidence. Zhou et al. (2020) observed that endosinusal bone gain was significantly higher in the lateral window technique after 24 months of follow-up, evidencing greater volumetric stability of the graft over time. Similarly, Tsai et al. (2020) demonstrated that, in situations of residual bone height ≤3 mm, the two-stage lateral approach provided superior bone gain when compared to the transcrestal technique.

From a biological point of view, this superiority can be explained by the greater manipulation capacity of the Schneider membrane and the formation of a more stable three-dimensional space, delimited by the lateral wall of the maxillary sinus, the alveolar bone crest, and the elevated sinus membrane. This environment favors bone neoformation and the maintenance of graft volume over time (LYU et al., 2023).

However, despite the greater amount of bone obtained with the lateral technique, histological studies indicate that the quality of the newly formed bone tissue is similar between the techniques. Esfahanizadeh et al. (2012) demonstrated that there are no significant differences in the formation of vital bone, connective tissue, and residual material between the lateral approach and the osteotome technique.

In addition, the transcrestal technique has shown satisfactory clinical results in terms of bone gain in well-selected cases, especially when associated with technological advances, such as hydraulic systems and precision instruments (TORRES et al., 2017; DI FRISCHIA et al., 2025). These features allow greater control of the elevation of the sinus membrane, expanding the indications for this technique even in situations of lower residual bone height.

Thus, although the lateral window technique is superior in terms of absolute bone gain and predictability in severe cases, the transcrestal technique can provide adequate clinical results when correctly indicated. Thus, the choice of technique should consider not only the desired bone volume, but also the complexity of the case, the anatomical conditions, and the surgeon's experience.

2.3 POSTOPERATIVE MOMORBIDITY

Regarding postoperative morbidity, the literature consistently demonstrates that the transcrestal technique has significant advantages when compared to the lateral window approach, especially in terms of less discomfort and faster patient recovery (FARINA et al., 2018; STACCHI et al., 2017).

In a randomized clinical trial, Farina et al. (2018) observed a lower incidence of edema, ecchymosis, and nosebleeds in patients undergoing the transcrestal technique, in addition to a lower impact on daily activities in the postoperative period. These findings are corroborated by systematic reviews that indicate lower morbidity associated with minimally invasive techniques, especially when compared to the traditional lateral approach (STACCHI et al., 2017).

This difference can be explained by the less invasive nature of the transcrestal technique, which does not require the creation of a lateral bone window and significantly reduces the extent of mucoperiosteal detachment, resulting in less surgical trauma and shorter operative time. Consequently, there is a reduction in the inflammatory response and an improvement in the patient's postoperative experience.

On the other hand, the transcrestal technique has important limitations, especially related to the absence of direct visualization of the sinus membrane, which characterizes it as a technique dependent on the operator's skill. This condition can increase the risk of perforation of Schneider's membrane, particularly in cases with unfavorable anatomy or lower residual bone height (SCHNEIDER et al., 2014; LYU et al., 2023).

On the other hand, the lateral window technique, although associated with greater morbidity, offers better visual control of the procedure, allowing greater predictability in complex cases and reducing the risk of intraoperative complications when performed properly. However, this approach is related to a higher incidence of edema, postoperative discomfort, and longer recovery time, as described in the literature (STACCHI et al., 2017).

Thus, a clinical balance is observed between lower morbidity and lower visual control in the transcrestal technique, in contrast to greater invasiveness and greater surgical predictability in the lateral window technique. Thus, the choice of approach should consider not only the technical aspects, but also the patient's profile, the complexity of the case, and the surgeon's experience, aiming to optimize clinical results and minimize complications.

2.4 CLINICAL INDICATIONS AND ANATOMICAL FACTORS

The selection of the maxillary sinus lift technique is directly related to the patient's anatomical conditions, and residual bone height is one of the main determining factors for

the choice of surgical approach. Traditionally, the transcrestal technique is indicated in cases with residual bone height greater than 5–6 mm, while the lateral window technique is preferred in situations of more severe atrophy, in which there is a need for greater vertical bone gain (TSAI et al., 2020; ZHOU et al., 2020; DEL FABBRO et al., 2012).

