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Sinus Lift by Lateral Approach versus Short and Extra-Short Implants: Split-Mouth Case Series

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Abstract

Introduction: The treatment of the atrophic posterior maxilla is a challenge, and there are different techniques for its rehabilitation with dental implants. In the present study we compare two of the most widespread: the classic lateral approach and transcrestal elevation. ***Material and methods:*** A retrospective open-mouth pilot study was carried out to evaluate the predictability of the two surgical techniques described above. To this end, patients in whom both techniques were used (one per quadrant) were followed up and a quantification of bone loss and gain over the implant apex was carried out, as well as an estimate of survival in both groups of implants. ***Results:*** Five patients were recruited and 13 implants were inserted (8 in conventional sinus lift and 5 in transcrestal sinus lift). The mesial bone loss of the implants studied at the end of the follow-up time was 0.40 mm in the mesial zone (+/- 0.23) and 0.50 mm in the distal zone (+/- 0.34) for implants placed in traditional elevations. For implants inserted in the transcrestal elevation the mesial bone loss of the implants studied at the end of the follow-up time was 0.30 mm in the mesial zone (+/- 0.13) and 0.20 mm in the distal zone (+/- 0.24). There were no statistically significant differences between the mean bone losses of both techniques (p=0.021). ***Conclusions:*** Both techniques have proven to be predictable for the treatment of the atrophic posterior maxilla in height. The use of short and extra-short implants and transcrestal elevation requires fewer surgeries and has a priori a lower risk of complications. In the patients of our split-mouth study we found no statistically significant differences between the two procedures.

Keywords: Sinus lift, transcrestal sinus lift, short dental implant.

INTRODUCTION

The loss of teeth in relation to the maxillary sinus, or antral teeth, involves, in addition to the loss of bone volume in height inherent to edentulism, an added loss due to the excessive pneumatization generated in the maxillary sinus, which occupies part of the bony ridge in its expansion (Sharan and Madjar 2008, Lombardi *et al*., 2018). This sinus occupation of the adjacent residual ridge is different depending on the tooth to be extracted, the bone loss associated with that tooth and the presence or absence of communication of the potential odontogenic infection with the sinus. However, it is often the case that the greatest loss in height resulting from the process of post-extraction sinus pneumatization is for the second molar or when the first and second molar are extracted simultaneously (Sharan and Madjar 2008). Once the point of height resorption of the maxilla in the posterior region has been reached, which does not allow direct insertion of dental implants (even short or extra-short implants), we need to perform accessory surgical techniques to recover the lost bone height that will allow us to rehabilitate these sectors. In some cases, the surgical technique must be performed in a first phase and then, once the desired height has been achieved, proceed to implant insertion, as happens in the classic approach to the maxillary sinus (lateral approach) when there is less than 3 mm of residual bone height (Corbella *et al*., 2015, van der Berg *et al*., 2000, Anitua *et al*., 2009, Anitua *et al*., 2012, Torrella *et al*., 1998). Nowadays, with short and extra-short implants, this 3 mm bone volume barrier is the limit for conventional sinus lift with deferred implant, since with a larger volume we can opt for other techniques such as transcrestal lift and the insertion of short and/or extra-short implants. This technique allows us to perform an approach from the bone crest generating a neo-alveolus through which the membrane is detached, the insertion of the graft (when necessary) and the subsequent placement of the implant (Jain *et al*., 2016, Anitua *et al*., 2017, Anitua *et al*., 2016, Anitua *et al*., 2017, Anitua *et al*., 2017, Huang *et al*., 2020, Lundgren *et al*., 2017). This technique is indicated when we have a minimum height volume that guarantees correct primary stability of the short or extra-short implant (Anitua *et al*., 2017, Anitua *et al*., 2016, Anitua *et al*., 2017, Huang *et al*., 2020, Lundgren *et al*., 2017). Nowadays, both techniques coexist in implantology, although the trend, as in other medical disciplines, is towards the use of those techniques with a lower invasive potential for the patient, so the use of short and extra-short implants together with transcrestal elevations is gaining weight, even more so, with the new modifications of implants and surgical techniques that allow them to be used with predictability even in cases of extreme atrophy. Even so, the lateral elevation technique still has its indications today and several years ago it was the technique of choice in cases of height atrophy in the posterior sectors of the edentulous maxilla. In the following article we present a series of cases in which a split-mouth study has been carried out with both techniques: in one upper quadrant rehabilitation using short implants and in the opposite quadrant a sinus lift by conventional approach with delayed implant insertion, comparing both situations in each of the patients retrospectively, evaluating the behaviour of both procedures and the survival of the implants.

