

# Trephine Core: An Alternative Sinus Lift Technique

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## INTRODUCTION

Typically, the posterior maxilla demonstrates the lowest density of bone in the oral cavity. The posterior edentulous maxilla also presents special challenges in implant placement compared with other areas of the mouth due to progressive resorption that results in less available bone. This poor quality and quantity of available bone challenges the essential condition for successful implant placement.

The maxillary sinus is an air cavity located in the maxilla that enlarges after tooth loss, complicating implant placement in this region. It is pyramidal in shape and is frequently reinforced with internal vertical septa, creating further intrasinus cavities.<sup>1</sup> After tooth extraction, the initial decrease in bone is due to resorption of buccal bone plate that is of lower density and thinner in cross section than the palatal osseous plate. As the edentulous area continues to atrophy, there is a continuing loss of bone height and density and an increase in antral pneumatization.<sup>2,3</sup> As a result, the sinus floor enlarges in a crestal direction, decreasing available osseous height for implant placement over time. This finding is related to 2 phenomena: (1) the enlargement of the sinus at the expense of the alveolus after tooth extraction because of the increased osteoclastic activity of the periosteum of the schneiderian membrane<sup>4</sup> and (2) increased pneumatization of the sinus simply because of the increase in positive intra-antral pressure.<sup>5</sup> In addition, the maxilla is made of primarily spongy bone and is composed of the least dense bone in the oral environment. The amount of bone inferior to the sinus is often limited. Thus, treatment of the posterior maxilla depends on the amount of bone

present in the subsinus region. The longer the site is edentulous or the higher the amount of periodontal inflammation present before tooth extraction influence how much available bone height and width will be present for implant placement. To achieve ideal height and width of posterior maxilla, sinus lift procedures are often required.<sup>1</sup>

Tatum<sup>4</sup> was the first to report penetration of the maxillary sinus with a modified Caldwell-Luc technique. This technique makes use of an unfinished fenestration osteotomy in the maxilla's external face to raise the sinus membrane, creating a hole in the floor of the antral cavity. This hole is then filled with a grafting material, providing required dimensions of the bone for implant placement. However, one of the most common complications of this technique is perforation of the Schneiderian membrane. Today, to overcome this complication many modifications are available, depending upon the available bone. Sinus lift procedure using trephine is one such procedure that was introduced by Emtiaz et al.<sup>6</sup>

In this technique, after raising a mucoperiosteal flap, by use of a trephine on a straight implant handpiece, a round bone cut is made 4–5 mm above the crest of the alveolar ridge and inferior to the sinus floor by several millimeters. A trephine drill is a hollow cylinder with a serrated terminal edge that creates a cylinder of bone in the osseous site (Figure 1). The outer bony cortex is removed gently to avoid tearing the membrane; this is important because the membrane can later be used for repositioning over the graft or crushed and used as particulate graft material in the site. The exposed membrane is then lifted from the sinus floor using osteotomes (Figure 2). Additional graft material is placed until the lateral wall of the maxilla is reconstituted. The mucoperiosteal flap is repositioned and sutured.<sup>1</sup>

When the trephine technique is to be used with simultaneous implant placement, a trephine is selected that has an outer diameter no greater than the implants core diameter (diameter minus

