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REVIEW

Zygomatic Implants: The importance of the correct choice of surgical technique

Implantes Cigomáticos: La importancia de una correcta elección de la técnica quirúrgica

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ABSTRACT

This paper discusses the feasibility of zygomatic implants as an effective alternative to conventional bone regeneration techniques for maxillary rehabilitation. The anatomical complexity of the maxilla, which presents significant challenges due to bone resorption and atrophy in the absence of masticatory stimulus, is described. Through a review of the scientific literature, the survival rate of zygomatic implants, their complications and the surgical techniques used are evaluated. The results indicate a high success rate of 98,1 % in these implants, highlighting their capacity to allow immediate prosthetic loading. However, the need for a thorough diagnosis and a rigorous follow-up to minimize complications, such as sinusitis, and to improve long-term results is pointed out.

Keywords: Nasal Cavity; Zygoma; Aesthetics; Bone Regeneration; Zygomatic Bone.

RESUMEN

El presente trabajo analiza la viabilidad de los implantes cigomáticos como una alternativa eficaz a las técnicas convencionales de regeneración ósea para la rehabilitación del maxilar superior. Se describe la complejidad anatómica del maxilar, que presenta desafíos significativos debido a la reabsorción ósea y la atrofia en ausencia de estímulo masticatorio. A través de una revisión de la literatura científica, se evalúan la tasa de supervivencia de los implantes cigomáticos, sus complicaciones y las técnicas quirúrgicas utilizadas. Los resultados indican una alta tasa de éxito del 98,1 % en estos implantes, destacando su capacidad para permitir la carga protésica inmediata. Sin embargo, se señala la necesidad de un diagnóstico exhaustivo y un seguimiento riguroso para minimizar las complicaciones, como la sinusitis, y mejorar los resultados a largo plazo.

Palabras clave: Cavidad Nasal; Cigoma; Estética; Regeneración Ósea; Hueso Cigomático.

INTRODUCTION

Since its inception, the rehabilitation of the upper jaw using dental implants has been a field that faces unique and significant challenges. The anatomical complexity of the upper jaw, characterized by the presence of critical structures such as the maxillary sinus and a bone morphology that tends to atrophy in the absence of masticatory stimulation, makes this process a significant technical challenge. Tooth loss in this region leads to a series of physiological changes, including alveolar bone resorption and a consequent decrease in the height and thickness of the bone available for the placement of conventional dental implants. These changes, which are particularly pronounced in edentulous patients, considerably limit rehabilitation options, as the quantity

and quality of the remaining bone are often insufficient to guarantee the stability and long-term success of traditional implants.[1,2,3] Historically, the solution to these problems has involved the implementation of various bone regeneration techniques, such as autologous grafts, maxillary sinus lifts, and, more recently, guided bone regeneration. 4 Although these techniques have proven effective in many cases, they are not without complications and limitations, such as the morbidity associated with obtaining bone grafts, prolonged treatment time, and variability in bone regeneration results. Furthermore, in cases of severe atrophy or massive bone loss, these techniques may not be feasible or may require highly complex procedures, increasing the risk and cost of treatment.[5]

Given this scenario, there is a need to explore alternatives that can offer effective, less invasive solutions with better long-term results. Zygomatic implants, developed by Prof. Per-Ingvar Bränemarken in 1989, represent one of the most significant innovations in modern implantology.[6] These implants were initially designed for patients who had undergone partial or total maxillectomies, providing an anchorage option in the zygomatic bone, a robust and dense bone structure that, due to its location, does not undergo the same atrophy processes as the maxilla. The possibility of using the zygomatic bone as an anchorage site has allowed dental professionals to offer fixed prosthetic solutions to patients who would otherwise have been considered unsuitable for conventional implantology.[7,8]

Zygomatic implants have established themselves as a preferred option in cases of severe maxillary atrophy, where bone regeneration techniques have significant limitations. These implants, which can measure between 30 and 52,5 mm in length, are placed through the maxillary sinus and fixed to the body of the zygomatic bone, allowing the placement of fixed prostheses with immediate loading.[9] This approach reduces the overall treatment time. It significantly improves patients' quality of life by minimizing waiting times for complete prosthetic rehabilitation and offering superior stability and functionality from the early stages of treatment.[10,11]