MATERIAL AND METHODS

We retrospectively recruited patients who had undergone both techniques of maxillary sinus approach: conventional elevation and insertion of short and extra-short implants by transcrestal elevation, from January 2015 onwards, in order to have at least 5 years of loading of the implants inserted in the area to be treated. All patients were studied before implant insertion by means of diagnostic models, intraoral examination and dental CT (Cone-beam). Trans-alveolar elevation was performed using biological drilling without osteotomes, according to the technique described in previous publications (Anitua *et al*., 2016, Anitua *et al*., 2017). The implants are inserted in the same surgery as the crestal approach.

The filler material in cases where grafting was necessary was autologous bone obtained from the drilling of the implants themselves or from adjacent areas embedded in freshly activated PRGF-Endoret fraction 2. The lateral elevation technique is also the one described by our study group (Anitua *et al*., 2009, Anitua *et al*., 2012), with the use of ultrasound for the sinus approach and the use of biomaterial (bovine hydroxyapatite) combined with autologous bone obtained from milling or from adjacent areas by scraping (bone scraper) and all of this also mixed with activated PRGF-Endoret fraction 2.

In both cases, prior to implant insertion, an antibiotic pre-medication consisting of amoxicillin 2 g orally one hour before surgery and paracetamol 1 g orally (as an analgesic) was used. Subsequently, the patients were treated with amoxicillin 500-750 mg orally every 8 hours (according to weight) for 5 days.

Every 6 months, the patients underwent control panoramic radiographs and the necessary measurements were taken on these radiographs to check the stability and crestal bone loss of the implants. Once the X-ray has been obtained in digital format, it is calibrated by means of specific software (Sidexis measure) using a known length on the X-ray such as the dental implant. Once the calibration measurement has been entered, the software performs a calculation based on this measurement to eliminate the magnification, allowing linear measurements to be taken free of this error.

The implant was the unit of analysis for descriptive statistics in terms of location, implant dimensions, and radiographic measurements. The patient was the unit of measurement for the analysis of age, sex and medical history. The primary variable was implant survival and secondary variables were mesial and distal bone loss and final bone crest height achieved after implant insertion and loading.

A Shapiro-Wilk test was performed on the data obtained to confirm the normal distribution of the sample. Qualitative variables were described by frequency analysis. Quantitative variables were described by means of mean and standard deviation. Implant survival was calculated using the Kaplan-Meier method. Data were analysed with SPSS v15.0 for windows (SPSS Inc., Chicago, IL, USA).