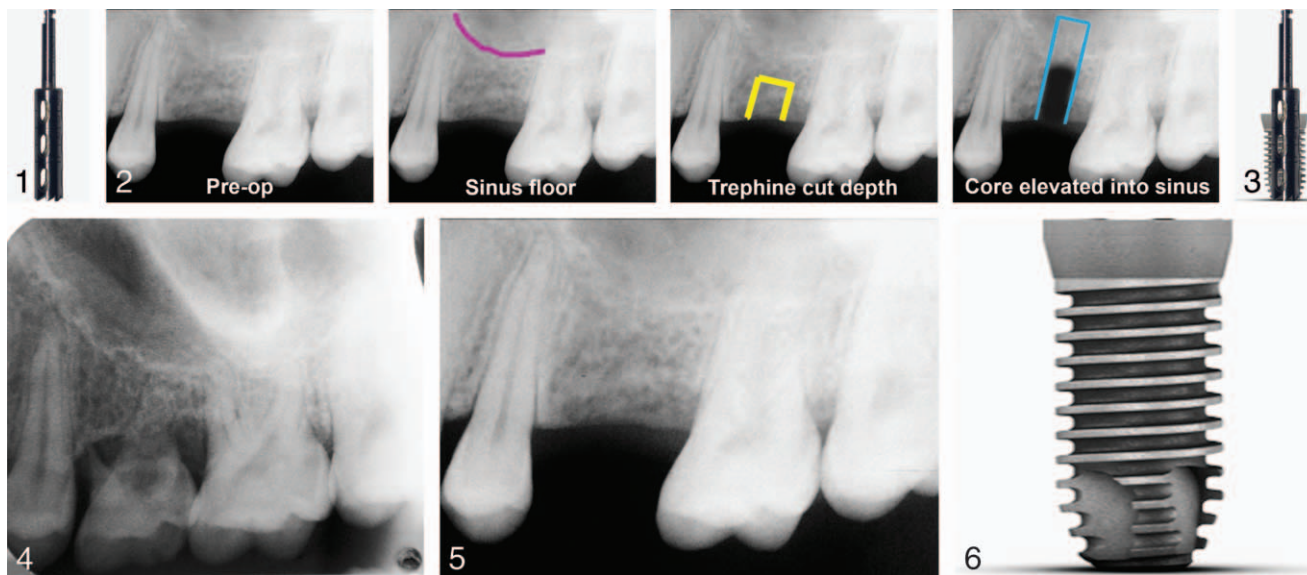
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**FIGURES 1–6.** **FIGURE 1.** Trepine drill used to create the majority of the implant osteotomy. **FIGURE 2.** Surgical sequence for use of the trephine to gain ridge height in the maxilla. **FIGURE 3.** Trepine diameter in comparison with the implant that will be placed into the osteotomy created by the trephine demonstrating the osteotomy matches the core diameter of the implant while allowing the implant threads to engage into the bone when placed. **FIGURE 4.** Initial radiograph demonstrating root resorption of the overretained deciduous molar. **FIGURE 5.** Radiograph after extraction of the overretained deciduous tooth. **FIGURE 6.** A 5.0 × 10.5-mm threaded fixture (Biohorizons) with an internal hex connector was selected to fit the intended site.

the thread depth). This allows the full depth of the implant's threads to engage bone, ensuring primary stability at implant placement (Figure 3). If a tapered implant is to be used, we recommend a trephine that is the diameter of the apical of the implant to be placed to ensure that the crestal half of the implant engages bone, achieving primary stability. In addition, to avoid overheating the bone and to allow irrigant to flow to the cutting end, it is recommended that the trephine be used with light pressure and with a 1–2-mm in-and-out stroke as its advanced to the desired depth. We also recommend running the trephine in reverse as it is less likely to slip during initial osseous penetration, and if close to the sinus membrane, it decreases the chances of tearing the membrane.

The advantages of the trephine technique are as follows:<sup>1</sup> (1) The time required to prepare the lateral window is decreased in favor of a crestal approach. (2) A more precise osteotomy can be performed. (3) Depending on the size and anatomy of the sinus, smaller or larger preparation with the various sizes of trephines available can be made. (4) There is no need for a barrier membrane because the bony segment acts as a barrier. (5) Use of osteotomes

allow an improvement in the sites density compared with use of sequential drills.

The disadvantages of the trephine technique are as follows:<sup>1</sup> (1) A limitation in approach in some patients is caused by angulation of the trephine. (2) The approach is technique sensitive, but we believe that all existing approaches for sinus elevation are also technique sensitive.

#### CASE PRESENTATION

A 21-year-old female patient presented with an overretained upper left second deciduous molar with clinical mobility. A periapical radiograph was taken and demonstrated severe root resorption and an absence of a permanent premolar apical to the deciduous tooth (Figure 4). Treatment options were discussed with the patient; options included, after extraction of the deciduous tooth, placement of a fixed bridge using an abutment tooth mesial and distal to the space created, or placement of an implant and restoration with a single crown. With the patients projected life span, treatment with an implant would pose the least long-term complications compared with those known for fixed natural tooth bridges, such as marginal decay of the

abutment teeth apical to the bridge connectors with the pontic.

