A retrospective study

Extra-short single-tooth implants rehabilitated using single-tooth transepithelial with a crown-to-implant ratio 2

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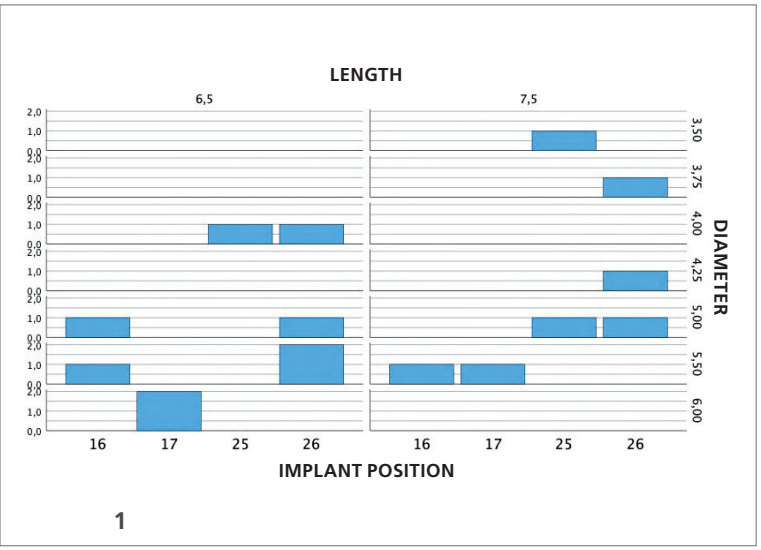
Nowadays, we can rehabilitate the majority of cases that come to our practice requesting a type of treatment using dental implants. This is mainly due to major advances in implant design, which have enabled implants of smaller length or diameter to be adapted to any clinical situation, and to improve regenerative surgical techniques for those situations where they are necessary.[1,2]

Short and extra-short implants are a highly predictable solution for vertical atrophies of both the maxilla and mandible, with current survival rates of 86.7 to 100%.[3,4] In this type of atrophy, one of the main drawbacks that must be solved when carrying out subsequent rehabilitation is the disproportion generated between the prosthesis and the implants on which they sit, as the prosthetic space in these situations is high and the proportion or ratio generated between the crown and the implant is often greater than 2. Theoretically, if we study the potential distribution of forces, a crown-to-implant ratio greater than 2 would represent a lever arm on an implant of reduced size to be considered, even more so when the force is going to be transmitted on a recently inserted implant. In splinted implants, it has been repeatedly demonstrated that this ratio, however unfavourable it may be, does not generate greater bone loss on the implants or a higher failure rate.[5–7]

Short and extra-short single implants, for the resolution of localised vertical atrophies, are also subsidiaries for carrying a prosthesis with a crown/implant disproportion of sometimes more than 2. In these cases, there are studies that analyse



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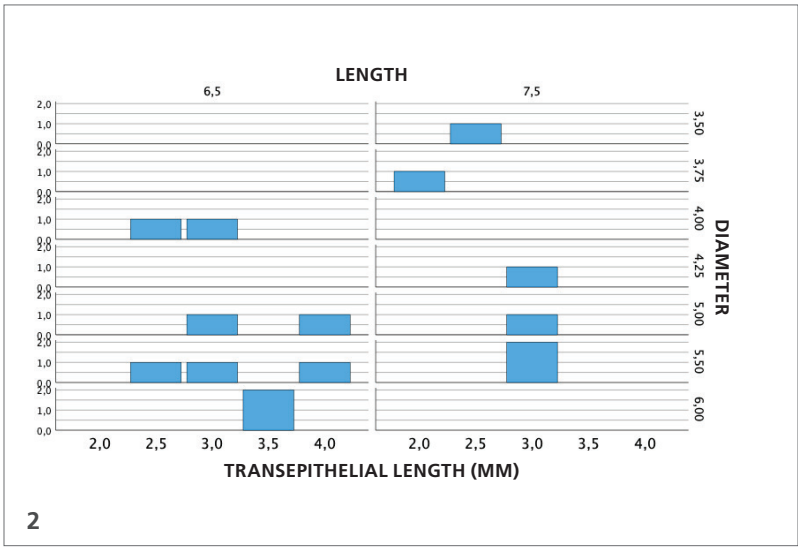

