A NEW TUNNEL TECHNIQUE WITH ACCELLULAR DERMAL MATRIX FOR SOFT TISSUE PREPARATION PRIOR TO SYMPHYSEAL BLOCK GRAFT—A DESCRIPTION OF TECHNIQUE AND CASE REPORT

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The aim of this report was to describe a newly designed tunnel technique (A New Tunnel Technique) using acellular dermal matrix (ADM) allograft for soft tissue augmentation prior to mono-cortical block graft. Two cases with vertical and horizontal ridge deficiency in the mandibular anterior area were indicated for mono-cortical block grafting before implant placement. Soft tissue evaluation and measurements showed thin tissue covering the defect area composed mainly of nonkeratinized alveolar mucosa measuring 1 to 2 mm in most of the sites. Soft tissue augmentation was done first using a new tunnel technique with ADM allograft. After 2 months of healing, mono-cortical block graft was harvested from the mandibular symphysis area and fixed to the recipient site. Soft tissue measurements were made before soft tissue graft and immediately before block graft. Healing was evaluated at 2, 4, 12, and 24 weeks post-block grafting surgery to evaluate healing. In both cases, there was generalized 1- to 2-mm increase in soft tissue thickness covering the defect areas following allograft. Both cases had healed uneventfully with no soft tissue complications following block grafting procedure to the time of implant placement. The new tunnel technique for soft tissue augmentation using acellular dermal matrix allograft seems to be a valid approach in soft tissue preparation prior to mono-cortical block grafting. Further research is needed to evaluate if this procedure will help to prevent soft tissue complications associated with block grafting.

Key Words: new tunnel technique, tunnel technique, acellular dermal matrix, block graft, autogenous bone graft

INTRODUCTION

The ideal placement and restoration of dental implants is dependent on the presence of adequate bone volume and quality at the edentulous site. Alveolar bone loss can result from tooth extraction, infection, trauma, and pathology and can prevent implant placement in favorable positions and angulations.1 The morphology of a bony defect is an important factor in the selection of a method for ridge augmentation.2
Alveolar ridge defects can be classified according to Seibert and Cohen as horizontal, vertical, or a combination of vertical and horizontal bone loss. Horizontal bone loss is the most amenable to augmentation, while a combination of horizontal and vertical bone loss offers the lowest predictability for surgical correction. Several alveolar ridge augmentation techniques, including bone spreading, bone grafting, and guided bone regeneration, have been described in the literature. While many materials have been proposed and studied with these techniques including allografts, xenografts, and alloplasts, the use of autogenous bone grafts represents the gold standard for bone augmentation procedures.

Autogenous bone graft can be harvested from extra-oral or intra-oral donor sites. Several studies have confirmed that intraorally harvested intramembranous bone grafts, when compared with extraorally harvested endochondral bone grafts, may have minimal resorption, enhanced revascularization, and better incorporation at the recipient site. Other advantages include proximity to the recipient site, and therefore reduced morbidity; no hospitalization; convenient surgical access; and no cutaneous scar formation. Autogenous bone grafts have been used in block and particulate forms. Block grafts when compared with particulate bone marrow, have been associated with lower osteogenic activity and slower revascularization. Block type grafts may be harvested from the mandibular symphysis, body, or ramus area. Larger bone volume could be harvested from the symphysis compared with other intraoral sites. The block should be contoured to better adapt to the recipient site and fixed to the recipient site using 2 fixation screws ranging from 1 to 1.5 mm in diameter. The purpose of the present report was to describe a newly designed tunnel technique (A New Tunnel Technique) using ADM allograft for soft tissue augmentation prior to mono-cortical block graft.

**Materials and Methods**

**Case 1**

A 30-year-old, healthy, nonsmoking woman presented to our clinic with a missing mandibular right central incisor; she was seeking an implant. After clinical examination (Figures 1 and 2), soft tissue measurements, bone sounding, and radiographic evaluation, we found the patient had flaring of mandibular anterior teeth, which makes the space of the missing central incisor larger than it should be and a Class III ridge defect at the edentulous area. The patient needed mono-cortical block graft prior to implant placement, but she had very thin soft tissue composed mainly of nonkeratinized alveolar mucosa measuring 1 to 2 mm in most of the sites, which may complicate
the block graft procedure and may cause dehiscence of the wound and block graft exposure.

The treatment plan was soft tissue augmentation followed by block graft, and after healing, orthodontic alignment of teeth, then dental implant.

