Bone Condensing in the Placement of Endosteal Palatal Implants: A Case Report

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Bone condensing as a technique to prepare an implant site is demonstrated on a patient who was to undergo orthodontic treatment utilizing a palatal implant as an anchor. Based on the anatomic constraints of the palate and the desire to load the implant as axially as possible, adapted instrumentation for bone condensing is presented. Bone condensing for preparation of the implant site in soft maxillary bone avoids the risk of heat generation, and palatal implants can be placed precisely with primary stability.
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Key words: bone condensing, orthodontic anchorage, osteotome technique, palatal implant

The use of implants as bone anchors provides a valuable tool for orthodontic therapy.[1–9] A wide range of anatomic locations, including the alveolar process, retromolar regions, tuberosity, and anterior palate, are available for this purpose.[4,7] The placement of implants in the palate involves working with highly spongy bone and thin cortical plates—so-called Type III or IV quality bone.[10,11] Furthermore, the vertical height of bone available in the palate is rather limited, requiring precise planning for the implant to be placed correctly.[12] Maxillary bone quality can also vary greatly within the same area because of fibrous inclusions, hollow spaces, and soft marrow.[12]

Given the anatomic features, the generally accepted biomechanical requirement that an implant be placed so that it will be loaded axially makes the surgical procedure even more challenging. To achieve better primary stability as well as expand the range of indications with inferior bone quality, a procedure for bone condensing has been developed. This procedure has also been called the osteotome technique.[12–16] The objective of this procedure is to retain bone that would otherwise be removed by compressing it laterally and axially to create a precisely formed implant site. Biomechanical research on peri-implant bone loading has shown that a maxillary implant surrounded with firm bone is more desirable than a reliance on bicortical anchorage with inferior bone quality.[17,18]

The aim of this case report was to present a practical bone condensing procedure for a palatal implant that minimizes patient morbidity. The challenge was to adapt instrumentation to the anatomic features of the anterior palate.

Case Report

One patient (male, 16.5 years of age) who was slated to undergo orthodontic treatment utilizing a palatal implant placed using the bone condensing procedure is presented. The bone condensing technique represents a nonablative method of preparing an implant site while avoiding potential heat necrosis associated with drilling by gently forcing the existing bone laterally and axially. According to Misch,[11] there is a possibility of undesirable compression of blood vessels in denser bone, such

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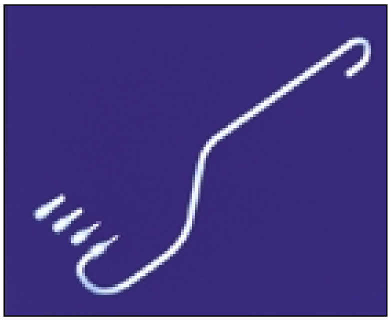

Fig 1 Palatal transfer instrument used with the various Frialit-2 BoneCondensers (diameters of 2.0 mm, 3.0 mm, and 4.5 mm). Each condenser is threaded onto the palatal transfer instrument. The S shape allows for the axial transfer of force during bone condensing.

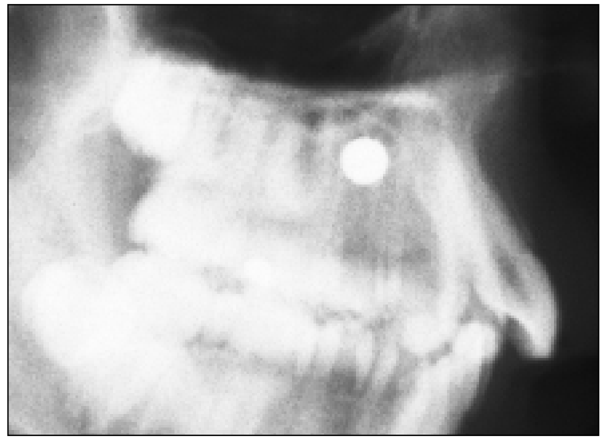

Fig 2a Preoperative lateral cephalograph with a radiographic marking ball.

