AESTHETIC ENHANCEMENT OF ANTERIOR DENTAL IMPLANTS WITH THE USE OF TAPERED OSTEOTOMES AND SOFT TISSUE MANIPULATION

An adequate bone base is usually a prerequisite for functionally and aesthetically optimal reconstruction of the soft tissue architecture around a dental implant. In patients with sufficient bone height but insufficient bone width as a result of tooth loss, a jaw enlargement technique with osteotomes combined with soft tissue manipulation may be utilized to facilitate proper implant placement while concomitantly optimizing the aesthetics of the final implant prosthesis. The learning objective of this article is to familiarize the reader with the principles of ridge expansion with tapered osteotomes combined with periodontal plastic soft tissue surgery to aid in proper implant placement and enhance the aesthetic result of the final prosthesis.

INTRODUCTION

Despite the numerous implant systems available in the present day market, the predictability of endosseous dental implants becoming osseointegrated is very predictable and well documented. For the past several years, the emphasis and, for the most part, currently, the standard of dental implant treatment have shifted from function to achieving aesthetic long-term results.

An adequate alveolar bone base is the prerequisite for functional and aesthetically optimal reconstruction of the soft tissue architecture for either a fixed partial denture pontic site or a dental implant site.1 If the horizontal and vertical dimensions of the ridge deficiency are within 3 mm of their original contour, acceptable results can be achieved by soft tissue augmentation procedures only,2 that is, connective tissue grafts,3 onlay grafts, or an inlay rolled graft.4-6 These procedures are usually performed at the time of either placement or uncovering of dental implants or at the time of hard and soft tissue manipulation in an edentulous region in order to maintain ridge topography or enhance it for future prosthetic rehabilitation.

Unfortunately, the facial plate of alveolar bone is lost or remodeled to a greater extent than the lingual/palatal...
bone after tooth loss, disease, or trauma, probably because the labial bone over natural teeth is usually much thinner than its lingual counterpart.

Because of precept that maxillary implant placement should, for the most part, be dictated by the aesthetic demands of a prosthesis and not by the available bone, the placement of the maxillary anterior implant after tooth loss is critical. The clinician must be cognizant of the rule that generally an appropriate tissue profile and contour can be developed in several ways, providing the dental implant is correctly positioned. This is because, within the first year following tooth loss, as much as a 40% decrease can occur in the crestal width of the maxillary alveolar ridge, resulting in a labial plate of bone that is then located lingual of its original location. Because available bone width and height are important factors for dental implant selection, placement, and longevity, along with optimal aesthetics in edentulous areas, it is crucial that hard and soft tissue manipulation and augmentation techniques be utilized in these aforementioned type cases of bone resorption, mainly to improve the available bone dimension in the maxillary arch, especially in the premaxilla region.

The success of a correctly contoured prosthetic restoration depends on soft tissue health and contour. Without an appropriate soft tissue “frame” for the prosthesis, it is very difficult to develop a restoration that replicates the natural tooth in function and appearance. For instance, even when the dental implant placement is optimal, the lack of soft tissue contour or the disparity between the dimensions of the implant and the dimensions of the final restoration can preclude success. This is especially evident when the difference in dimensions between a root of a natural tooth and a dental implant can be observed when viewing the anterior teeth from the sagittal aspect.

Numerous procedures have been devised to compensate for a deficient ridge width in the maxillary arch, including particle and solid types of grafting materials to widen this altered ridge. Guided bone regeneration techniques have been used extensively to create new bone.8 Other techniques, such as the split-crest bone manipulation technique,9 and other bone-spread- ing treatment modes, such as that described by Tatum (personal communication) utilizing “D”-shaped osteotomes, have been published that address this problem.

In a majority of the cases seen by the author (LHS), patients present with sufficient bone height but insufficient bone width because of resorption of the alveolar ridge (Fig 1). In these situations, a “jaw” ridge enlargement surgical technique can be used as an alternative to “block” bone grafting.8 This ridge expansion treatment method utilizing osteotomes, as first described by O. Hilt Tatum, Jr, is a safe and effective means of widening thin ridges that can be performed under local anesthesia.10 Instead of removing bone from a donor site, such as the tuberosity, chin, and hip, increasing the risk of patient morbidity, the use of osteotome instruments permits the expansion of a narrow osseous ridge by compressing and pushing the alveolar bone in a lateral (facial) direction. This hard tissue therapy would subsequently allow the dental implant surgeon to provide an accurately shaped osteotomy site while concomitantly producing a denser bony interface and therefore good initial stabilization of the dental implant.

In general, the expansion of bony ridges with osteotome hand instruments is limited to use in the maxillary arch and in soft bone as reported by Summers.11 This hard tissue manipulation technique will be further described to familiarize the reader with this ridge expansion technique utilizing the new tapered osteotomes with the bullet-shaped tip.