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the crestal bone loss of these implants with high cumulative survivals of 87, 95.7 and 96.6% respectively.[8–11] In most of the studies that consider this type of unitary rehabilitation, the possible repercussions of the presence of an intermediate element in the prosthesis, such as the unitary transepithelial, are not considered. In most cases, these are direct-to-implant prostheses, where the seal between the prosthesis and the implant may be compromised by the use of calcineable elements and the loss of hermeticity at this level.[12–20] This loss of seal may lead to a higher incidence of peri-implantitis and therefore the survival data of these study groups may be influenced by this factor, especially in cases of lever arm crown-to-implant ratios greater than 2, where a gap can easily open in the implant-prosthesis connection, especially in lateral load.[13]

In the present case series, we show a group of patients rehabilitated with short and extra-short implants (6.5 and 7.5 mm), trated as a unit using a screw-retained prosthesis and unitary transepithelial, all of them with a crown-to-implant ratio greater than 2. In them, implant survival and crestal bone loss will be evaluated as well as the influence of the use of unitary transepithelial.

Methods

We retrospectively reviewed the medical records of patients who underwent insertion of 6.5 and 7.5 mm long implants with screw-retained unitary rehabilitation using transepithelial from May 2014 to December 2015, so that the implants could be followed up after loading for at least five years. Data were collected in a data collection notebook for subsequent statistical analysis, the main study variables being: bone height gain and implant survival.

All patients were studied before implant insertion by means of diagnostic models, intra-oral exploration and dental CT (cone-beam) subsequently analysed by means of specific software (BTI-Scan II). Prior to implant insertion, antibiotic premedication consisted of amoxicillin 2g orally 1 hour before surgery and paracetamol 1g orally (as an analgesic). Subsequently, patients were treated with amoxicillin 500–750 mg orally every 8 hours (according to weight) for 5 days.

The implants were placed by the same surgeon, using the biological drilling technique, at low revolutions, without irrigation.[21–22]

Control visits were scheduled for suture removal and for the control of possible adverse events from implant insertion to the time of the second surgical phase (five to six months).

Once the treatment was completed (implant loading), a visit was scheduled after six months, followed by an annual follow-up visit to check the stability of the implant.

Statistical analysis

The main variable studied was implant survival. Secondary variables studied were crestal bone stability, prosthetic complications and prosthesis survival.

The patient was the unit of measurement for the analysis of age, sex and medical history.

A Shapiro-Wilk test was performed on the data obtained to verify 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. All analyses were performed with SPSS v15.0 (SPSS) and the significance level was set at 5% ($p < 0.05$).

Results

Sixteen patients were recruited who met the previously established selection criteria. Of the patients, 42.9% were female, with a mean age of 54.19 ± 13.6 years (range 32 to 77 years). The most frequently rehabilitated tooth was tooth 26 in 43.8% of cases, followed by tooth 16, 17 and 25 with the same percentage for each, 18.8%. The predominant diameter of the patients studied was 5.50 mm (31.3%) followed by 5 mm (25%). The length was divided between 56.3% for 6.5 mm implants and the rest (43.8%) for

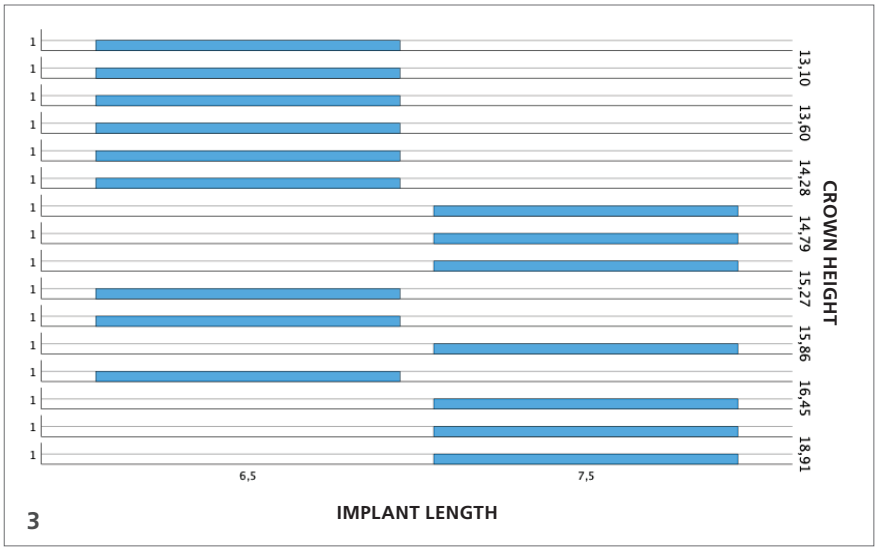


Fig. 1: Implants included in the study with their diameter and length according to their location. **Fig. 2:** Unit transepithelial height as a function of implant diameter and lengths. **Fig. 3:** Crown height as a function of the length of the implants included in the study.

