Implant Bone Rings. One-Stage Three-Dimensional Bone Transplant Technique: A Case Report

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A variety of techniques and materials has been used to provide the structural base of bone and soft tissue support for dental implants. Alveolar bone augmentation techniques include different surgical approaches such as guided bone regeneration, onlay grafting, interpositional grafting, distraction osteogenesis, ridge splitting, and socket preservation. In the case presented, a technique was used to augment the alveolar bone three-dimensionally with autologous “bone rings” and immediate implant placement in a 1-stage procedure following teeth extraction. Bone rings (circular osteotomies) were outlined at the symphysis area using trephine burs, and a central osteotomy for implant placement was done before its removal. The rings were then removed and sculptured to fit the extraction socket; this was followed by screwing the implant through the ring, gaining its primary stability from the prepared basal bone.

Key Words: trephine bone grafting, immediate implants, bone rings

INTRODUCTION

The definitive implant restoration needs to be surrounded by hard and soft tissue environment that is in harmony with the surrounding dentition. The amount of bone and soft tissue present prior to implant surgery is the main issue but also the precision in execution of the surgical techniques should be considered to obtain an overall favorable outcome.

This article describes a surgical technique of restoring maxillary incisors using immediate implants and autogenous bone graft in the form of “bone rings” harvested from the symphysis.

A 45-year-old woman presented with persistent mobile maxillary central and lateral incisors after definite periodontal treatment (pocket depth ranged from 6 to 8 mm). The panoramic radiograph showed moderate to severe bone loss around the teeth. The patient underwent extensive full
mouth periodontal therapy including scaling, root planing, and oral hygiene instructions to control her periodontal problem. The inflammatory condition stabilized; however, mobility of the maxillary incisors did not improve and temporary splinting was not acceptable or predictable. Diagnostic casts were mounted to visualize the treatment plan for immediate implant placement with simultaneous bone augmentation.

**Surgical procedures**

The patient was instructed to rinse with 0.12% chlorhexidine gluconate mouthwash just prior to surgery for 1 minute. Surgery was performed under deep conscious sedation (Propofol) and local anesthesia (articaine 4%, epinephrine 1:100 000) for pain control. Preoperative antibiotic clindamycin, 600 mg, was administered intravenously.

**Bone rings harvesting**

The symphysis was accessed through a genioplasty incision. The mental nerves were exposed and protected. Using an 8-mm trephine bur and under copious saline irrigation, multiple circular osteotomies were outlined, spaced, and drilled through the exposed symphysis. The bone discs outlined were placed 3–4 mm away from the root apices of the mandibular anterior teeth. During this step, the trephine was slightly torqued to partially loosen the bone discs to facilitate its subsequent removal without fracture. An implant drill was subsequently used to prepare central osteotomies corresponding to the final implant diameter to be placed in the center of each disc converting it to a “bone ring.” The osteotomies corresponded to eventual placement of 3.0-mm diameter implants. The “bone rings” were then carefully removed from the chin. Four rings were harvested using the described procedure (Figures 1 and 2).

**Implant surgery**

Gingival sulcular incisions were made around the teeth to be extracted with 2 oblique vestibular releasing incisions. The incisor teeth were extracted atraumatically. Soft tissue remnants in the extraction socket were carefully removed to ensure complete removal of all contaminated tissues. Sequential osteotomies through the extraction sites were accomplished for immediate implant placement as recommended by the implant manufacturer. The osteotomies were performed at least 3 mm apical to the extraction socket as recommended in the literature to obtain primary stability. The bone rings were then used to guide the pilot drill over the socket and assist in their optimum prosthetic planned positions.

The harvested bone rings were then snuggly fitted in the extraction socket. Minor contour adjustments were necessary to ensure their adaptation and stability. Implants were then tapped through the “bone rings,” achieving and even increasing the primary stability of “bone ring” and implant to the basal alveolar bone. Countersinking of the implants 1 mm was performed within the bone rings to compensate for the anticipated crestal bone resorption and provide the best emergence profile by the surrounding soft tissue drape.

Using a bone curette, scraping of cancellous bone from the harvested site was used to fill any observed gaps found between the bone rings and the implant preparation site. Concurrently, augmentation of facial defect was also accomplished to further reconstruct the alveolar bone. Sharp edges were identified and gently rounded by low speed fissure bur under copious saline irrigation. Periosteal scoring was then accomplished at the base of the flap to advance and expand the soft tissues and provide primary closure without tension (Figures 3 and 4).
A pressure bandage was applied to the chin after layered closure and resuspension of the mentalis muscle to provide continued soft tissue support and to minimize postoperative edema.

