



Original Article

Use of beta-tricalcium phosphate bone graft in dental implants for bone regeneration

Uso de enxerto ósseo de fosfato beta-tricalcium em implantes dentários para regeneração óssea

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Abstract

Objective: to avoid alveolar bone loss and prevent bone resorption and implant failure through the use of beta-tricalcium phosphate bone graft. **Case Report:** 43-year-old patient who underwent dental extraction of the upper right canine due to root fracture; subsequently, a Bicon® dental implant was placed accompanied by a bone regeneration process in the peri-implant space with beta-tricalcium phosphate substitute and collagen plug, preserving the alveolar bone and papillary gingiva. **Results:** adequate healing was observed, without gingival retraction. When evaluating the final tomography, an increase in bone tissue was observed at the intervention site with greater measurements than the initial ones and without bone resorption. A fixed temporary crown was made on a temporary abutment which allows the soft tissues to be conditioned, improving the emergence profile for the final crown.

Keywords: Regeneration. Bone Regeneration. Dental Implants.

Resumo

Objetivo: evitar a perda óssea alveolar e prevenir a reabsorção óssea e falha do implante por meio do uso de enxerto ósseo de beta-fosfato tricálcico. **Relato do Caso:** paciente de 43 anos submetido a extração dentária de canino superior direito devido a fratura radicular; posteriormente, foi colocado implante dentário Bicon® acompanhado de processo de regeneração óssea no espaço peri-implantar com substituto de beta-fosfato tricálcico e tampão de colágeno, preservando o osso alveolar e a gengiva papilar. **Resultados:** observou-se cicatrização adequada, sem retração gengival. Na avaliação da tomografia final, observou-se aumento do tecido ósseo no local da intervenção com medidas maiores que as iniciais e sem reabsorção óssea. Uma coroa provisória fixa foi confeccionada em um abutment provisório que permite o condicionamento dos tecidos moles, melhorando o perfil de emergência para a coroa definitiva.

Palavras-chave: Regeneração. Regeneração Óssea. Implantes Dentários.

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Introduction

Dental implants are a treatment option that arises from the need to recover functionality and aesthetics which are lost when an extraction is carried out¹. Tooth extractions can be performed in two ways, the first one is the conventional technique which is effective but can often cause fracture of the tooth and surrounding bone, which would lead to postoperative complications. The second option is the atraumatic extraction technique, which seeks to preserve periodontal tissues such as papillary gingiva and alveolar bone: from this point of view and taking into account what has been described above, the ideal would be to perform the atraumatic technique due to its conservative nature². There are multiple reasons why teeth are lost and extractions need to be performed, among the most common are periodontal disease, dental caries, and trauma¹.

Dental implantology aims to achieve a good placement and correct osseointegration of the implants, reduce risks and complications, and that the implants accomplish being aesthetic, functional, and capable of imitating the original dental anatomy¹.

After a dental extraction and an implant placement, the bone healing process begins, leading to the appearance of new bone. However, there is no complete restoration due to physiological bone resorption, which generates a decrease in bone volume in both directions, vertical and horizontally. It is important to emphasize that the alveolar bone must have adequate dimensions and volume to guarantee long-term success after placing an implant. Another point which should be taken into account before a dental extraction and subsequently performing immediate implant placement is that many of these patients come to the office with alveolar ridges that show considerable bone loss^{3,4}.

Scientific advances in biomaterials make it possible to repair or replace living tissue through minimally invasive surgeries. In order to achieve this goal, growth factors and cultured cells were incorporated into the biomaterials, allowing them to fulfill the biological function of inducing tissue regeneration and facing multiple obstacles such as the high cost of growth factors and immune rejection⁵.

Since it is so important to deal with bone tissue in good clinical condition, multiple alternatives seek to provide a solution to this problem. These options include autologous bone grafts, allografts, xenografts, and alloplastic. Of the latter, beta-tricalcium phosphate (β -TCP) stands out as a bioceramic material widely used in the medical and dental field, which is an excellent alternative due to its availability and cost⁶.