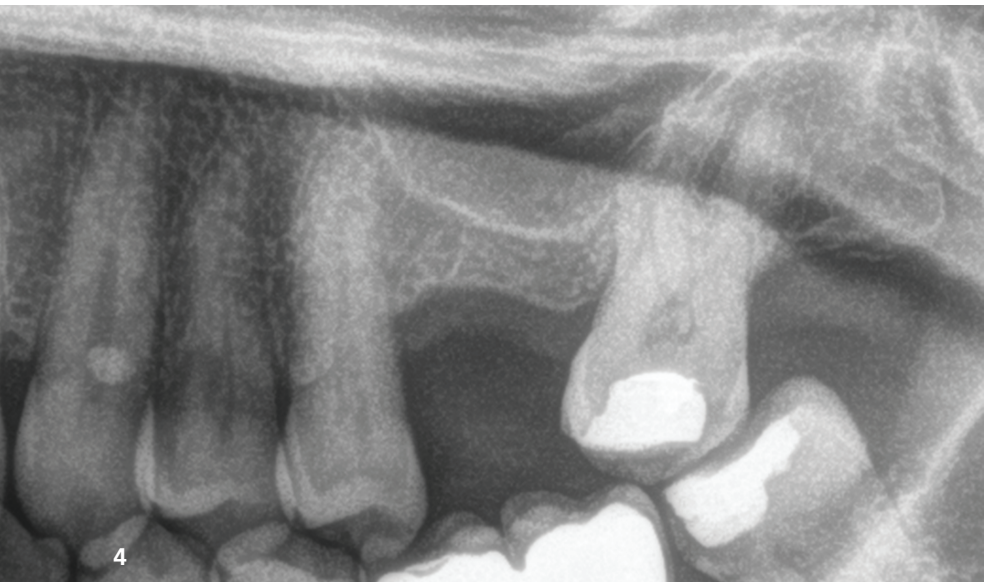


Fig. 4: Initial X-ray of the patient showing the edentulous section of the second quadrant to be rehabilitated with a short single implant.

7.5 mm implants. The implants included in the study with their diameters and lengths, according to their insertion position, are shown in Figure 1.

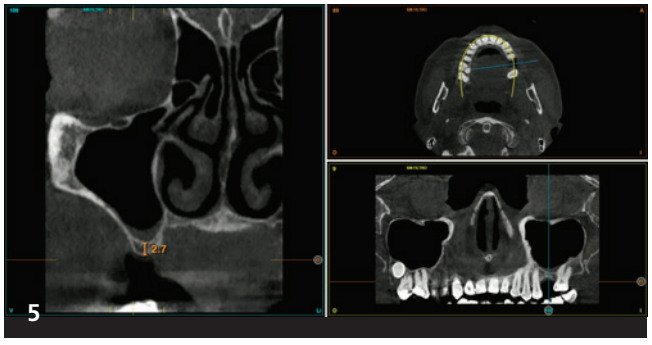
The mean insertion torque of the implants included in the study was 45.9 Ncm ± 7.1 (range 35–65 Ncm). The main bone type where the implants were inserted was type III (550 Hu) in 25% of the cases. All implants were loaded in two surgical phases, at five months in the upper arch and at three months in the mandible. The prostheses used were metal-ceramic screw-retained unitary transepithelial prostheses. The most frequently used unit height was 3 mm (43.8%), followed by 2.5 mm (18.8%). The remaining transepithelial heights are shown in Figure 2. The crown height of the implants studied ranged from 13.1 to 18.9 mm. The different crown lengths as a function of implant length are shown in Figure 3.

