Single short implant in maxillary second molar area with low bone density

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The replacement of maxillary second molars with implants is a complex procedure, primarily due to the often limited residual bone height and the typically low bone density in the posterior maxillary region near the tuberosity.

When these molars are also replaced in a single unit, the situation is even more complex. In this article we present a series of clinical cases of maxillary second molars replaced with unitary implants.

Introduction

The loss of residual bone height in maxillary posterior edentulism is a common issue. When teeth in direct contact with the maxillary sinus, or "antral teeth", are extracted, the resulting alveolus undergoes partial healing, leading to a reduction in available bone height. Additionally, excessive pneumatisation of the sinus, particularly in cases of long-standing edentulism, further complicates implant placement. To avoid more complex regenerative procedures like sinus lifts, short implants have been developed as a viable solution.

Today, these implants are one of the rehabilitation techniques for the atrophic maxilla that can be considered routine, being a minimally invasive option and with survival rates of around 99%.[1,2] Many of the short and extra-short implants are rehabilitated as part of bridges or complete rehabilitations, with a smaller percentage being used for single crowns. The position in which these implants are inserted is also a fact to be taken into account, as the posterior maxillary areas have less bone density and therefore a worse situation for stabilising a short or extra-short implant and allowing its correct posterior integration without micromovements, especially when we replace a second upper molar, a fact which sometimes means that this molar is not even restored in some patients.[7] Furthermore, this area in particular (posterior maxilla) usually has a lower bone density, so that rehabilitation with dental implants in these sectors is complicated when the residual bone volume in height is very low and the bone density is also very low. In these cases, controlling all factors to achieve implant insertion with predictability is key. The protocol described by our study group highlights the importance of prior diagnosis of the residual bone (height, width, density and bone

Fig. 1: Initial X-ray of the case, where we can see in the second quadrant an edentulous section corresponding to tooth 27 that will be rehabilitated using dental implants.

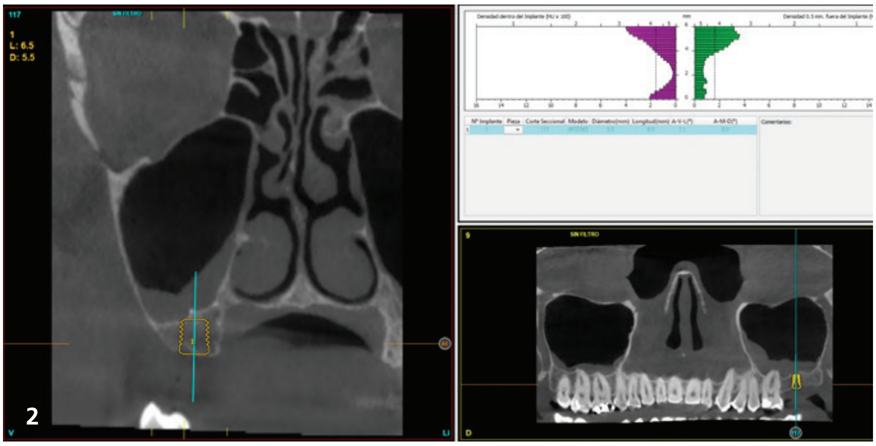
type) and the planning of the drilling to achieve three-dimensional stability of the implant and avoid micromovement in the initial phase of osseointegration.[9,10] In this sense, the use of implants of different diameters and lengths can provide us with a larger contact surface for osseointegration and different anchorage points that guarantee greater primary stability.[7,11–13] The factors that influence the achievement of primary stability in general and in these cases in particular are: geometry, length and macro-design of the implant, drilling pattern and bone density, mainly.[16–18] In the present work, we show a series of cases of short (7.5 mm) and extra-short (5.5 and 6.5 mm) single-tooth implants placed in the maxillary second molar position (teeth #17 and #27), rehabilitated in a single-tooth fashion with low bone density.