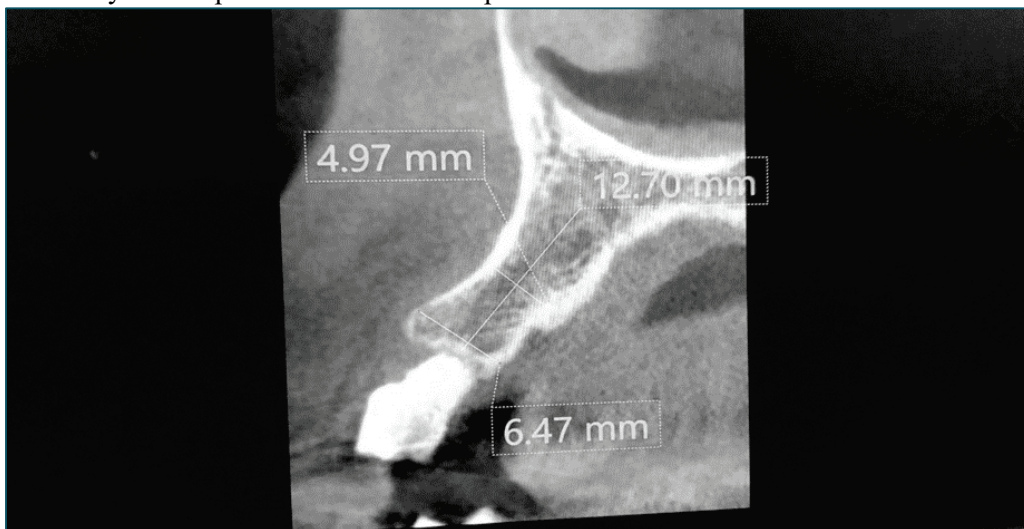
Beta-tricalcium phosphate is a biocompatible alloplastic bone graft, which induces bone regeneration and growth through the fixation, proliferation, and differentiation of osteoblasts and mesenchymal cells, in addition to having a fast degradation rate compared to other bone substitutes. β -TCP undergoes resorption and replacement by mature bone in a short time interval of six months, but this process can take years to complete. This material generates fewer complications and its success rate is similar to that of autografts. It should also be taken into account that bone growth varies depending on the diameter and length of the implant⁷.

The objective of this article is to report a clinical case in which the importance of the use of bone grafts in the placement of immediate implants is evidenced when there is a deficiency of remaining bone, linked to effective alternatives such as alloplastic beta-tricalcium phosphate type bone grafts in bone augmentation, providing, meanwhile, the long-term success of the implant.

Case report

A 43-year-old female patient came to the dental office at the dental clinic of the University of Cartagena, in the city of Cartagena de Indias, Colombia, with a root fracture in the right maxillary canine, with no relevant personal or family medical history. Computed tomography was performed to study the initial state of the alveolar bone and its dimensions, assessing the height, width, and length of the bone in the area of the upper anterior teeth, focusing on the affected tooth and area (Figure 1).