RESULTS

Five patients were recruited and 13 implants were inserted (8 in conventional sinus lift and 5 with transcrestal sinus lift). Of the 5 patients, 4 were women and none of them were smokers. The mean age of the patients studied was 69 years (+/-3.5). The mean residual bone height in the sinus lift zone was 2.33 mm (+/- 0.88) and the mean residual bone height in the transalveolar lift zone with short or extra-short implant was 3.50 mm (+/- 0.28). The lengths of the implants inserted in the transalveolar elevation zone were 5.5 mm in 4 of the 5 cases and 6.5 mm in the remaining case. The diameters of these implants ranged from 4 to 6 mm. The length of the implants inserted in the conventional sinus lift zone was 10 mm in 5 of the cases, 6.5 mm in two of the cases and 11.5 mm in the remaining case. The diameters of these implants ranged from 3.75 mm to 5.5 mm. The mean follow-up of the implants from loading studied was 6 years (+/- 1.5 years). All implants were rehabilitated in two phases and all implants were splinted to other implants in the rehabilitation. The prostheses placed on the implants were screw-retained transepithelially in 100% of the cases. The mesial bone loss of the implants studied at the end of the follow-up time was 0.40 mm in the mesial zone (+/- 0.23) and 0.50 mm in the distal zone (+/- 0.34) for implants placed in traditional elevations. For implants inserted in the transcrestal elevation the mesial bone loss of the implants studied at the end of the follow-up time was 0.30 mm in the mesial zone (+/- 0.13) and 0.20 mm in the distal zone (+/- 0.24). There was no statistically significant difference between the mean bone loss of the two techniques (p=0.021). No implants failed during the follow-up period and no biological complications were observed during surgery.

Figures 1-10 show images corresponding to one of the cases included in the study.

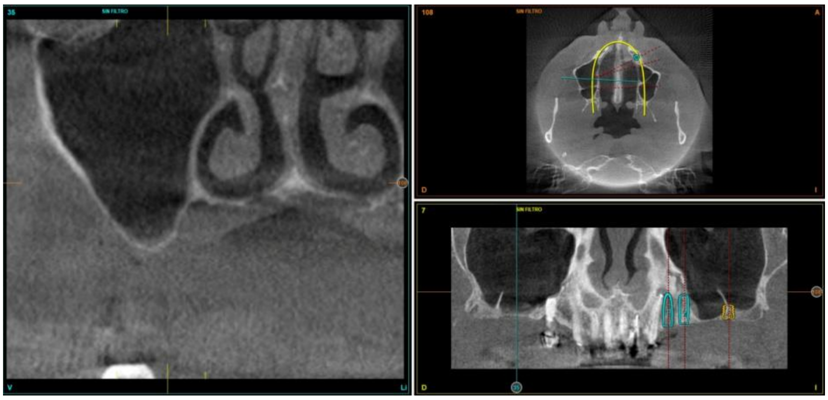

Fig 1: Image corresponding to the surgical planning of the first and second quadrants. In the first quadrant we can see a residual height of 1.5 mm, which makes us opt for a conventional lateral elevation. In the second quadrant, we performed a transcrestal elevation with the insertion of an extra-short implant

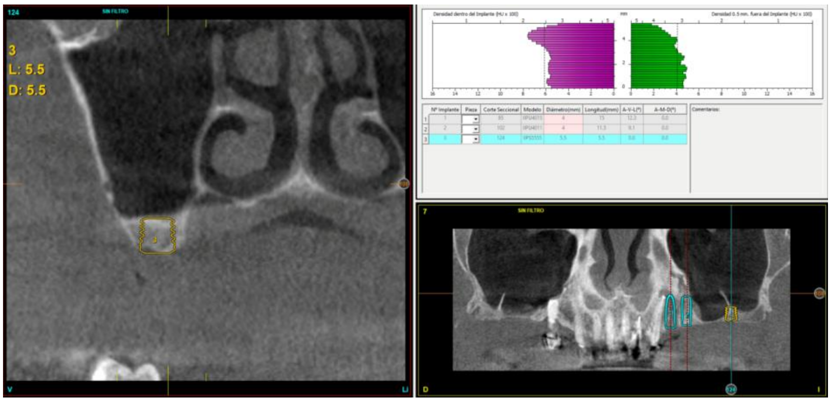

Fig 2: Image corresponding to the surgical planning of the first and second quadrants. In the first quadrant we can see a residual height of 1.5 mm, which makes us opt for a conventional lateral elevation. In the second quadrant, we performed a transcrestal elevation with the insertion of an extra-short implant