The local anesthetic 2% Xylocaine with 1:100 000 epinephrine was applied using local infiltration. The deciduous tooth was extracted atraumatically using a periosteal elevator. A radiograph was taken to verify no residual pieces of the deciduous tooth's roots remained in the site (Figure 5). A crestal incision was made using a #15 scalpel blade to the palatal of the crests midline, and a full thickness flap was elevated without the use of releasing incisions.

Based on the dimensions of the site, it was determined a 5.0 × 10.5-mm implant would be placed after site preparation (Figure 6). A trephine with an internal diameter of 4.0 mm and external diameter of 5 mm (Meisenger, Centennial, Colo) was placed into the surgical handpiece, and with saline irrigation the osteotomy was initiated at the center of the existing crest to a depth of 2 mm (Figure 7). The trephine drill was removed from the handpiece and placed into the site. A radiograph was then taken to verify trajectory of the intended osteotomy and its relation to adjacent anatomical structures (Figure 8). The trephine drill was returned to the surgical handpiece, and the osteotomy continued to a depth of 5 mm as measured from the crestal bone (Figure 9). A Buser elevator (Hu Friedy, Chicago, Ill) was used to loosen the trephined core gently from all sides.

An offset osteotome (Biohorizons, Birmingham, Ala) with a diameter of 3.2 mm was introduced into the site, and gentle apical pressure was applied to a depth of 10.5 mm to fracture the trephined core to improve the bone quality and density of the surrounding bone of the osteotomy. The osteotome also aids in elevating the sinus floor atraumatically by pushing the bone core to a superior direction (Figure 10). The osteotome was placed into the site, and a radiograph taken to again verify trajectory of the site and its relation to anatomical structures (Figure 11).

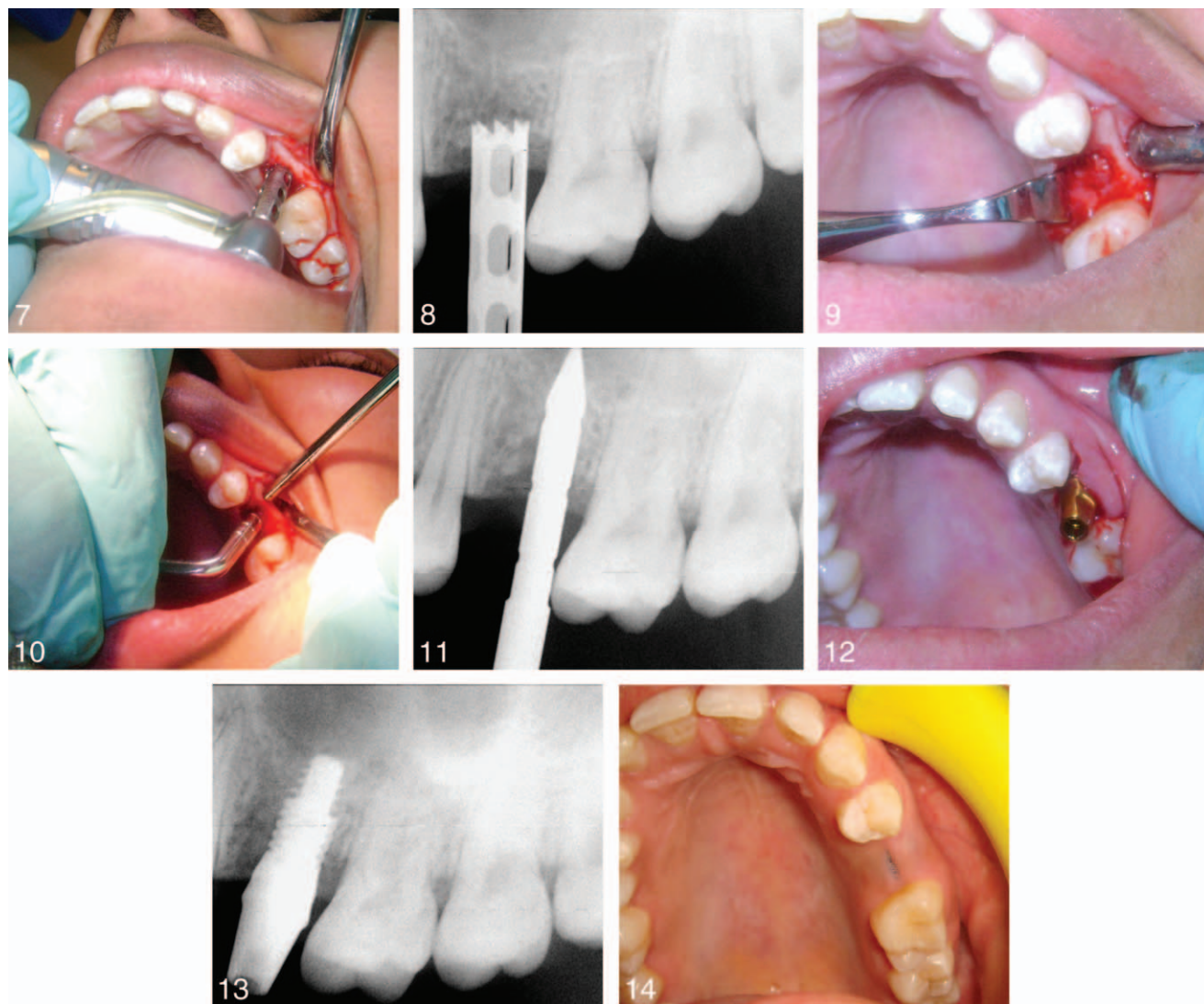
A 5.0 × 10.5-mm internal hex threaded implant (Biohorizons) was introduced into the site at 15 rpm until the fixture was seated 75% of its depth. Insertion was then completed using a hand wrench until the fixture was fully seated in relation to the crestal bone (Figure 12). A radiograph was taken to document final implant placement that clearly demonstrates the core lift into the sinus (Figure 13). The portion of the flap that would overlay the