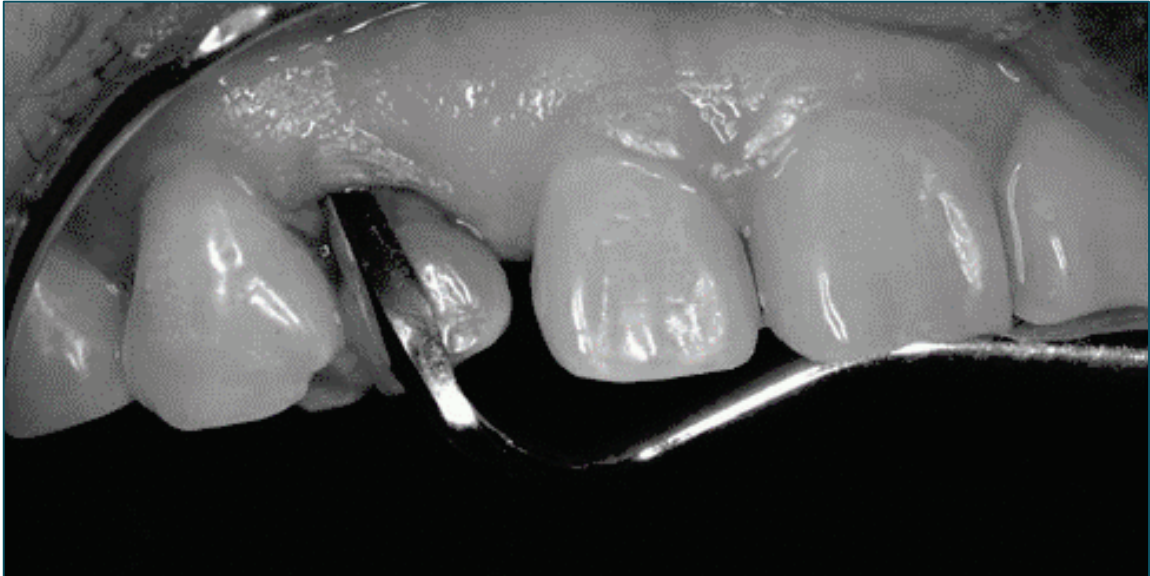
Figure 1 - Residual alveolar ridge of 6.47 mm is observed, with the presence of trabecular bone which is necessary for the placement of dental implants. Residual alveolar ridge of 6.47 mm is observed, with the presence of trabecular bone which is necessary for the placement of dental implants.



After evaluating the case, the treatment plan was designed. It consisted of atraumatic extraction of the right maxillary canine, followed by the immediate placement of a dental implant of the Bicon® system and the performance of bone regeneration of the peri-implant space using a bone substitute of the beta-tricalcium phosphate type.

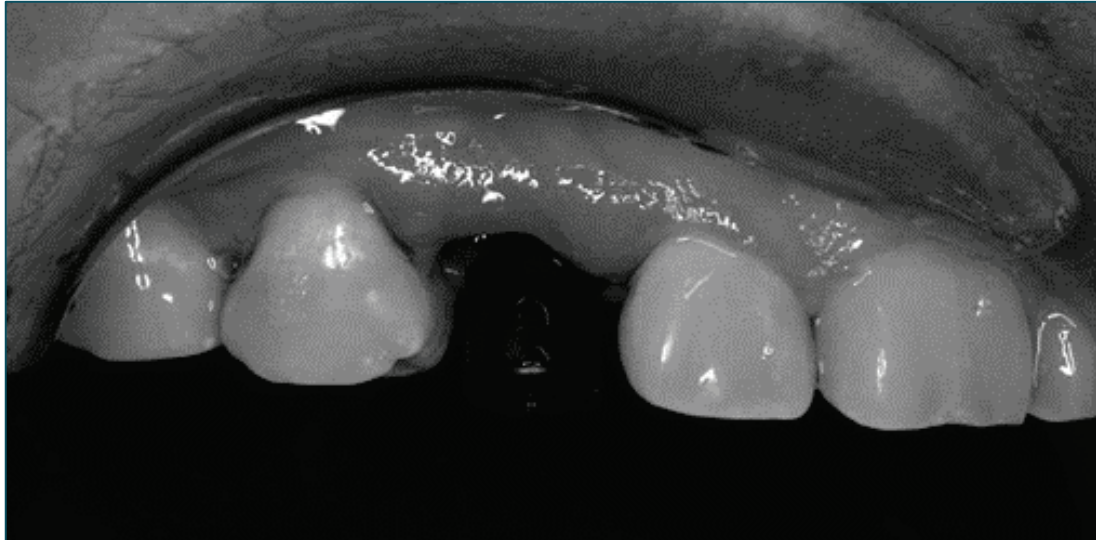
Atraumatic extraction was performed under local anesthesia with 2% lidocaine. Syndesmotomy was performed without detaching the interdental papillae and using limited support points, in order to maintain the integrity of the periodontal tissues, especially that of the alveolar bone and the papillary gingiva. After the extraction, curettage and disinfection of the socket with tetracycline were performed (Figure 2).