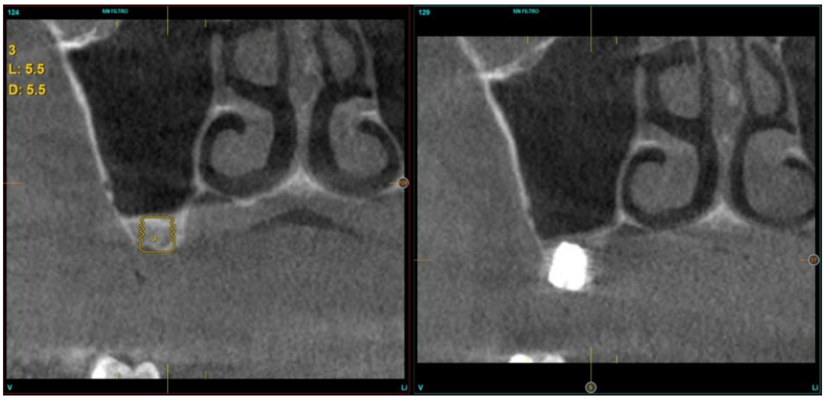

Fig 3: Image of the implant inserted using the crestal approach technique 6 months after surgery, in the planning tac for the insertion of the lateral sinus lift implants

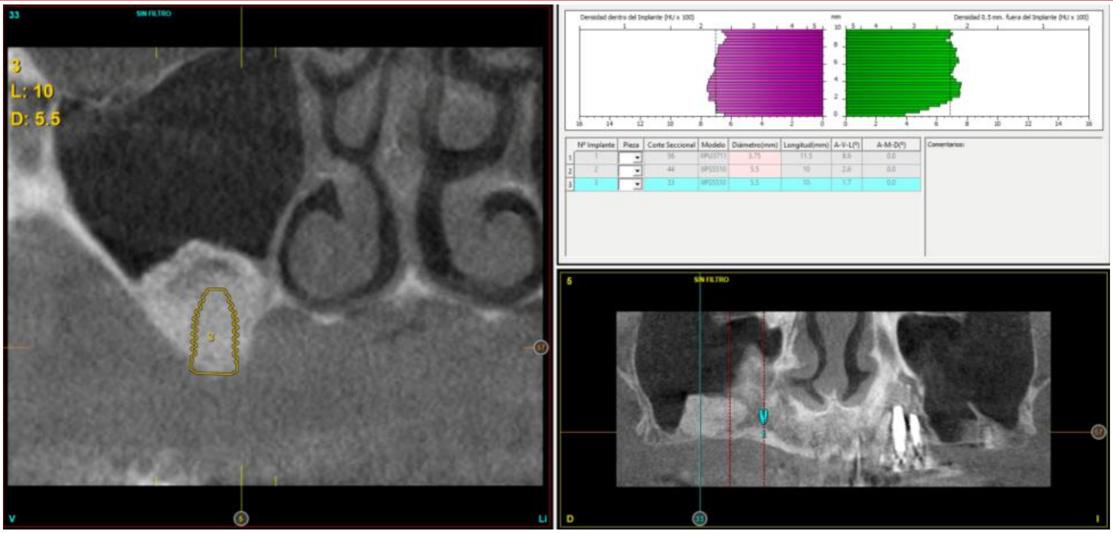

