Immediate Implant Placement in Maxillary Molars Using Septa Dilatation with Threaded Expanders

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Abstract

Background: Immediate implant placement in maxillary molar extraction sites has many challenges including low bone density and proximity to the maxillary sinus. This paper describes a septum expansion technique which allows for predictable immediate placement of dental implants into maxillary molar extraction sites.

Methods: Atraumatic extraction of maxillary molars leaving intact bony septums are treated with expansion drills to laterally compress adjacent bone prior to implant fixture placement. Bone grafting material is used to fill remaining voids, a healing abutment is placed, and primary closure is achieved. Implant stability was measured with a Periotest device at implant placement, at stage 2 surgery (when performed), and 12 months following implant placement for 21 patients on which this technique was used. This data was compared to data from a previous study that compared standard delayed implant placement versus a variation of the technique described in this paper.

Results: None of the implants placed failed during the evaluation period. Periotest values at placement averaged -2.476 (± 0.680), -2.762 (± 1.044) at 2nd stage surgery, and -2.857 (± 0.655) at 12 months. Comparing these results with the previous data, we observed better results with the expander technique compared to the delayed technique, and no differences were observed with the osteotome technique.

Conclusions: The septa expansion technique described in this paper demonstrated promising results and provides a viable option for immediate implant placement for maxillary molar sites.

KEY WORDS: Dental implant, immediate dental implant placement, septum expansion

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INTRODUCTION

Immediate placement of dental implants has reported to reduce treatment times and provide better preservation of the alveolar ridge.[1-3] This concept has limitations during replacement of teeth with multiple roots as found in molar positions.[4] Additionally, the maxillary molar region also presents a lower bone density and the proximity of the maxillary sinus. Many attempts have been made to place implants into extraction sockets in the maxillary posterior, while some advocate the best treatment option is a delayed approach following extraction. Immediate options include placement of the implant in the palatal socket off axis or modification of the palatal socket.[5-7] In a previous published article the author (Luchetti) presented a technique to place immediate implants in maxillary molar sites using the interseptal bone, which has shown improved clinical results compared to the delayed approach after osseous healing.[8]

The original technique included the use of sharpened osteotomes and a partial thickness rotated palatal flap to achieve primary closure. As evolution of the technique developed, during the past two years the author started to dilate the socket using threaded expanders. This proved to be a more comfortable procedure for the patient. The technique includes the use of a healing abutment to be placed at time of implant placement making the surgical procedure a one stage approach. The aim of this study was to improve a proven technique and to compare it to the original procedure in order to place immediate implants in maxillary molar region.

MATERIAL AND METHODS

Case selection

The technique is specifically indicated in cases of tooth extraction with minimal bone loss that does not extend into the furcal portion of the root. The more bone that has been maintained along with the septum of bone between the roots the easier the technique is to perform. Additionally, the anatomy of the roots plays an important role, with roots with more spread and thicker septa providing a more favorable situation.

After expansion of the socket has been completed, should the expander have insufficient initial stability, this can serve as a reference of the possible stability of the implant and the procedure can be aborted. The extraction socket is grafted and closed to be re-entered and a delayed implant placement performed 2-4 months later.

Instruments

The threaded expanders have a conical shape. The set (Microdent System, Spain) is composed of five expanders with a sharpened terminal end plus an additional tool with a flat end which is used for sinus lifts. The first two expanders (yellow and red) are for initiation, increasing the site from 1mm diameter to 2.3mm (yellow) or 3mm (red). Expander number 3 (blue) is used for 3.3mm to 3.75mm implants. Expander number 4 (green) is used for 3.75mm to 4.2mm implants and expander number 5 (black) is used for 5mm implants (figure 1).

The sequence is chosen according to the shape of the implant fixture being used and the density of the bone encountered. In most situations, it is recommended that tapered implants are utilized and site development is stopped at the green expander (#4). The implant shown in

Figure 1: Threaded osteotomes (apical and coronal dimensions in mm).

the case presented has a 3.4mm diameter in the apical portion and 5mm diameter at the platform (NG implant - B&W, Argentina). When soft low density bone (D4) is encountered, expansion is stopped after the green expander has been used and further expansion is accomplished when the implant is placed. If denser bone is encountered, the black expander (#5), should be used to make the implant placement easier and decrease incidence of fracture of the buccal plate.