Figure 2 - Affected right upper canine, atraumatic extraction with a curved Flohr root elevator, to preserve the alveolar bone and the papillary gingiva.



A Bicon® dental implant with dimensions of 4.5x 8.0 mm was placed immediately, leaving 2.5 mm of subcrestal space in order to have an adequate emergence profile. In the peri-implant space, bone regeneration was performed, filling it with beta-tricalcium phosphate bone graft (Synthograft® 50 to 500 µm), which was applied in layers and mixed with the patient's blood until the desired bone volume was acquired, in order to preserve the coronal portion of the mucosa and improve healing. Finally, a collagen plug was placed and simple stitches were made with 6-0 nylon while maintaining the height of the soft tissues (Figure 3).

Figure 3 - Bicon® implant abutment placement.



As a postoperative medication, 500 mg of amoxicillin every 8 hours for 7 days and 200 mg celecoxib tablets once a day for 5 days for pain management were prescribed. The stitches were removed 10 days later. Follow-up was done and, after 4 months of healing, the second phase began with the realization of an aesthetic crown integrated into the abutment.

Three months after surgery, a satisfactory evolution was observed, the patient showed complete healing and the final tomography showed an increase in bone volume with greater measurements than those initially observed, as it was expected after performing the bone regeneration procedure (Figure 4).

Figure 4 - Aesthetic smile with a temporary crown in the upper right canine.



Results

After surgery, adequate healing was observed without the presence of gingival retraction. When evaluating the final tomography, no bone loss was observed. In spite of that, an increase in bone tissue was evidenced at the intervention site, with larger measurements than the initial ones. A fixed temporary crown was made on a temporary abutment which allowed the soft tissues to be conditioned, improving the emergence profile for the definitive crown, which must meet the criteria of aesthetics and function.

Discussion

The combination of dental implants with the implementation of biomaterials such as the β -TCP bone graft has been widely discussed. This bone substitute functions such as an osteoconductive tool that benefits proliferation and regeneration of bone, when it is reabsorbed and replaced, allows regenerated bone. From a clinical point of view, β -TCP shows a good bone healing period of 6 months, as mentioned by Velasco Ortega et al., in addition to multiple benefits such as reducing complications and minimizing alveolar bone loss and gingival retraction. Despite being an alloplastic or synthetic bone substitute, this material has excellent biocompatibility and an accelerated degradation rate when compared to other types of bone grafts⁸.

The placement of unitary implants immediately after an atraumatic extraction in the anterior area is a complex procedure that seeks to maintain the natural aesthetics of the tissues which surround dental crowns, avoiding gingival retraction and loss of alveolar bone, whose regeneration is sought through the use of bone grafts such as beta-tricalcium phosphate to fill the remaining space between the implant and the soft tissues. The placement of immediate implants requires highly trained personnel since it is an intervention that combines two dental procedures. On the contrary, it is less traumatic for patients since only one surgical intervention is performed. As commented by Joseph Yun Kwong Kan et al., who also mentioned that flapless procedures reduce incompatibility, it is important to fill the spaces with biocompatible material and, in order to perform implants with immediate loading, the patient must have specific characteristics⁹.

Conclusion

The long-term success of implant treatments to restore function and aesthetics in the anterior area of the oral cavity is determined by the proper management of hard and soft tissues, therefore, it

is important to use conservative approaches which allow the bone to be preserved at the crestal level.

The combination of different surgical techniques within the same procedure allows improving the tissues which have been lost. Bone regeneration using beta-tricalcium phosphate graft as an osteoconductive tool is an ideal option for the proliferation and regeneration of bone tissues. Despite being an alloplastic or synthetic bone substitute, this biomaterial has excellent biocompatibility and an accelerated degradation rate compared to other substitutes, making it a perfectly valid alternative for these cases.

Authors' contribution

All authors have approved the final version of the manuscript and declared themselves to be responsible for all aspects of the work, including ensuring its accuracy and integrity.

Conflicts of interest

The authors declared that they have no conflicts of interest

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