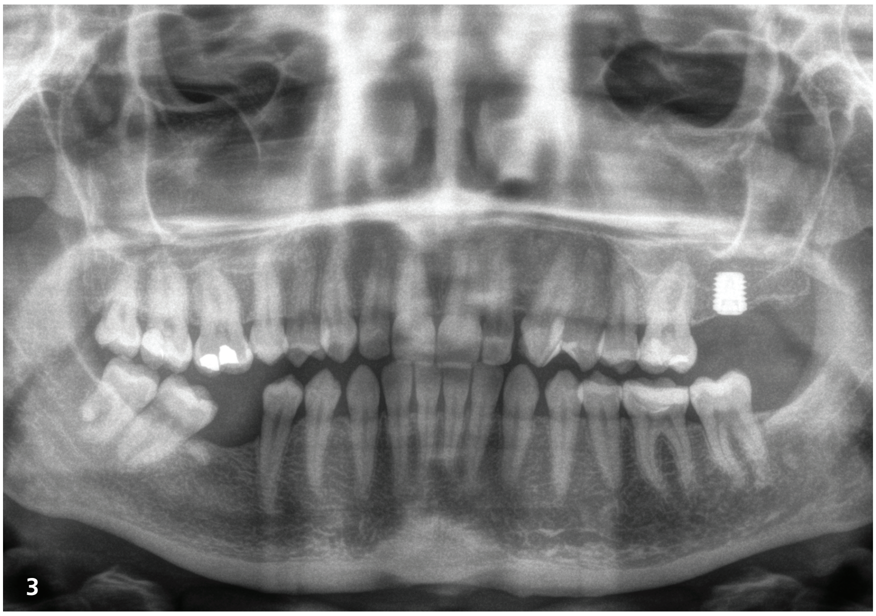
Material and methods

A retrospective study was carried out selecting patients with short, extra-short implants located in maxillary posterior sectors, with a bone density between 200 and 300 HU, as measured in the planning tac using the software (BTI-Scan III, Biotechnology Institute), in a private clinic in Vitoria, Spain, during the period from January 2017 to December 2018.

Surgical and rehabilitation protocol

In all cases, an accurate diagnosis of residual bone volume (height, width and bone density) was performed, measured using the specific software BTI-Scan III. Prior to implant insertion, antibiotic premedication consisted of amoxicillin 2 g orally one hour before surgery and paracetamol 1 g orally (as an analgesic). Subsequently, patients were treated with amoxicillin 500–750 mg orally every eight hours (according to weight) for five days and the necessary analgesia based on paracetamol on demand with a maximum of 3 g daily. All implants were inserted by the same surgeon using the biological drilling technique, at low revolutions[14],





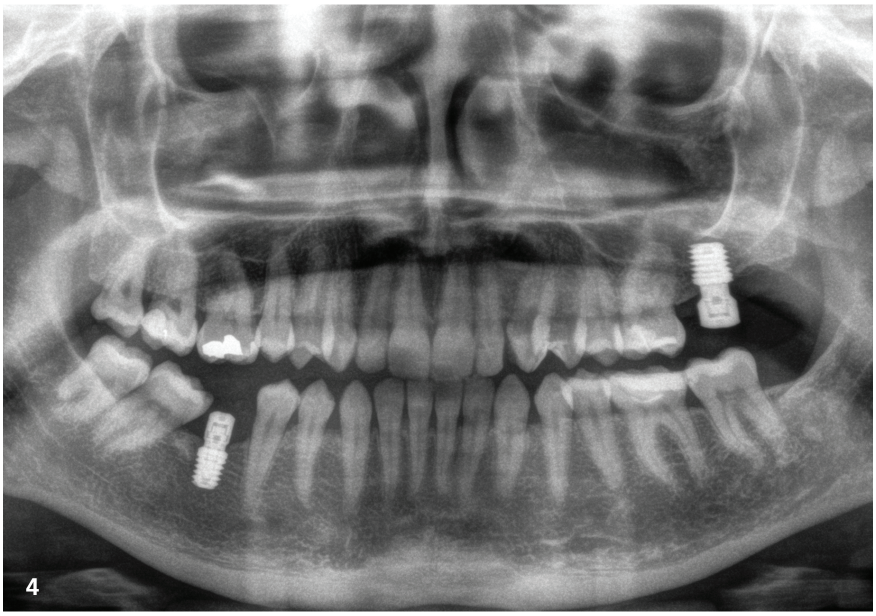


Fig. 2: Planning of the implant to be placed. – **Fig. 3:** Post-surgical panoramic X-ray with the recently placed implant. – **Fig. 4:** Placement of the unitary transepithelial after the second phase at five months for progressive loading of the implant.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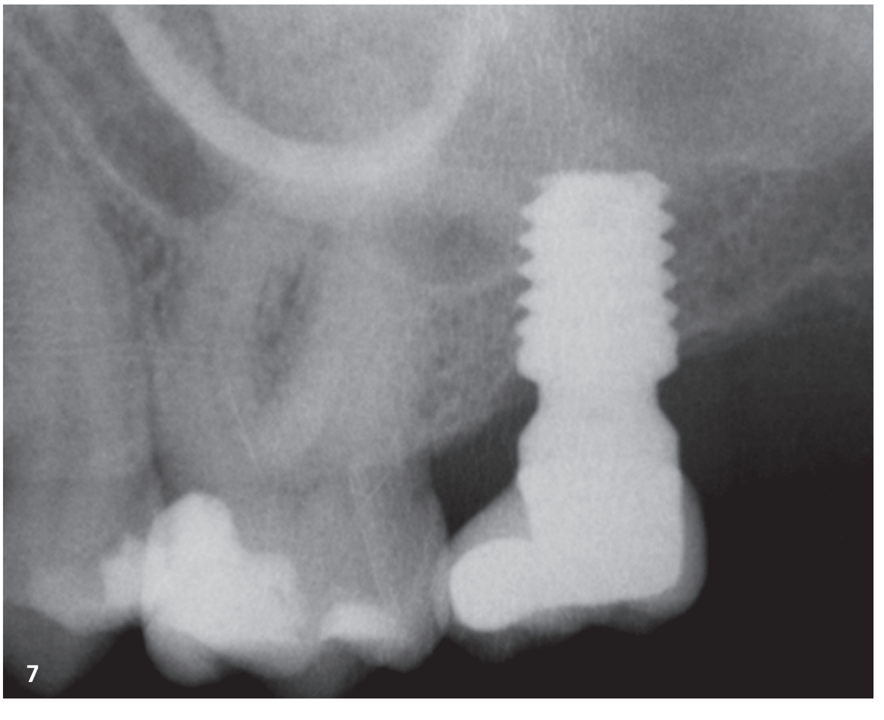
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Figs. 5+6: Clinical images of the patient at the time of crown placement. – **Fig. 7:** Radiographic image after four years of follow-up showing the bone stability of the implant and the rehabilitation.

described by our study group, where the neoalveolus is widened using incremental drills in diameter.