After signing the consent form for the treatment, the patient was scheduled for soft tissue augmentation.

**Soft tissue graft**
The aim of this procedure was to prepare the soft tissue prior to mono-cortical block grafting.

The recipient site was anesthetized using local infiltration with 2% lidocaine, containing 1:100 000 epinephrine. Two vertical incisions were made at least 1½ tooth wider mesiodistally than the area of the defect, starting just apical to the mucogingival junction going apically about 5 to 7 mm (Figure 3). Partial-thickness dissection was extended horizontally connecting the 2 vertical incisions (Figure 4), then coronally undermining the tissue covering the defect area (Figure 5). A small straight instrument (periosteal elevator or chisel) was then passed into the tunnel from one side to the other. The ADM allograft was hydrated, as suggested by the manufacturer, in 2 saline washes, then the mesial part of the graft was sutured with a single knot to the straight instrument, and the instrument was pulled so that the graft could slide under the tunnel (Figure 6). The graft was positioned over the defect area using a periosteal elevator and fixed in place using 5 suspension sutures (Figure 7). The vertical incisions were sutured with interrupted sutures. The patient was given nonsteroidal anti-inflammatory drugs to manage postoperative pain and chlorhexidine mouthwash for 1 week post surgery. No antibiotic was given at this stage.

After 10 to 14 days, the patient came for suture removal, and then the healing was evaluated at 6 and 8 weeks (Figure 8). Soft tissue measurements were made after 8 weeks at the time of the block grafting surgery.

**Mono-cortical block graft**
After 2 months of healing following soft tissue graft, the patient was scheduled for block graft from mandibular symphysis. The advantage in this case was that the donor site was located just apical to the recipient site.

The patient was given 1 g of amoxicillin 1 hour prior to surgery and was advised to continue with 500 mg every 8 hours for 1 week. Also, the patient was given nonsteroidal anti-inflammatory drugs and chlorhexidine mouthwash for 1 week post surgery.

The procedure was performed under local anesthesia only. Bilateral mandibular nerve block anesthesis was given with local infiltration in the lower anterior area using 2% lidocaine, containing 1:100 000 epinephrine.

**Recipient site**
Crestal incision was made from the mesial of mandibular left central incisor to the mesial of mandibular right lateral incisor, and divergent releasing incisions remote to the defect were used to facilitate closure and maintain adequate blood supply. The recipient site was recontoured to improve bone-to-graft contact. The underlying bone was also perforated with a small round bur. The dimension and the morphology of the bony defect were measured.

**Donor site**
The mucoperiosteal flap was reflected toward the inferior border of the mandible. The size and shape of the graft required was marked out with a fissure bur in a surgical handpiece under copious saline irrigation. The superior horizontal osteotomy was made with a minimum distance of 5 mm from the apices of mandibular incisors and canines. Inferior horizontal osteotomy was made parallel to the inferior border of the mandible. The graft was then elevated from the symphysis with bone chisels. The donor site was filled with a mixture of bovine bone and calcium sulfate (ratio 4:1).

**Graft fixation**
The graft was refined to fit into the defect. All sharp edges were rounded. The graft was fixed to the recipient site with two 1.2-mm diameter titanium screws. Deficiencies at the edge of the graft were filled with a mixture of bovine bone and calcium sulfate (Figure 9). A collagen bioabsorbable membrane was used to cover the graft.

**Wound closure**
The periosteum at the base of the flap was carefully incised to allow stretching of the mucosa and tension free adaptation of the wound margins. The flap was then secured using nonresorbable expanded polytetrafluoroethylene interrupted sutures.

Provisional restorations were modified to prevent any pressure to the healing tissue. The grafted site was allowed to heal for 6 months prior to orthodontic treatment.

**Evaluation of graft healing**
Sutures were removed after 14 days. The soft tissue healing was monitored carefully during the healing period to evaluate any early or late complications on the recipient site and the effect of these complica-
tions—if any—on graft healing and success. The patient was reevaluated after 1, 3, and 6 months (Figure 10). After 6 months, the patient was sent to the orthodontic department to start orthodontic treatment.

**Case 2**

A 55-year-old, healthy, nonsmoking woman presented to our clinic with missing mandibular left and right central incisors; she was seeking implants. After clinical examination (Figure 11), soft tissue measurements, bone sounding, and radiographic evaluation, we found the patient had a Class III ridge defect.

The patient needed a mono-cortical block graft prior to implant placement, but she had very thin soft tissue composed mainly of nonkeratinized alveolar mucosa measuring 1 to 2 mm in most of the sites, which may complicate the block graft procedure and may cause dehiscence of the wound and block graft exposure.