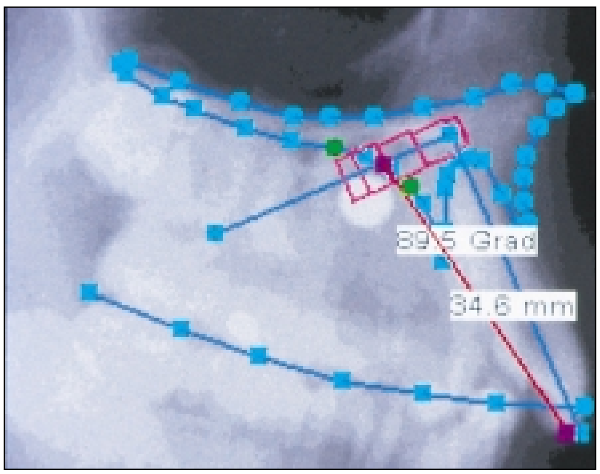

Fig 2b Treatment planning utilizing the Friacom program.

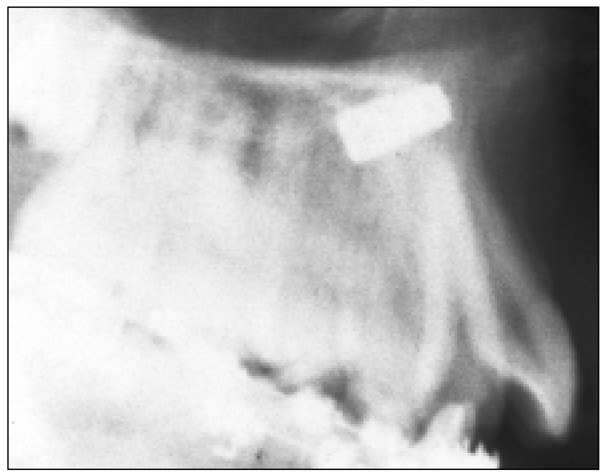

Fig 2c Postoperative radiograph of the palatal implant. The site was prepared by bone condensing.

as Type I and II. The resulting disruption to the blood supply could lead to loss of bone. Therefore, the osteotome technique is used primarily for the Type III and IV bone that is typically found in the maxilla.

The site was prepared with 2.0-, 3.0-, and 4.5-mm-diameter Frialit-2 BoneCondensers (Fig 1), and a 4.5 × 8-mm Frialit-2 stepped cylinder implant (Friadent GmbH, Mannheim, Germany) was placed. A specially designed transfer instrument (Fig 1) enabled correct and careful extraoral application of force in the appropriate direction to the condensers.

Presurgical Planning. Figure 2 shows respective radiographs of the patient. A radiographic marking ball (Fig 2a) facilitated precise determination of the dimensions at the site of implant placement. The implant location was determined utilizing the Friacom planning program (Friadent GmbH) (Fig 2b). The angulation of the anterior teeth and the distance from the incisal edges served as guides. With these calculations it was possible to determine the appropriate implant location and angulation.

Surgical Procedure. Figure 3 shows the process of bone condensing as it was used. A tissue punch with a larger diameter (5.5 mm) than the implant was used to remove the overlying soft tissue (Figs 3a and 3b). This was done to prevent epithelial cells from being introduced into the implant site. The cortical bone was marked and a pilot hole was prepared in the planned direction to a depth of 8 mm with a 2.0-mm twist drill (Fig 3c). This provided the surgeon with the tactile information for evaluating the bone quality.

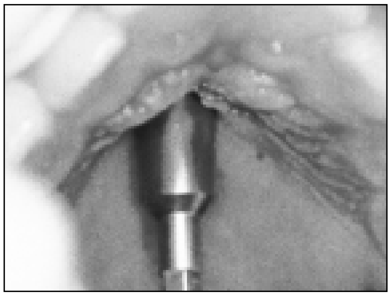

Fig 3a Tissue punch to incise the overlying soft tissue.

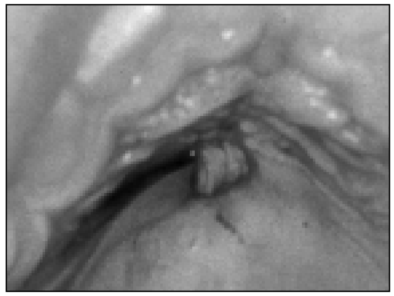

Fig 3b Removal of the incised palatal soft tissue of a larger diameter than the implant to avoid introducing epithelial cells into the site.

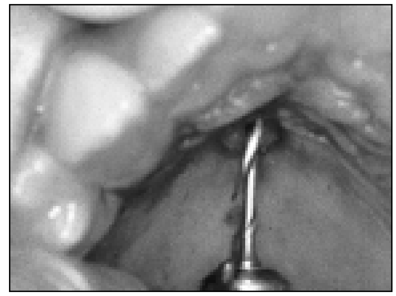

Fig 3c Pilot hole prepared with a twist drill to the planned implant length.