**Treatment outcome**

All implants were osseointegrated. On inspection during the second phase surgery (6 months), improvement in the overall alveolar bone height and consequent soft tissue level was achieved at the augmented site. This was further supported by the postoperative panoramic radiograph (Figures 5 and 6). No signs of infection or dehiscence were noted around the implant’s bone interface.

The patient showed complete satisfaction with the final prosthesis with respect to esthetics and function (Figures 7 through 9).

When placing an implant in an immediate extraction site, the surgeon needs to consider the socket dimension and possible gaps that occur around the coronal aspect of the implant. One area that is overlooked or difficult to simultaneously reconstruct is the crestal bone height, especially after its loss due to periodontitis.

Another concern with immediate implant placement with anterior teeth sockets is the thin facial cortex of the alveolar housing. This residual bone can rapidly resorb or dehisce, compromising the implant.

There are several advantages proposed by this technique, including a 3-D augmentation of the native alveolar ridge, elimination of the socket gap implants interface, and the ability to provide additional stability of the implant at the crestal region of the implant. The additional stability is achieved through screwing the implants to the bone.

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**Figures 1-4. Figure 1.** Bone rings outlined in the symphysis with the central osteotomies corresponding to the diameter for implants to be placed. **Figure 2.** Bone rings after removal from the symphysis. **Figure 3.** Three dimensional augmentation using “bone rings” with simultaneous implant placement. **Figure 4.** Diagrammatic representation of the “bone ring” technique.
The simultaneous onlay crestal augmentation by the “bone rings” at the residual socket also enhances the soft tissue contour and helps resist soft tissue contraction in this highly esthetic zone. The “harvested” bone rings “can be carved to any desired dimensions, thus ideally reconstructing any alveolar defect to optimize the biomechanical and esthetic outcome. The implant also symbiotically provides stabilization of the bone graft to promote graft union and minimize graft resorption.

Considering the treatment and healing time, rather than performing 2 surgeries for socket augmentation, waiting for graft healing, and reopening for implant placement, a 1-stage procedure for augmentation with simultaneous implant placement can be done in an acceptable operative time.\textsuperscript{9,10} This also will prevent further bone resorption and soft tissue shrinkage with subsequent loss of attached gingiva due to a second surgery if a staged procedure is used.

Clinical reports have suggested that a history of periodontal or endodontic infections is a predictive marker for implant infection and failure. This clinical experience...
has led most clinicians to avoid the immediate implant placement at infected sites and to consider infection as a contraindication for immediate placement. However, the present case report was performed in accordance with a study made by Casap et al.\textsuperscript{11} who concluded that successful immediate implantation in infected alveoli can be obtained, depending on complete removal of all contaminated tissues and controlled regeneration of the alveolar defect.

With the aid of advanced radiographic techniques (computed tomography) for preoperative bony assessment and by using graded trephine burs with different sizes, it is possible to exactly harvest a precise precalculated height and diameter bone graft needed to augment the extraction socket with simultaneous implant placement in the optimum 3-D position.\textsuperscript{12} Also, in restoring multiple missing adjacent teeth, an exact width of the needed bone rings can be predetermined in the treatment plan and can be harvested in an exact dimension from the chin providing a precise custom-made augmentation at the desired area.

It should be mentioned that proper preoperative treatment planning is mandatory in order to obtain favorable results. During the grafting procedure, vertical and horizontal measurements of the socket defects were obtained to provide a 3-D review for both bone ring graft dimensions and to assist in implant emergence profile.

Care should be taken during bone rings harvesting from the symphysis because they may fracture during removal. It is prudent to map out planned areas should it be necessary to harvest additional bone rings. Autogenous bone, which is still considered the gold standard, is accompanied by the usual donor site morbidities, such as pain, edema, infection, and occasionally paresthesia.
The patient was closely monitored clinically and radiographically once a week for 1 month to ensure proper healing. Possible early complications include dehiscence, graft exposure, and infection. Late complications include graft resorption, implant mobility, and failure. In the present case, minor bone changes were compensated by adding to the crown length (limited cervical collar) without compromising the biomechanics.

The patient was strongly encouraged to maintain oral hygiene measures with chlorhexidine mouthwash and was maintained for 5 days on antibiotics (clindamycin 300 mg/8 hours) to minimize the risk of infection. Brufen, 400 mg/8 hours, was used for pain control. Temporary prosthesis was kept out of occlusion, and the underside of the bridge was also relieved to avoid any pressure on the surgical site during the healing period.

In conclusion, the proposed technique offers multiple advantages of a 1-stage procedure for immediate implant placement and 3-D bone augmentation. Proper treatment planning and careful surgical execution are essential to ensure predictability.

REFERENCES