The expanders are hand driven. The system provides a finger wheel to attach to the square head of the expander for use during the initial expansion. When the advance of the expander meets greater resistance, a wrench must be used to generate greater torque and advance the expander to its desired depth.

Clinical Technique

The initial step of the technique is an atraumatic extraction. This is common in all cases when an immediate placement is planned, but it is very important that the septa are preserved in order to carry out this technique. During extraction, if the

septa are lost, the technique cannot be performed. Following the extraction, a careful examination and debridement of the socket is performed followed by socket decontamination with a 2% citric acid gauze sponge packed into the socket for 1 minute.

Implants are immediately placed with a technique of septal dilatation using threaded expanders. The procedure begins with the use of a 1mm diameter pilot drill to create the initial preparation for the expanders to follow. The procedure continues through the use of threaded expanders in a sequence of increasing diameters to a size smaller than the intended implant diameter. Following this, a 5x10mm tapered implant fixture is placed with a healing abutment. The residual spaces of the socket surrounding the fixture are grafted with bone and the soft tissues are sutured to achieve tight closure around the healing abutment.

The differences with the previous technique can be divided in two areas: instrumentation and management of the soft tissue. The previous technique used osteotomes, which did not require the use of a starter drill, but was considered more aggressive by the patient. Regarding soft tissues, the original technique was developed as two stages, which included a partial thickness rotated palatal flap to close the site. This was developed based on concepts at that time, which held to the concept of a two stage surgical approach. The main problem with this approach was the donor area for the palatal flap had increased morbidity and presented greater discomfort for the patient. The current technique modified the procedure to a single stage, using a healing abutment at implant placement with approximation of the soft tissues surrounding the healing abutment. This technique modification has two major advantages. First, no palatal rotated flap is needed to close the site, and second, no additional surgery is necessary to expose the implant.

CASE REPORT

A patient presented with the complaint of sensitivity in the upper right posterior quadrant.

Figure 2: Presurgical radiograph demonstrating coronal breakdown.

Figure 3: The second premolar was restoratively treated but the first molar had decay extending into the furcation rendering it nonrestorable.

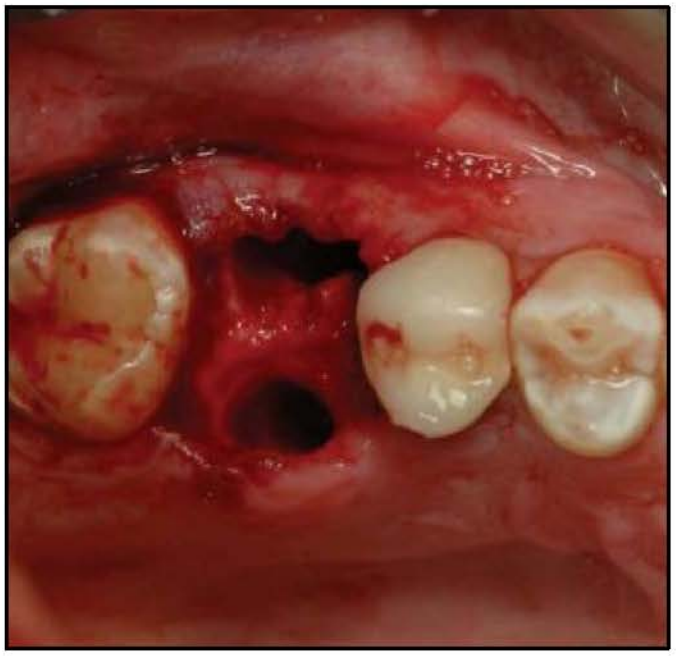

Figure 4: The first molar was atraumatically extracted to preserve the bone.

Figure 5: Following use of a pilot drill, expanders are used to develop the osteotomy site.