Fig 4: Tac planning of the lateral sinus lift area

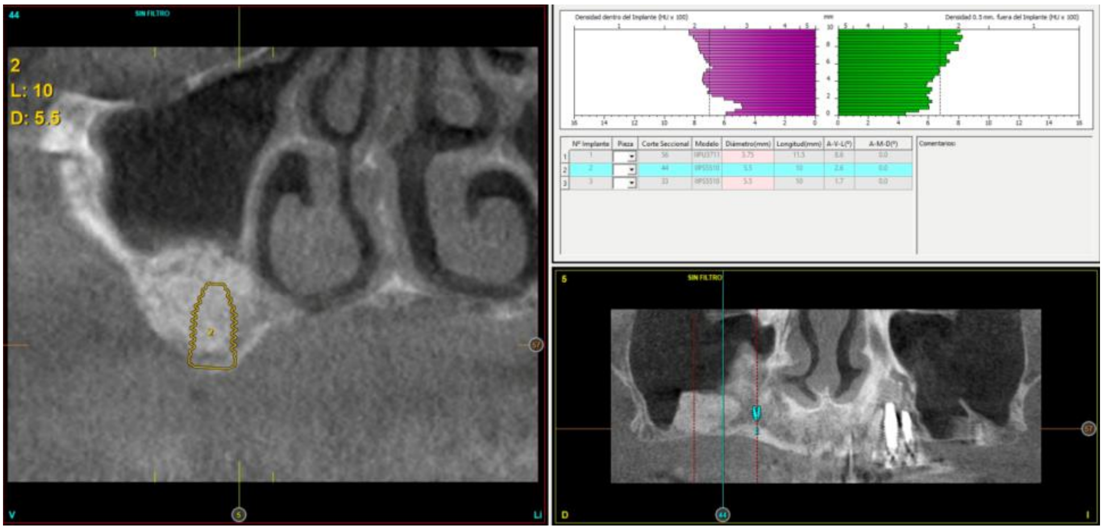

Fig 5: Tac planning of the lateral sinus lift area

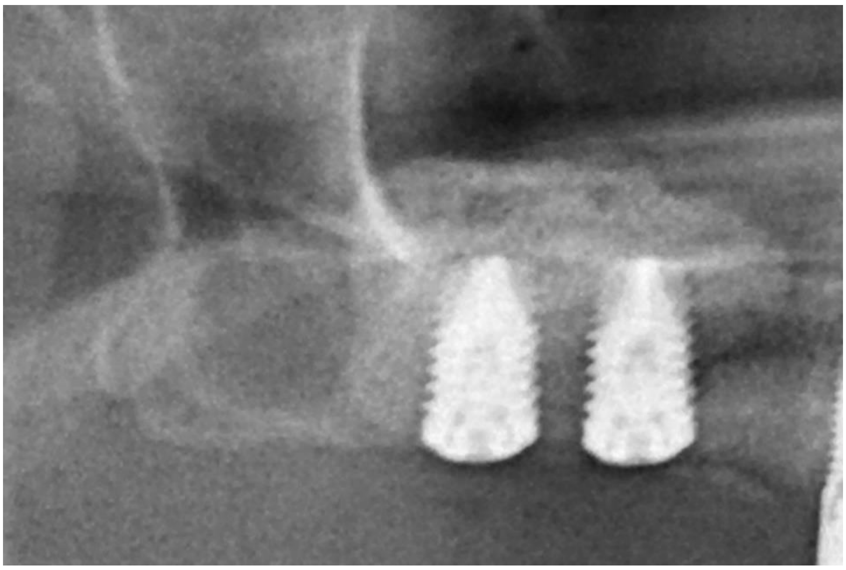
Fig 6: Radiological image after insertion of the first quadrant implants after sinus lift (6 months later)