**METHODS**

The objective of the ridge expansion technique is to maintain the existing maxillary bone by pushing the buccal bony plates of the residual ridge laterally with minimal trauma while simultaneously developing an accurately shaped osteotomy. This technique takes advantage of the softer bone quality found in type III and type IV maxillary bone by relocating the alveolar bone to suit the needs of the sur-
Osteotomes and Tissue Manipulation

FIGURES 5–11. FIGURE 5. Mallet used to tap osteotome to predetermined depth while compressing buccal and palatal bony plates. FIGURE 6A, B. Tapered osteotomes are sequentially inserted into osteotomy in alveolar bone, expanding bone in a facial direction while concomitantly creating an accurately shaped osteotomy for dental implant placement. FIGURE 7. Note expansion of alveolar bone in buccal direction. FIGURE 8A, B. Tapered osteotomes have expanded the osteotomy site buccally, so the tapered dental implant can be placed properly, that is, in a more upright position and encased by alveolar bone. FIGURE 9A–C. Surgical flap is approximated with 3-0 coated vicryl suture material by a horizontal mattress technique of suturing. Note the illusion of root prominences in order to optimize the aesthetic result of future dental implant prosthesis. FIGURE 10A, B. Photographs of facial and side views showing the proper peri-implant tissue color and contours achieved with the use of both hard and soft tissue manipulation 1 year after prosthetic rehabilitation. FIGURE 11. Radiograph taken 1 year after insertion of prosthesis.

In addition, the osteotome technique is essentially heatless and therefore should not destroy the viable bone-forming cells.12

The ridge expansion technique can be performed predictably by adhering to the following guidelines.

1. This technique should be performed only when there is at least 3 mm of buccal/palatal ridge width. The surgeon should also be cognizant that utilization of osteotomes, because of their large size, is difficult to perform properly in the posterior region of the mouth or with a patient who has a limited opening because of the access necessary for the surgeon’s digits to compress the buccal and palatal bony plates during expansion so as not to fracture these alveolar plates.

2. Subsequent to reflection of the
mucoperiosteal flap (Fig 2) and insertion of a surgical stent, an initial hole into the implant or expansion site is made with a 1.5-mm disposable drill through the cortical bone to the desired depth (Fig 3).

3. The tip of the smallest osteotome is then inserted 1–2 mm into the pilot hole (Fig 4), and the osteotome instrument is then pushed into the implant or ridge expansion osteotomy site while using a rotating motion. If the bone is dense, it may be necessary to use a mallet to tap the osteotome to the predetermined depth (Fig 5). Note: It is important to leave the osteotome in place for approximately 1 minute to allow for flexure of the bone while compressing the buccal and palatal bony plates simultaneously.

4. Remove the osteotome instrument from the osteotomy site while concomitantly rotating the osteotome and pulling it out along the straight axis of the osteotomy site. More importantly, if much resistance is felt when attempting to remove the osteotome after allowing 1 minute after insertion, it is imperative to wait another minute with the instrument in place to allow the expanded bone to flex and spread enough so the osteotome can easily be removed in a twisting motion along the straight path of the osteotomy.

5. Enlargement of the osteotomy is accomplished by sequentially inserting larger sized osteotomes (Fig 6A, B). This will improve the maxillary ridge morphology and comb the alveolar bone in a buccal dimension is the beneficial result of the osteotome ridge expansion treatment (Fig 7). In addition, subsequent to a learning curve with this technique, the practitioner will be able to feel the alveolar bone flex and/or spread around the osteotomes as they penetrate farther into the piloted sites. Therefore, tactile sensation is an essential part of this ridge expansion process, particularly during the insertion of the next larger sized osteotome.

**DISCUSSION**

The dental implant surgeon must be able to visualize the final restoration. This visualization will allow the clinician to ascertain which hard and soft tissue corrective procedures have to be implemented, particularly in patients who have lost labial support that often accompanies loss of anterior teeth. In other words, the mesial, distal, facial, and palatal aspects of the dental implants must be spatially correct in relation to the final prosthesis.

The ridge expansion technique with tapered osteotomes described in this article can be used in any location in the maxilla when a change in external ridge morphology would be advantageous for both aesthetics and proper dental implant placement (Fig 8A, B).

Usually after tooth loss, the maxilla is somewhat undercut in form. This ridge expansion technique can be used to reduce the undercut by bulging out the base of the facial/buccal plate. This would recreate the illusion of root prominences or permit implant fixtures to be inserted in a more upright position (Fig 9A–C).

The tapered osteotomes can therefore predictably be used to expand the facial bone to facilitate a more upright and proper buccal/palatal placement of the tapered dental implants in soft maxillary bone. This ridge enlargement osteotome forming technique, by virtue of conserving, expanding, and condensing bone facially, combined with soft tissue grafting treatment, will optimize the final aesthetic result of the dental implant prosthesis (Figs 10A, B, 11). This is because, without a proper soft tissue “frame,” development of a prosthesis that replicates a natural tooth is highly improbable.14

**REFERENCES**


9. Misch CM, Misch CE, Resnick RR, et al. Reconstruction of maxillary alveolar defects with mandibular sym-