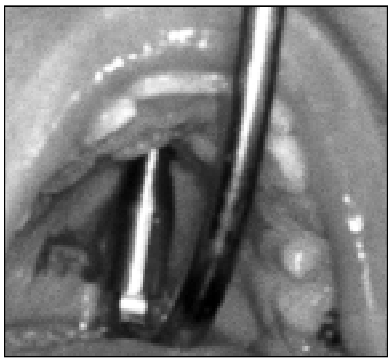

Fig 3d View of the Frialit-2 BoneCondenser and transfer instrument. Note implant orientation.

Fig 3e Frialit-2 implant with placement head in place.

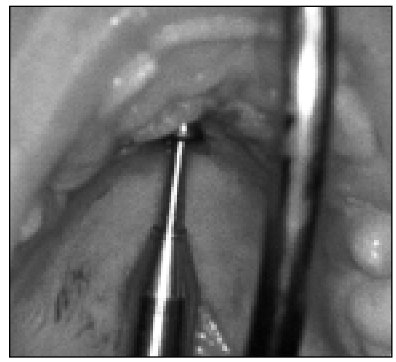

Fig 3f Final seating of the Frialit-2 implant utilizing the transfer instrument on the cover screw.

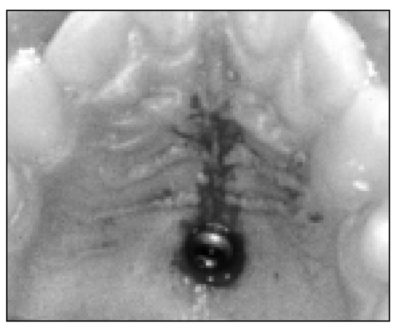

Fig 3g The palatal implant in place.

BoneCondensers were attached to the transfer instrument (Fig 1). This instrument served to transfer the force created by carefully tapping with a surgical mallet to the condensers. In addition, the S-shape of the extraoral instrument facilitated a precise determination of the correct implant angulation (Fig 3d). This would be difficult with drills because of the torque and obstructed view caused by the handpiece. Since deformation of the bone appears to be important, the BoneCondenser was left in the site for a minimum of 1 minute to allow the bone to move away from the instrument. If resistance to the condenser had been apparent, the site would have been irrigated with saline before continuing with the next condenser. Each condenser has a corresponding drill that can be used if resistance is too great. When a drill is utilized, it should be followed by as many additional steps with condensers as necessary. Because of the tight fit of the condensers after the bone is compressed, the instrument must be withdrawn carefully to avoid compromising the shape of the implant site. After the implant was introduced into the prepared site with the placement head (Fig 3e), the implant was seated utilizing the transfer instrument on the cover screw (Fig 3f). Figure 3g shows the implant in place.

Discussion

The maxilla consists primarily of Type III or IV quality bone.[11,19] Compared to the mandible, the cortical plate is rather thin. The apical cortical plate has negligible thickness in the posterior palate and is therefore of minimal therapeutic value. Another factor is the high variability of maxillary bone resulting from fibrous inclusions, hollow spaces, and loose marrow.[12]

Tactile sensitivity in determining bone quality is significantly more difficult with drilling. This can lead to inadvertent preparation of an oversized implant site, with subsequent reduced contact between the implant and the bone, potentially jeopardizing primary stability and hence osseointegration. According to Summers and Mawr,[12–15] condensing of the bone by a non-ablative procedure during preparation of the implant site creates a lateral and apical thickening of the bone. The bone structure is compressed without heat being generated. The quality and density of the peri-implant bone is thus improved. Irrigation with physiologic saline between instruments is recommended, particularly if resistance is met during condensing. Psychologically, the patient should be prepared and advised when to expect tapping with the mallet.

According to Summers and Mawr,[12–15] peri-implant bone conditions are not improved with threaded implants in Type III or IV bone. The press-fit of cylindric implants seems to be essential with bone condensing procedures.

Conclusions

1. Bone condensing provides a non-ablative method to prepare the site and provide adequate primary implant stability in soft maxillary bone.
2. This technique can also be used when an inadequate amount of bone is present (eg, elevation of sinus floor).
3. Bone condensing is a less ablative, less traumatic procedure than drilling.
4. Precise placement in difficult areas to access, such as the hard palate, is possible, providing implants with biomechanically favorable positions.

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