However, recent evidence suggests that the clinical decision should not be based solely on residual bone height. Additional anatomical factors, such as the thickness of the lateral wall of the maxillary sinus, the presence of sinus septa, the shape of the sinus cavity, and the characteristics of the Schneider membrane, play a key role in the predictability of the procedure and the risk of intraoperative complications (LYU et al., 2023; SCHNEIDER et al., 2014).

The presence of sinus septa, for example, can make it difficult to elevate the membrane and increase the risk of perforation, especially in the transcrestal technique, which does not allow direct visualization of the operative field. Similarly, the thickness of the sinus membrane and its structural integrity are critical factors that directly influence the success of the procedure and the stability of the graft (STACCHI et al., 2017).

In addition, the shape of the maxillary sinus and the degree of pneumatization can interfere with the ability to create and maintain the subantral space, impacting the volume of graft required and the choice of the most appropriate technique. In cases with complex anatomy or extremely low bone height, the lateral window technique tends to be more indicated, due to greater surgical control and better visualization of the sinus cavity (PIJETURSSON et al., 2008; WALLACE; FROUM, 2003).

On the other hand, recent technological advances have expanded the indications of the transcrestal technique, allowing its use in situations previously considered limiting. The use of hydraulic systems, piezoelectric instruments, and minimally invasive techniques has contributed to greater precision in the elevation of the sinus membrane and reduced risk of complications, enabling its application even in cases with lower residual bone height (TORRES et al., 2017; DI FRISCHIA et al., 2025).

Thus, the choice of technique should be based on a multifactorial analysis, which considers not only the residual bone height, but also the anatomical characteristics of the maxillary sinus, the complexity of the clinical case, the systemic conditions of the patient, and the surgeon's experience. This individualized approach allows optimizing clinical outcomes, reducing the occurrence of complications, and increasing the predictability of treatment with implants in the posterior region of the maxilla.

2.5 COMPARATIVE SYNTHESIS, LIMITATIONS AND CLINICAL IMPLICATIONS

The integrated analysis of the studies shows that both techniques are effective and predictable, but have different clinical profiles. The lateral window technique stands out for its greater bone gain and greater predictability in cases of severe atrophy, and is considered the approach of choice in complex situations. On the other hand, the transcrestal technique has lower morbidity, shorter surgical time, and greater patient comfort, and is indicated in cases with favorable anatomical conditions.

However, it is important to highlight that the studies analyzed have relevant limitations, such as methodological heterogeneity, variations in surgical protocols, differences in the biomaterials used, and diversity in follow-up periods. These factors can directly influence the results and make it difficult to compare studies directly.

Thus, the choice of technique should be individualized and based on a careful evaluation of anatomical factors, the extent of bone loss, the surgeon's experience, and the patient's expectations. Evidence-based decision-making, combined with the advancement of available techniques and technologies, allows for the optimization of clinical outcomes and minimization of complications, contributing to the long-term success of rehabilitation with posterior maxillary implants.

3 CONCLUSION

It is concluded that the techniques of maxillary sinus lift by lateral window and transcrestal approach are effective, safe and highly predictable approaches for rehabilitation with implants in the posterior region of the maxilla, presenting high success rates when correctly indicated.

The lateral window technique stands out for its greater potential for bone gain and greater predictability in situations of severe maxillary atrophy, being more indicated in cases that require greater volume of bone regeneration and expanded surgical control. On the other hand, the main advantages of the transcrestal technique are less invasiveness, reduction of postoperative morbidity, and greater patient comfort, being preferable in scenarios with favorable anatomical conditions.

In this sense, the choice of technique should be individualized and based on a comprehensive evaluation, which considers not only the residual bone height, but also anatomical factors of the maxillary sinus, complexity of the clinical case, and surgeon's experience. In addition, technological advances have contributed to the expansion of the indications for the transcrestal technique, expanding its clinical applicability.

Finally, the need for clinical studies with greater methodological standardization and long-term follow-up is highlighted, in order to strengthen the available evidence and improve evidence-based clinical decision-making.

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