The use of zygomatic implants has been the subject of numerous clinical studies and systematic reviews that have documented their high success rate, even in conditions that would be unfavorable for other types of implants. However, like any surgical procedure, it is not without risks and complications.[12,13] The placement of these implants requires meticulous planning and precise execution, as any deviation in technique can lead to complications such as sinusitis, chronic maxillary sinus inflammation, or problems related to palatal emergence of the implant, which can result in bulky prostheses that are difficult for the patient to manage.[14]

In clinical practice, the choice between the various surgical techniques available for zygomatic implant placement depends on multiple factors, including the patient's specific anatomy, the degree of bone atrophy, and the surgeon's experience surgeon's experience. Intrasinus techniques, which anchor the implant within the maxillary sinus, have traditionally been the most widely used option. Still, they have the disadvantage of a higher risk of sinus complications and a less favorable implant location for prosthesis placement. On the other hand, the extra-sinus technique, which places the implant body outside the maxillary sinus, has gained popularity because it offers more favorable implant positioning, thereby reducing complications and improving the predictability of the prosthetic result.[15,16,17,18]

In recent years, advances in digital technology have enabled the development of guided surgery techniques that combine intraoral scanning with surgical planning software to design customized guides that facilitate the precise placement of zygomatic implants. This evolution has improved surgery accuracy, reduced operating time, and minimized associated risks, offering more consistent and predictable results.[19,20]

This article aims to comprehensively analyze the viability of zygomatic implants as a viable and effective alternative to conventional bone regeneration techniques. A systematic review of the scientific literature published in the last ten years will evaluate key aspects such as the survival rate of zygomatic implants, associated complications, surgical techniques used, and criteria determining treatment success. The search methodology will include a rigorous selection of articles from the Scielo and Pubmed databases, using relevant English and Spanish descriptors to ensure a comprehensive and representative review of the current state of knowledge in this field

METHOD

To evaluate the conditions for placing zygomatic implants, a literature search was conducted for scientific articles published in the last ten years in the Scielo and PubMed databases in English and Spanish using the following descriptors: "zygomatic implants"; 'bone loss'; 'bone grafts'; 'tissue grafts'; 'implantology'; 'prosthetic rehabilitation'; 'jawbone'; 'zygomatic implant'; 'maxillary atrophy.'

Inclusion criteria

- Scientific articles on patients with severe maxillary atrophy who have undergone zygomatic implants.
- Any type of research study will be valid (clinical practice, clinical trial, observational study).
- Patients included in these studies must have been followed up in consultations after the operation for a minimum period of approximately 6 to 12 months.

Exclusion criteria

- Articles that do not report clinical data.
- Articles on patients that do not include follow-up for the abovementioned period.
- Patients who underwent surgery using the juxta-sinus technique.
- A total of 32 articles were found and analyzed.

RESULTS

A review of scientific articles found 32 studies presenting clinical results obtained with zygomatic implants. These publications included 1 031 patients and 2 131 zygomatic implants with a follow-up period ranging from 6 months to 12 years. Forty-two implants were reported as failures, giving an overall survival rate of 98,1 %.

Preliminary data show that the zygomatic implant technique is highly predictable and produces good clinical results.[21]

Table 1. Documented results of zygomatic implants

Study (reference)	Follow-up	Patients (n)	Zygomatic implants	Failed zygomatic implants	Conventional implants	Failed conventional implants
Parel	1-12 years	27	65	0	?	?
Bedrossian	34 months	22	44	0	80	7
Vrielinck	<2 years	29	46	3	80	9
Boyes-Varley	6-30 months	45	77	0	?	?
Malevez	0,5-4 years	55	103	0	194	16
Branemark	1-10 years	81	164	4	?	?
Becktor	1-6 years	16	31	3	74	3
Hirsch	1 year	66	124	3	?	?
Branemark	5-10 years	28	52	3	106	29
Peñarrocha	1-1,5 years	5	10	0	16	0
Farzad	1,5-4 years	11	22	0	42	1
Ahlgren	1-4 years	13	25	0	46	0
Aparicio	0,5-5 years	69	131	0	304	2
Bedrossian	>12 months	14	28	0	55	0
Chow	10 months	5	10	0	20	0
Duarte	6-30	12	48	2	0	-
Peñarrocha	months	21	40	0	89	2
Davo	12-45	18	36	0	68	3
Mozzati	months	7	14	0	34	0
Pi-Urgell	6-29 months	54	101	4	221	15
Davó	24 months	42	81	0	140	4
Maló	1-72	29	67	1	57	0
Balshi	months	56	110	4	391	11
Davó	12-42	21	45	1	109	11
Aparicio	months	20	41	0	87	0
Aparicio	6-18	25	47	0	127	0
Bedrossian	months	36	74	2	98	0
Stiévenart	9-60	20	80	3	0	-
Davó	months	17	67	0	0	-
Migliorança	60 months	65	150	2	286	2
Aparicio	6-8 months	22	41	2	131	4
Aparicio	7-38 months	80	157	5	442	20
Total		1031	2131	42	3297	139