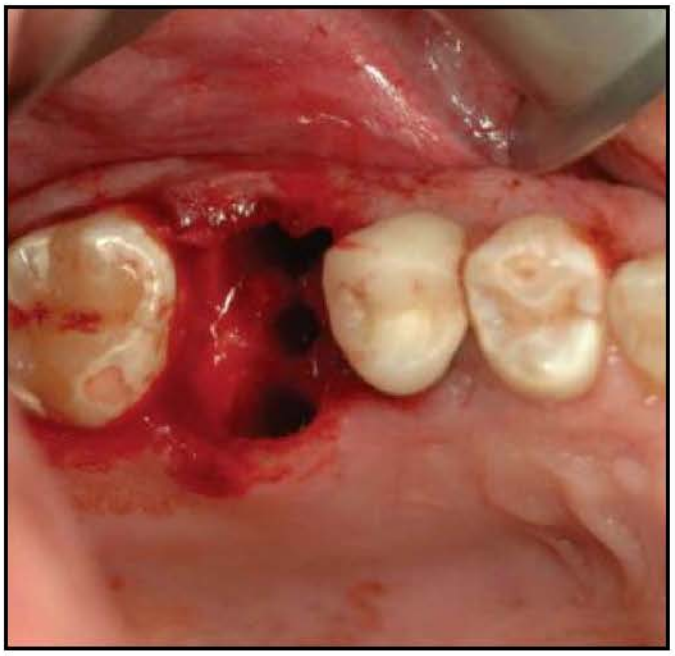

Figure 6: The osteotomy has been created in the septal bone of the furcation.

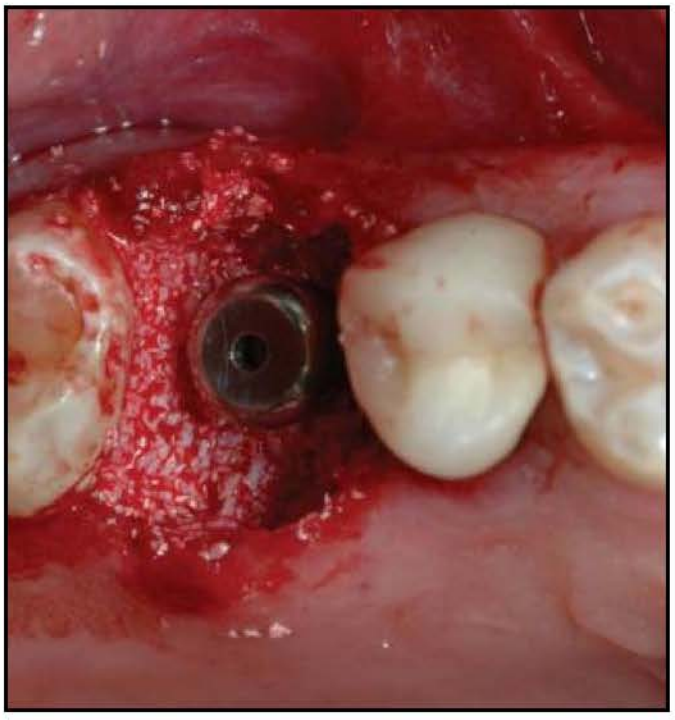

Figure 7: Implant placement with healing abutment and grafting of adjacent defects.

Figure 8: Attempt to get primary closure around the implant in a single stage approach.

Figure 9: Immediate postsurgical radiograph.

Figure 10: Site healing at the prosthetics phase of treatment.

Figure 11: Healed immediate implant site following healing abutment removal.

Figure 12: Final restoration (buccal view) demonstrating healthy soft tissue contours.

Figure 13: Final restoration (occlusal view) demonstrating healthy soft tissue contours.

Radiographic examination revealed periapical pathology and a large defective restoration on the maxillary first molar. The second premolar had a loose provisional filling and had undergone prior endodontic treatment (figure 2).

The premolar was deemed restorable and

Figure 14: 12 month postsurgical radiograph of surgical site.

treated with a cast post and core followed by placement of a porcelain fused to metal crown. Following removal of the defective restoration in the maxillary first molar, it was noted that decay extended into the furcation internally and the tooth was deemed to have a poor restorative prognosis (figure 3). Extraction was recommended with immediate placement of an implant followed by a healing period prior to restoration of the implant.