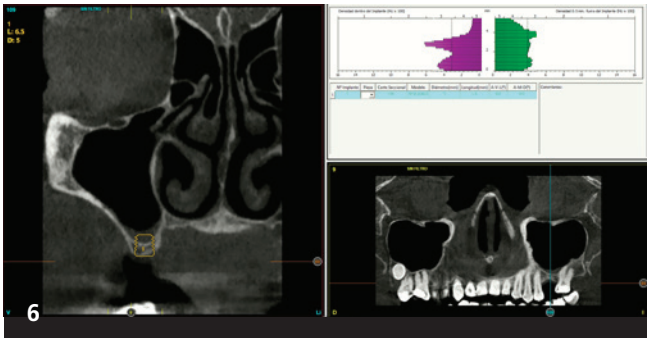
None of the implants included in the study failed during the mean follow-up time of 46.6 months (± 22.5). The mean mesial bone loss for all implants studied was 0.31 mm (± 0.51) and the mean distal bone loss was 0.33 mm (± 0.85). When mesial and distal bone loss was studied as a function of crown height, there was no statistically significant relationship ($p = 0.875$/ $p = 1.500$ respectively) and no statistically significant relationship between unit height and bone loss in either of the two bone loss estimates (mesial $p = 0.980$/ distal $p = 0.888$). A correlation was made between crown and transepithelial height and mesial and distal bone loss, and no significance was found between any of the parameters studied at any of the points.

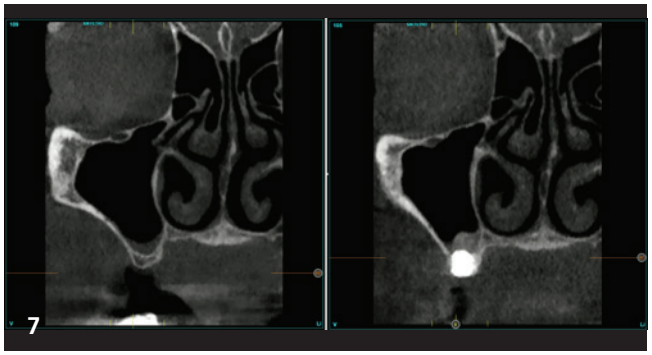
Figures 4–9 show one of the cases included in the study.

Discussion

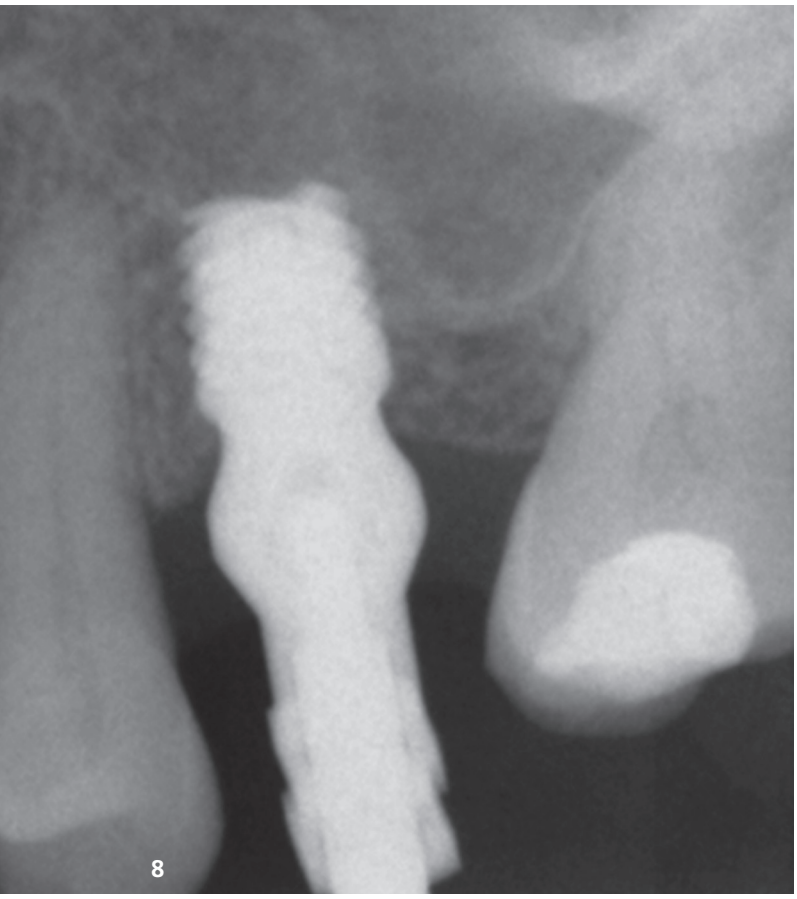
Short and extra-short implants of 6.5 and 7.5 mm, such as those reported in the present study, are safe and predictable alternatives in dentistry today, as they have been postulated as a therapeutic







Figs. 5 & 6: Planning images of the diagnostic cone-beam showing the residual bone volume and the planned implant, in this case 6.5 mm. **Fig. 7:** Control CT image before and after implant insertion surgery at six months, with correct integration of the implant in place.