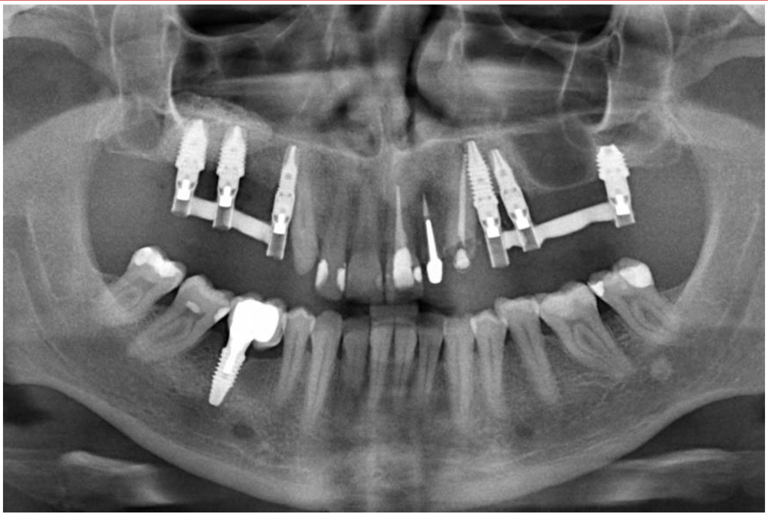

Fig 7: Provisional loading prosthesis of both quadrants. With this type of resin rehabilitation, on transepithelial with articulated bars, we achieve a functional prosthesis in a short laboratory time and it allows us to adapt the occlusion and the implants to receive a progressive load

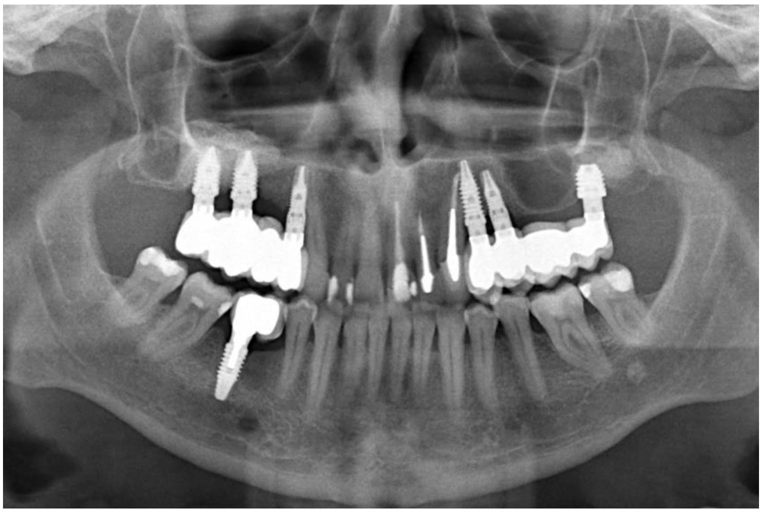

Figure 8: Final prosthesis once in place

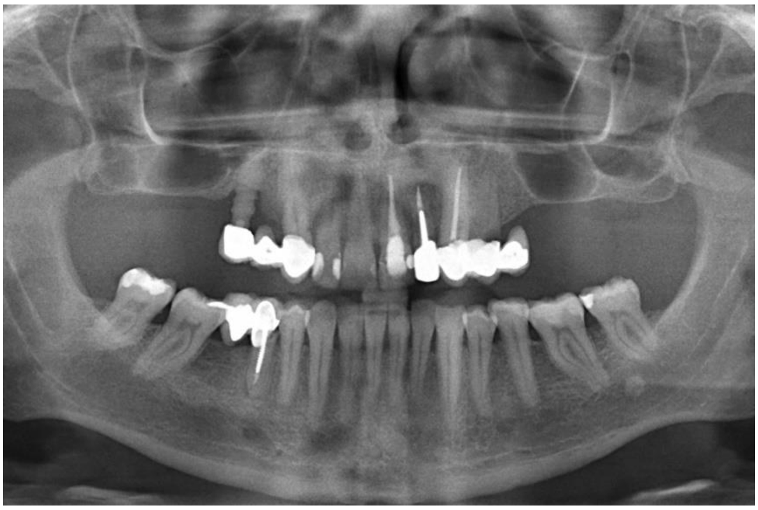

Fig 9: Comparison of the case before and 6 years after treatment. We can see the stability of both types of maxillary approaches