The molar was atraumatically extracted to preserve the bone at the buccal crest as well as the furcation (figure 4). A pilot drill was used in a surgical implant handpiece to initiate the osteotomy at the center of the septal bone of the furcation. Subsequently, expanders were used to laterally expand the socket bone and complete the osteotomy in preparation for implant placement (figures 5, 6). Final expansion of the site was performed with the implant which was slowly placed into the furcation osteotomy. An osseous graft material was packed into the voids present where the roots were located and any other remaining defects (figure 7). A healing abutment was placed and the

Table 1: Comparison of Periotest Values for Delayed Placement (control), Osteotome Septal Expansion Technique, and Threaded Expander Technique

	Initial Stability	2nd Stage Surgery	12 months
Control (from prior Luchetti study)	0.727 (±1.352)	0.136 (± 0.889)	-0.682 (± 0.894)
Osteotome Technique (from prior Luchetti study)	-2.04 (±0.935)	-2.440 (± 0.712)	-2.64 (±0.700)
Threaded Expander Technique	-2.476 (±0.680)	-2.762 (± 1.044)	-2.857 (± 0.655)

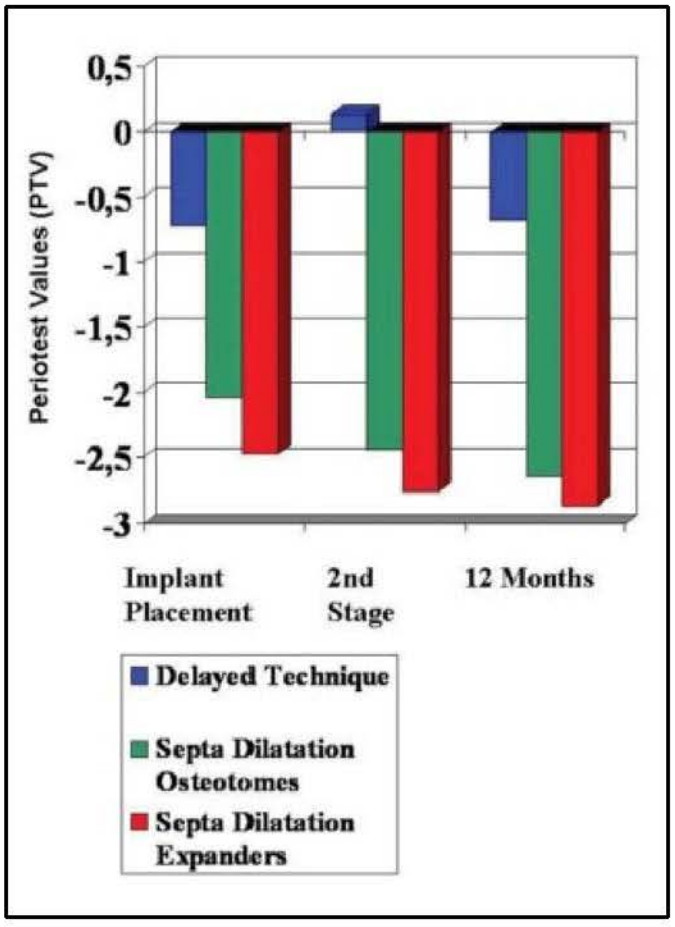

Figure 15: Periotest results for the twenty one patients observed.

surgical site was closed with sutures in an attempt to gain primary closure (figure 8). A radiograph was taken to document bone levels and density around the immediate placed implant (figure 9).

Following an appropriate healing period, the patient presented to initiate restoration of the implant (figure 10). The healing abutment was removed and an impression was taken following standard implant prosthetic principles (figure 11). Following fabrication of an abutment head, a porcelain fused to metal crown was luted and occlusion was checked and adjusted as necessary (figures 12 and 13). A final radiograph was taken showing dense bone around the implant and fill of the root spaces present after extraction of the tooth (figure 14).

CLINICAL STUDY

Twenty one (21) patients with an indication for maxillary molar extraction were consented for the study. Inclusion criteria included: patients younger than 50 years, tooth extraction due to caries, bone loss no greater than the coronal of the roots, and good general health. Implants

were placed using threaded expanders following the technique described. Primary stability was assessed by means of Periotest device at fixture placement, 2nd stage (when required), and at 12 months following implant placement.