The treatment plan was soft tissue augmentation followed by block graft, and after healing, placement of 2 dental implants.

After signing the consent form for the treatment, the patient was scheduled for soft tissue augmentation. The same surgical protocol used in Case 1 was followed starting with ADM soft tissue graft (Figure 12); then, after 2 months, mono-cortical block graft was placed and healing was evaluated after 1, 3, and 6 months (Figures 13 and 14).

**RESULTS**

**Soft tissue graft**

In all cases, soft tissue healed with no complication, pain, or infection. There were generalized 1- to 2-mm

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**Figures 3-6.**

**Figure 3.** Two vertical incisions were made at least 1½ tooth wider mesiodistally than the area of the defect; starting just apical to mucogingival junction going apically about 5 to 7 mm. **Figure 4.** Partial-thickness dissection was extended horizontally connecting the 2 vertical incisions. **Figure 5.** Partial-thickness dissection was then extended coronally undermining the tissue covering the defect area. **Figure 6.** The acellular dermal matrix (ADM) was sutured with a single knot to the straight instrument, and the instrument was pulled so that the graft could slide under the tunnel.
increases in the thickness of the soft tissue covering the defect areas 8 weeks following allograft surgery.

**Mono-cortical block graft**

**Donor Site**

In all cases, donor sites healed with no complications. No permanent sensory disturbances of the skin or teeth were noted.

**Recipient Site**

In all cases, recipient sites healed with no complications or infection. Six months following the block graft surgery, 1-mm recession was found in mesiolabial line angles of the teeth adjacent to the defect areas in both cases.

The soft tissues were 2 to 3 mm thick and there were no dehiscence or fenestration over the block graft (Figures 10 and 13).

**DISCUSSION**

Maintenance of soft tissue closure is a very important factor in the success of any bone grafting procedure. Wound dehiscence and premature exposure of the bone graft are the most common causes of graft failure.

With mono-cortical block grafting procedures, the presence and maintenance of enough soft tissue coverage for the block is more important due to the great increase in the ridge width and height.

In cases of thin mucosa, the maintenance of soft tissue coverage may be more difficult due to inability of the tissue to overcome the continuous pressure from the block, and it can be easily penetrated by any sharp edges of the block or fixation screw.

Soft tissue preparation and grafting is a mandatory

References 1, 7–9, 14–16, 21, 23, 28, 29, 31, 33, 37, 38, 42, 44, 50
step prior to mono-cortical block grafting in cases of thin mucosa. The use of ADM allograft seems to be a good substitute for CTG for soft tissue augmentation.\textsuperscript{48,49} The ultimate supply and availability are the main advantages of using ADM over CTG.

The tunnel technique was first described by Miller\textsuperscript{1986} as a simplified technique for soft tissue ridge augmentation under a fixed prosthesis using a subepithelial connective tissue graft. This technique was modified by many authors and was used for coverage of gingival recession.\textsuperscript{52–57}

The new tunnel technique described in this report differs from the original and modified tunnel techniques in the location of the incision lines, the method of dissection, the way of sliding the graft under the tunnel, the suturing technique used to fix the graft, and the aim of using the technique prior to block graft surgery.

The use of ADM for soft tissue preparation using a new tunnel technique offers the advantage of increasing the soft tissue thickness prior to block grafting and may minimize or eliminate the early or late post-surgical soft tissue complications associated with this procedure. The new tunnel technique is simple and predictable. No pain or complications were noted after the soft tissue surgery. The average time for the procedure was 30 to 45 minutes.

In both cases described in this report, the soft tissues were thin originally, but after soft tissue augmentation with ADM, there were no early or late soft tissue complications following block grafting procedure.

The major shortcoming of this report was having all surgical procedures and evaluation completed by the authors. This made blind evaluation impossible. We need randomized controlled clinical trials to evaluate the effect of soft tissue augmentation with the new tunnel technique using ADM in minimizing or preventing post-surgical complication following mono-cortical block grafting.
A NEW TUNNEL TECHNIQUE WITH ACELULAR DERMAL MATRIX

CONCLUSIONS
Within the limitation of this report, the new tunnel technique for soft tissue augmentation using ADM allograft seems to be a valid approach in soft tissue preparation prior to mono-cortical block grafting. Further research is needed to evaluate if this procedure will help to prevent soft tissue complications associated with block grafting.

REFERENCES
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