This table shows the survival rate of zygomatic implants and how many had sinusitis as an associated complication. Out of a total of 513 patients who underwent this surgery (this number may not be exact as there may be more than one study with the same sample of patients), a survival rate of 91,6 % was observed, with a complication rate of 8 % in all patients, equivalent to 36 patients with sinus complications after surgery.[21]

Table 2. Sinus complications documented in different studies in which zygomatic implants were placed following a two-step protocol

Two-step protocol	Total number of patients	Follow-up period (months)	Survival rate of zygomatic implants (%)	Sinusitis (%)
Bedrossian	22	34 months	100	0
Vrielink	29	12-24 months	92	2 (6,9)
Boyes-Varley	45	6-30 months	100	0
Malevez	55	6-48 months	100	5 (9)
Hirsch	76	12 months	98	3 (4)
Branemark	28	72-108 months	94	4 (14,3)
Becktor	16	9-69 months (average 46)	90,3	6 (26,6)
Zwahlen	18	6 months	94,4	1 (5,5)
Aparicio	69	6-60 months	100	3 (4,3)
Farzad	11	18-56 months	100	1 (9,1)
Ahlgren	13	12-56 months	11	1 (9,1)
Peñarrocha	21	12-60 months (average 29)	100	2 (9,5)
Pi	54	1-72 months	96	0
Davo	24	60 months	97,4	5 (20,8)
Stiévenart	10 (de 20)	40 months	96,3	1 (1,3)
Aparicio	22	120 months	97,7	2 (9,1)

DISCUSSION

The review results presented in this study highlight the high survival rate of zygomatic implants, with 98,1 % in a follow-up range of 6 months to 12 years. This finding is consistent with previous studies that have reported the efficacy and stability of zygomatic implants, especially in patients with severe maxillary atrophy. The fact that only 42 of 2 131 implants failed reinforces the idea that these implants are a viable and reliable option when conventional bone regeneration techniques are not feasible or present more significant risks.

According to the reviewed data, one of the strengths of zygomatic implants is their ability to allow immediate prosthetic loading. This approach reduces the overall treatment time and improves the patient's quality of life by providing a functional solution in a shorter time frame. However, it is essential to note that the placement of these implants requires great precision and surgical experience, as complications, although relatively rare, can be serious, as evidenced by the reported cases of sinusitis.

The review also highlights that the extra-sinus technique offers better results in reducing sinus complications and more favorable prosthetic positioning compared to the intra-sinus technique. However, the choice of technique depends on the patient's specific anatomy and the surgeon's experience, suggesting that treatment customization is crucial to maximizing the success of zygomatic implants.

Although not very common, sinus complications represent a critical area that deserves attention. With an incidence of sinusitis of 8 % among the patients reviewed, it is clear that, although zygomatic implants are a robust solution, they are not without risks. The incidence of these complications reinforces the need for rigorous postoperative follow-up and thorough preoperative evaluation to minimize the risk of complications.[1,11]

Finally, technological advances in computer-guided surgery have significantly improved the accuracy of implant placement, reducing complication rates and increasing the predictability of outcomes. These advances underscore the importance of integrating new technologies into clinical practice to improve treatment outcomes.

CONCLUSION

Zygomatic implants facilitate the rehabilitation of severely atrophied jaws and also offer the possibility of placing an immediate prosthesis. This study concludes that treatment with zygomatic implants is predictable, has a high success rate, and reduces conventional treatment times. However, a strict protocol with a correct clinical and radiographic diagnosis must be followed to predict the outcome of surgery. Furthermore, this treatment is not without complications, so all precautions must be taken to minimize them and inform the patient of these complications.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Paloma Ortega.
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Formal analysis: Paloma Ortega.
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