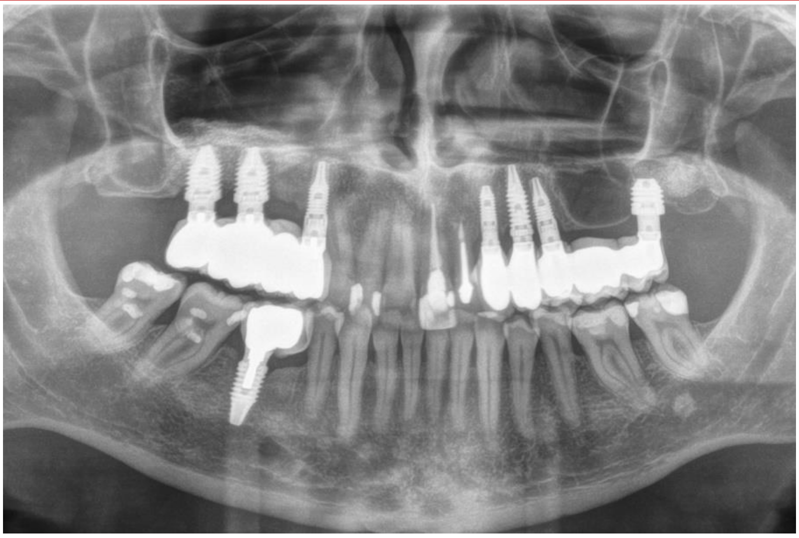

Fig 10: Comparison of the case before and 6 years after treatment. We can see the stability of both types of maxillary approaches

DISCUSSION

The evolution of surgical techniques in dentistry, as in other areas of medicine, is constant, and there are different approaches to solve the same situation that are constantly being renewed in the constant search for more predictable and less invasive techniques for the patient, both in terms of the surgical procedure (morbidity) and waiting times (shortening of waiting times) (Greenberg 2017). Since the description of the conventional sinus lift technique (lateral window) by Tatum in 1986 (Esfahrood *et al.*, 2017, Lemos *et al.*, 2016, Tatum 1986), this procedure has been used for the rehabilitation of maxillary posterior sectors with vertical atrophy with high success rates, currently standing at around 98% with long-term follow-up (over 15 years) (Esfahrood et al 2017, Lemos *et al.*, 2016, Tatum 1986, Beretta *et al.*, 2015). The main disadvantage of this type of approach is the need to resort to two surgical phases in most cases and the risk of perforation of the Schneider membrane during surgery, which can lead to a decrease in the survival of the inserted implants up to rates of 88.6% when this situation occurs during surgery (Viña-Almunia *et al.*, 2009). The crestal elevation technique was introduced by Summers in 1994 in an attempt to reduce time and achieve less invasive surgeries. This technique has been widely used for the transcrestal approach to extreme posterior maxillary resorptions with survival rates of inserted implants ranging from 88.65% to 100% (Anitua *et al.*, 2017, Anitua *et al.*, 2016, Anitua *et al.*, 2017, Huang *et al.*, 2020, Lundgren *et al.*, 2017, Cavicchia *et al.*, 2001, Del Fabbro *et al.*, 2012, Lin *et al.*, 2021). Both techniques are therefore precedible for the rehabilitation of atrophic posterior sectors, with the difference that transcrestal elevation allows to reduce the risk of membrane perforation (provided a careful drilling and implant insertion protocol is followed) (Lundgren *et al.*, 2017, Greenberg 2017, Lemos *et al.*, 2016) and when this perforation happens it is easier to be contained and insert the implant without subsequent complications (Del Fabbro *et al.*, 2012), as well as being a technique with fewer surgical interventions and less morbidity therefore for the patient. The advent of extra-short implants with different morphologies has also allowed us to use it in more and more extreme situations, with excellent results in achieving stabilisation of the implant (primary stability) in cases with extreme resorption (Rabel *et al.*, 2007, Anitua *et al.*, 2017).

CONCLUSIONS

Both techniques have proven to be predictable for the treatment of the atrophic posterior maxilla in height. The use of short and extra-short implants and transcrestal elevation requires fewer surgeries and a priori has a lower risk of complications. In the patients of our split-mouth study we found no statistically significant differences between the two procedures.

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