implant was denuded of epithelium and then folded under the buccal flap to help bulk out the buccal crestal contour as resorption had resulted in a slight contour defect. The 3-in-1 abutment head (mount, post, abutment) was removed from the fixture and a cover screw was placed. The flap was then closed with 4-0 nonresorbable PTFE monofilament suture (Cytoplast, Osteogenics Biomedical, Inc, Lubbock, Tex) using an interrupted technique, and the patient was dismissed with postoperative instructions.

The patient presented 5 months postsurgical implant placement to initiate restoration of the implant. Examination of the site demonstrated a lack of inflammation over the fixture, with slight exposure of the implant cover screw at the center of the site and better contours on the buccal aspect of the ridge (Figure 14). Local anesthetic was applied to the crestal soft tissue and a rotary tissue punch was used to expose the cover screw (Figure 15). The tissue punch was placed palatal to the midline at the site in the ideal location restoratively (Figure 16). A surgical curette was used to remove the soft tissue core and a healing abutment was inserted. A radiograph was taken to verify complete seating of the healing abutment on the implant fixture with no intervening gaps and also to verify integration of the implant with the surrounding bone (Figure 17).

The patient was dismissed and instructed to use warm salt water rinses 3–4 times daily for a few days to aid in healing of the soft tissue surrounding the healing abutment. After a 2-week healing period, the patient returned to start the restoration (Figure 18). The healing abutment was removed and a healthy soft tissue tunnel was noted over the implant (Figure 19). An impression head was placed onto the implant, and a closed tray impression was captured. A shade was selected to match the adjacent teeth, and the impression was sent to the lab for fabrication of a screw-retained porcelain fused metal crown. The crown was returned and inserted with a insertion torque on the fixation screw of 30 Ncm, and then the screw access hole was sealed with a cotton pellet followed by composite. Occlusion was checked and adjusted.

The patient was seen on regular recall appointments at her general dentist and presented for a 5-year follow-up on the implant at the authors practice. A cone beam computerized tomography scan had been taken before her recall and