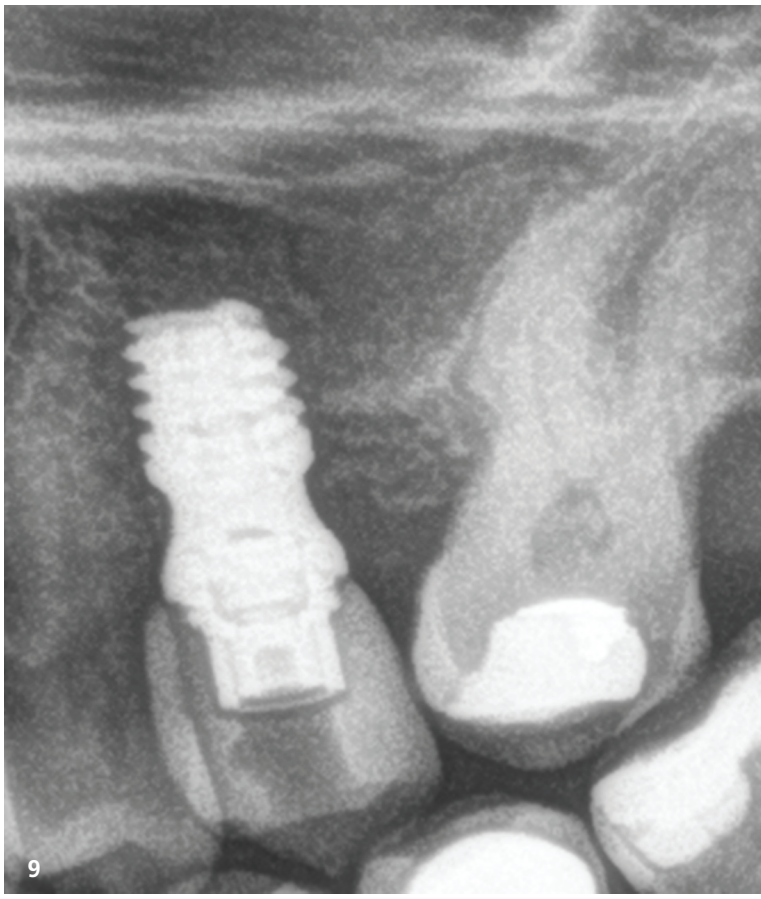


Fig. 8: Impression of the implant with the unitary transepithelial, in this case expanded, to achieve a better adaptation of the soft tissues with this emergence profile in the making of the prosthesis. **Fig. 9:** X-ray two years after placement of the definitive prosthesis. The stability of the treatment can be seen.

option with fewer biological complications, lower economic cost and fewer surgical sessions for patients.[8,20–23] The reported long-term survival rate of these implants is 98.9%, which is similar to that of longer implants placed without bone augmentation or those inserted in augmented bone using different procedures.[4,24]

In the patients studied, no higher bone loss rate has been reported for short or extra-short implants with a lower crown-to-implant ratio, where losses of 0.4–0.5 mm with one year of follow-up or 1.25 mm ± 0.99 mm with three years of follow-up have been reported.[8–10,11]

The height of the transepithelial, as an intermediate element between the prosthesis and the implant, has had no transcendence in the quantification of crestal bone loss, in any of its lengths, so that, like the height of the crown, it has not been a risk factor that increases crestal bone loss after loading, at least in the group of patients studied and in the time during which the follow-up has been carried out. The presence of transepithelial, on the other hand, according to the work published by our study group, may have a beneficial relationship for the whole, as it generates a better distribution of the load in the bone bed as well as achieving better sealing of the prosthesis.[13–16,18]

Conclusions

Implants 6.5 and 7.5 mm in length, rehabilitated with an unfavourable crown-to-implant ratio do not present an increased risk of failure or crestal bone loss, according to the data provided by the present case series. However, a larger number of studies analysing this topic in depth, with larger samples and a longer follow-up time are needed to confirm these conclusions.

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