Subsequently, patients underwent control panoramic radiographs every six months and the necessary measurements were taken on these radiographs to check bone stability. Easily reproducible periapical radiographs with a positioner were used to establish bone loss. At each of the visits, periapical radiographs are taken with a parallelisation device to estimate the crestal bone loss. Marginal bone loss was measured on the last periapical radiograph taken with a follow-up positioner. Once the X-ray was obtained in digital format, it was calibrated using specific software (Digora for Windows, SOREDEX Digital Imaging systems) through a known length in 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 made free of this error. The crestal bone loss was measured at two points: mesial and distal to each implant.

Statistical analysis

Statistical data collection and analysis was carried out by two different researchers. A Shapiro-Wilk test was performed on the data obtained to verify the normal distribution of the sample. The main variable evaluated was implant survival followed by crestal bone loss. Qualitative variables were described by frequency analysis. Quantitative variables were described by mean and standard deviation. Implant survival was calculated using the Kaplan-Meier method. Data were analysed with SPSS v15.0 for Windows (SPSS).

Results

Thirty patients were recruited and 40 single implants with lengths of 5.5 and 6.5 mm were inserted in upper second molar positions that fulfilled the inclusion criteria. Thirty percent of the patients included in the study were male and 70%

female, with a mean age of 62 (+/– 3.5) years. Implant position was 50% for tooth #17 and 50% for tooth #27. The diameter of the inserted implants was mostly 5 mm (56.42% of cases), followed by 5.5 mm (23.58%) and 4.5 mm in 20% of cases.

The length of the implants was mostly 6.5 mm (60% of cases) followed by 7.5 mm (30%) and finally 10% were 5.5 mm long implants. The mean densitometry of the implant insertion sites was 240 Hu (+/- 54; range 200–300 Hu). The mean insertion torque achieved for the implants studied was 40 Ncm (+/– 14.7; range 20–65 Ncm). The mean bone loss of the studied implants measured mesial to the implants was 0.5 mm (+/– 0.6) and measured distally was 0.3 mm (+/– 0.5). The mean follow-up of the studied implants was 60 months (+/– 34).

None of the implants failed during the follow-up period, resulting in 100% survival and no adverse surgical or prosthetic events were recorded. Figures 1–7 show one of the cases included in the study.

Discussion

Rehabilitation with dental implants is one of the most widely used techniques in dentistry. These implants, with the modifications they have undergone in recent years, adapt to most bone atrophies, whether vertical, horizontal or mixed. Short and extra-short implants are safe and predictable alternatives for vertical atrophy, as in the cases of second molars discussed in this article, presenting fewer biological complications, lower economic cost and fewer surgical sessions for patients than the accessory techniques of bone augmentation or regeneration that would be used in the case of wanting to initially recover the lost bone volume.[15–17] Long-term survival rates of these implants are reported to be 98.9%, so they have a similar survival to longer implants placed without bone augmentation or to those inserted in augmented bone by different procedures.[18, 19]

One of the main drawbacks reported in the literature is the lower predictability of these short implants when inserted in the posterior maxilla is the achievement of correct primary stability. This primary stability ensures that the newly inserted implant does not undergo micromovements during the integration phase and that the treatment is successful. To achieve this, the three-dimensional images of the cone-beam in its sectional slices allow us to choose the point of greatest density where to strategically place our anchorage zone and to individualise the drilling sequence.[8–10]

If we achieve the desired stability, even if the torque is low, we can achieve treatment success if the implant is inserted conservatively without damaging the bone bed. Systematic reviews and prospective studies on the insertion torque of dental implants at different torques do not find statistically significant differences between high and low insertion torques in implant survival or crestal bone loss.[20–23] Another point to bear in mind in this type of restoration is the use of a prosthesis that transmits the load effectively and generates a seal that avoids implant-prosthesis microleakage, such as the single transepithelial prostheses used in the cases studied. In addition, the way this trans-epithelial works in the prosthesis laboratory through the interfaces allows us to make a screwed or cemented crown, avoiding the machined connection portion having to undergo excessive heating processes by entering the ceramic furnace several times. All the work can be fabricated on the burn-out portion of the interface and then cemented to it once all the finishing and adjustments have been made.

Conclusions

Even with bone atrophy and low density in the area of the upper second molars, single implants can still be used. However, it's crucial that the rehabilitation follows a proper surgical and prosthetic sequence to ensure treatment success. Every step, from initial planning to crown placement, plays an essential role in achieving the desired outcome.

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References

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