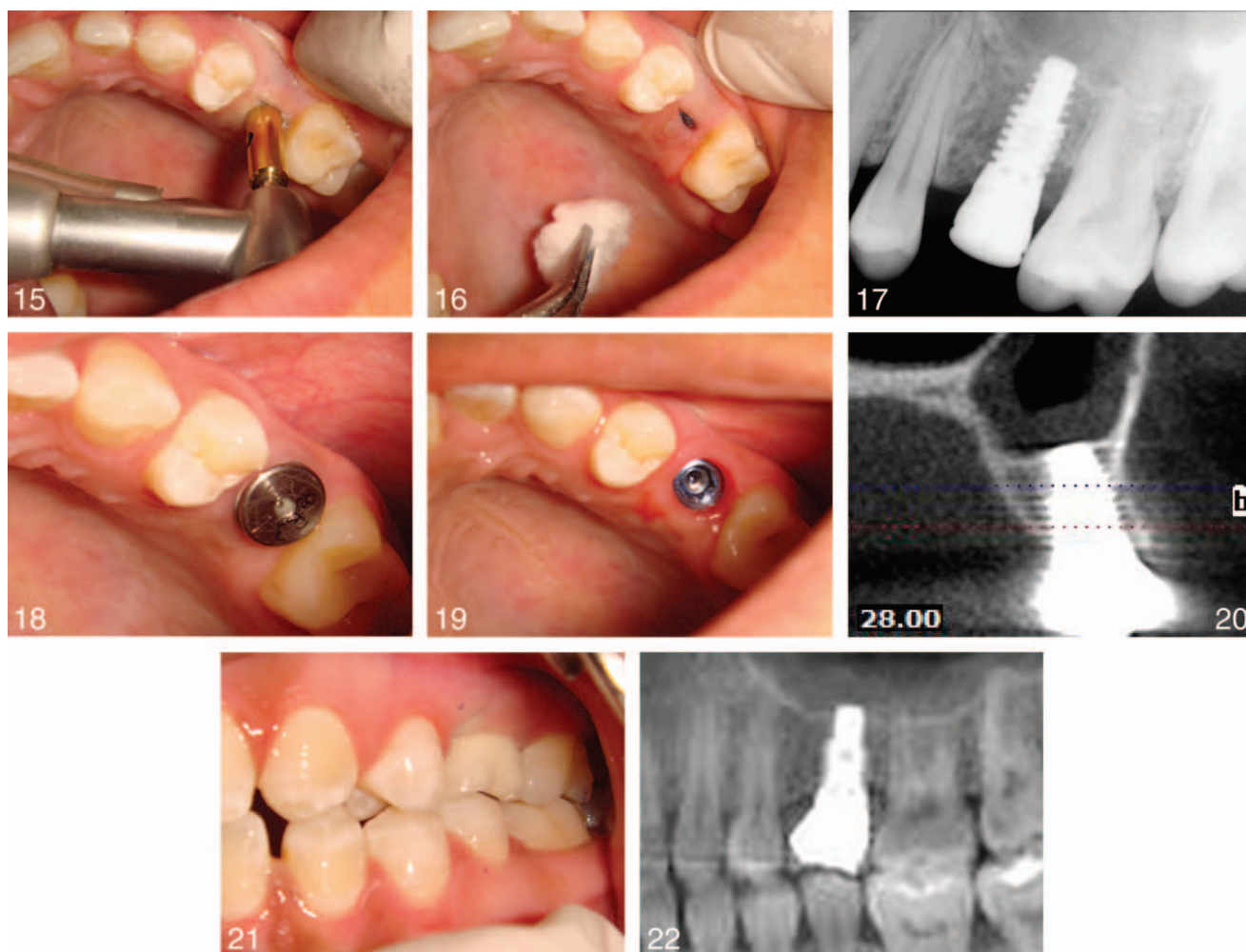


**FIGURES 7–14.** **FIGURE 7.** After a full thickness flap, the trephine is used to start the osteotomy. **FIGURE 8.** Radiograph after initial penetration of the trephine into the site to verify the trajectory of the intended osteotomy. **FIGURE 9.** Osseous core created by the trephine. **FIGURE 10.** An osteotome matching the outer diameter of the trephine is used to finalize the osteotomy created by the trephine after removal of the osseous core. **FIGURE 11.** Radiograph taken with the osteotome in the site to verify the trajectory of the osteotomy and its relation to anatomic structures. **FIGURE 12.** Implant has been placed into the site created with the trephine, and placement head/stock abutment head is shown still attached to the implant. **FIGURE 13.** Radiograph at implant placement with placement head on fixture. **FIGURE 14.** After 5 months of healing, the patient presented to initiate the restorative phase. The site shows an absence of inflammation and the cover screw can be visualized.

demonstrated maintenance of the crestal bone on the buccal and palatal as observed in cross section (Figure 20). Clinical examination showed a lack of gingival inflammation around the restoration (Figure 21), and a periapical radiograph was taken to compare the interproximal bone levels to the radiograph taken at placement. Radiographic comparison supported the stability of bone over the 5 years of function (Figure 22).