The Periotest instrument measures the stability of the implant by percussing the fixture laterally and calculating the contact time. The result is then converted to a special scale called Periotest value (PTV) which ranges from −8 to +50. Lower contact time translates into greater stability and lower PTV's. Negative eight (-8) represents the greatest stability and positive fifty (+50) represents the lowest. Usually, a PTV greater than +9 indicates a failing implant (figure 15).

The results obtained were compared to the data of the previous Luchetti study which evaluated the technique using osteotomes and the delayed implant placement.

RESULTS

None of the implants placed failed during the evaluation period. Periotest values were as follows: placement -2.476 (± 0.680), 2nd stage surgery (when required) -2.762 (± 1.044), -2.857 (± 0.655) at 12 months. Comparing these results with data from the previous Luchetti study, we observed better results with the expander technique compared to the delayed technique, and no differences were observed with the osteotome technique. Combined data is shown in figure 15 and table 1.

Statistical analysis was accomplished using SPSS software. One way analysis of variance (ANOVA) was used for group comparison at each measurement interval and the Holm-Sidak method was used for all pair wise comparisons. Statistical differences were found between the delayed technique and the two techniques for septa dilatation at initial placement, 2nd stage surgery, and 12 months ($p < 0.001$ One Way ANOVA, $p < 0.05$ Holm-Sidak method). No differences were found between the two techniques for septa dilatation at each interval ($p > 0.05$ Holm-Sidak method)

DISCUSSION

The delayed technique has some disadvantages, but longer treatment times and the possibility of bone loss during healing are the most often mentioned.[9,10] Anecdotally, we have observed that the healed bone is usually softer than bone at the time of extraction and height to the maxillary sinus is often less due to further pneumatization of the sinus. With this in mind, the site sometimes does not provide adequate conditions to achieve a good initial stability. Considering this, we recommend that the delayed approach should be used only in case of active infection or in complex socket anatomy.

The palatal socket off axis technique is easy to perform and allows placement of longer fixtures. However, such implant placement leads to the need for angulation of the abutment when restoring the implant. Although we know of no studies evaluating bone loss in this situation, we can extrapolate from other studies that it is clear that we will greater chances of failure.[11,12] Another consideration in this approach is whether the implant is free-standing or will function splinted with fixtures, which would better distribute occlusal loads and minimize the off axis loading of the fixture placed into the palatal root of the extraction socket.

The palatal socket modification technique is a slightly more complicated, but still easy to perform. The approach is to enter in the palatal socket and change the trajectory of the drill making the fixtures axis more vertical. Place-

ment of the implant is in the correct axis, but the future crown is situated more palatally. This may lead to a cantilever effect due to a portion of the crown being buccal to the fixture. Additionally, hygiene problems may develop due to the over contour of the crown on the buccal aspect.

Previous studies have shown the osteotome septa dilatation technique to provide good results that are often better than the classic delayed approach and with shorter treatment time.[8] When compared with other immediate techniques, although it is a more complicated surgically, the technique described in this paper provides for optimal buccal/palatal positioning and proper axial loading of the future crown.

Compared to the previous osteotome septa expansion study, the threaded expander septa dilatation technique of this study demonstrated comparable results in regards to implant stability and positioning. Although PTV's did not show statistical differences between the two techniques, the major advantage of the threaded expander technique is that it is less traumatic to the patient. For example, reports in the literature have recently documented risks of vertigo when using osteotomes.[13,14] Although this risk is low and transient in nature, it is important to have this potential complication in mind.

CONCLUSIONS

The threaded expander septa expansion technique has shown promising results. It reduces total treatment time, provides improved stability as documented by Periotest values at various intervals.

Immediate implant placement in maxillary molar sites is a predictable procedure. With immediate approaches, the threaded osteotome septa dilatation technique seems to be the most adequate regarding buccal/palatal orientation and axial loading. Comparing the two techniques for septa dilatation, the threaded expander technique seems to be better, since it showed similar results to the osteotome technique, but was less traumatic for the patient. Further studies are needed to evaluate the other techniques.

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DISCLOSURE
The authors report no conflicts of interest with anything mentioned in this paper.

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