#### DISCUSSION

Osseointegrated implants have shown a high long-term survival rate since 1965.<sup>7</sup> Sinus floor elevation is a technique for extending the application of implants, and it was devised for cases in which implant placement was difficult due to lack of adequate bone. Today, this operative method is considered to be highly predictable. The choice of procedure is often dictated by the amount of



**FIGURES 15–22.** **FIGURE 15.** A rotary tissue punch is used to expose the cover screw in preparation to initiate the restorative phase. **FIGURE 16.** The rotary tissue punch has created a core of soft tissue in the ideal location on the ridge over the integrated implant. **FIGURE 17.** Radiograph of the healing abutment placed on the implant, demonstrating integration of the fixture and an adequate sinus elevation with the infracted core. **FIGURE 18.** A healing abutment was placed, and tissue was allowed to mature and heal after exposure of the implant before restoration of the implant. **FIGURE 19.** Two weeks after removal of the soft tissue core created by the tissue punch, the healing abutment was removed and the implant connector can be visualized. **FIGURE 20.** Cone beam computerized tomography cross-sectional view through center of the implant after 5 years of function, demonstrating stable bone levels at the apical, buccal, and lingual margins. **FIGURE 21.** Clinical photograph taken 5 years postimplant placement and restoration, demonstrating stable peri-implant soft tissue. **FIGURE 22.** Radiograph 5 years postimplant placement and restoration, demonstrating stable bone levels with no bone loss.

residual crestal bone in the posterior maxilla.<sup>7</sup> However, irrespective of the procedure chosen, maintaining membrane integrity is important, and it is essential to produce a cavity that will limit the amount of sinus graft material inserted into the zone, thereby improving implant survival and reducing complications.<sup>8</sup>

A systematic review reported an incidence of membrane perforation ranging from 0% to 21.4%, and postoperative infection from 0% to 2.5% after transcresal sinus elevation procedures.<sup>9</sup> In an experimental evaluation of maxillary sinus mem-

brane response after elevation with osteotome technique in human cadavers, membrane perforation was observed in 6 of 25 implants (24%), with the risk being increased with an increasing extent of sinus floor elevation to be obtained.<sup>10</sup> Endoscopic studies have demonstrated the risk of membrane perforation while performing transalveolar sinus floor elevation.<sup>11</sup> However, according to Engelke and Deckwer,<sup>12</sup> in an endoscopic study, the sinus floor may be elevated up to 5 mm without perforating the sinus membrane. Also, with increasing risk of sinus membrane perforation, the survival

rate of implants is affected. Proussaefs et al<sup>13</sup> found fewer implant survivals for implants installed in a grafted sinus with membrane perforation. Similarly, Hernández-Alfaro et al<sup>14</sup> studied the prevalence of surgical complications and described an action protocol relating to the perforation size. They describe in their results a lower implant survival rate for implants installed in grafted sinus when there was a membrane perforation influenced also by perforation size. These results coincided with the results reported by Viña-Almunia et al<sup>15</sup> who concluded that the survival of implants diminishes when they are placed in sinus lifts with a perforated membrane.

Use of a trephine provides such a technique where membrane perforation can be avoided. At the same time, there is no use of bone graft so that the implant is in direct contact with the autogenous bone, accelerating osseointegration through direct contact to implant contact. Fugazzotto<sup>16</sup> reported a cumulative success rate of 98.0% with this technique after 13–48 months of follow-up.<sup>10</sup> In this case report, at 5-year follow-up intraoral periapical radiograph shows excellent peri-implant bone at the crestal level, and clinically healthy peri-implant soft tissue can be appreciated without any recession.

### CONCLUSION

The use of a trephine allows better prepared osteotomy in less time, making the procedure comfortable for the clinician and the patient and providing greater confidence and security. The membrane perforation risk during osteotomy is minimal, thereby reducing related complications. However, clinician must be experienced in using a trephine and should be used with caution.

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