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DENTAL TRAUMATOLOGY

Case Report

Localized edentulous ridge augmentation with upside down osteotomy prior to implant placement

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Abstract – Localized bone defects may be seen following the extraction of teeth with periapical lesion or advanced periodontal disease, or as a result of trauma. When these regions are considered for treatment with implants, localized ridge augmentation will be necessary. Autogenous bone grafts are used exclusively for ridge augmentation. This case report represents the treatment of a localized edentulous ridge with an upside down osteotomy technique at the symphysis region prior to implant placement. Systemically healthy 21-year-old female patient, who was missing a lower right incisor tooth, was scheduled for an implant treatment. However, the crestal width was only 1 mm. The augmentation was planned and the region was treated with an upside down osteotomy technique. Nine months after the augmentation procedure, the computed tomography (CT) examination of the area revealed that the width of the crest was 7 mm, and the height of the crest was in good relation with the cementoenamel junction of the adjacent teeth. Flipping a bone block graft, which was harvested from the edentulous area, upside down may provide a successful result in partially edentulous ridges, in both maxilla and mandible.

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Key words: autogenous bone grafts; guided tissue regeneration; implant therapy/ surgery; ridge augmentation; trauma

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Dental implant therapy is performed primarily for the purpose of replacing missing teeth and associated structures (1). In the past years, the range of implant indications has been widened, and partially dentate patients represent the majority of patients seeking treatment with dental implants today (2).

Many factors play an important role in the successful treatment of patients with osteointegrated implants. These include careful selection of appropriate patients with respect to systemic and local risk factors, the selection of appropriate implant shape, diameter and length, proper surgical procedure, and the shape, volume, and quality of the bone (3).

Localized bone defects may be seen following the extraction of teeth with periapical lesion or advanced periodontal disease, or as a result of trauma (4–7). When tooth is lost because of trauma or endodontic reasons, spongious part of bone resorbes rapidly, and labial and lingual cortexes join together, causing labial concavity. Thus 'keyhole-shaped bony defect' (5) occurs, and these regions, which are considered for treatment with implants,

necessitate a reconstructive procedure for the localized ridge augmentation (7).

Endosseous implant therapy is dependent on direct contact of implant with bone (8). If the preoperative evaluation reveals that the alveolar ridge is too narrow or that the vertical bone height is not sufficient for endosseous implant placement, this deficiency of bone should be corrected with a suitable surgical procedure before or during implant placement. Autogenous bone grafts are used exclusively for ridge augmentation (9). Autogenous bone grafts can be harvested from extraoral sites, such as calvarium, tibia, ribs, metatarsus, chest bone, and iliac crest. However, alternative sites are suggested because of the risk of infection. These areas are mainly maxillary tuberocity, hard palate, zygomatic arch, mandibular coronoid process, mandibular ramus, and mandibular symphysis (5, 6, 10–12). When mandibular bone grafts are compared with other donor sites, they have the advantages of being close to the operation area, elimination of hospitalization and general anesthesia, and causing less postoperative discomfort (5, 6, 10, 13).

Case presentation

A systemically healthy 21-year-old female patient was referred to our clinic with a problem of gingival recession and for re-establishment of esthetics in the lower anterior region. She had a gingival recession, 5 mm in length and 4 mm in width, on lower left central incisor, which also reached the mucogingival junction. Pocket depths were not more than 1 mm all around the tooth. Her lower right central incisor was missing. Her dental history revealed that it was extracted because of an extensive apical periodontal cyst 11 years ago. One year after the extraction, orthodontic treatment was initiated in order to correct the mandibular class I malocclusion. Radiographic examination showed that there was no bone loss around the teeth except the neighboring area of the extraction site.

Eight weeks after the initial periodontal treatment, consisting of scaling and root planning, free gingival graft surgery was performed to cover the recession and increase attached gingival width at the edentulous area. The patient was placed into a recall program during the healing period of the gingival graft, and the treatment of edentulous region with implant placement was considered.

Clinical and radiographic examination, including computed tomography (CT), revealed that the width and the height of the crest were suitable for implant placement. Because of the previous traumatic and destructive surgery procedure, the crestal width was only 1 mm. Therefore, the augmentation of the residual crest was planned 3 months after the gingival graft surgery.

Augmentation procedure

Local anesthetic containing 40 mg articaine hydrochloride with 0.012 mg epinephrine was used to anesthesize the region. Horizontal incision at the crest of the edentulous region was made and was continued as sulcular incision to distals of the neighboring teeth, which was ended with two vertical releasing incisions. Full thickness mucoperiosteal flap elevated extending to the symphysis area. The borders of the bone graft to be harvested from the mandibular symphysis region were established with thin carbide bur. Specific care was taken to keep bone graft borders within the limits of the edentulous region (Fig. 1). Bone graft was carefully removed with the underlying cancellous bone using thin bone chisels. The harvested block was shaped like a pyramid, the base of which was at the symphysis area (Fig. 2). The graft was 0.6 cm × 0.7 cm × 1 cm (depth, width, and height) in size. After bleeding had been controlled, the block bone graft was flipped upside down and placed coronally to the same edentulous area and fixed with a titanium screw (Figs. 2 and 3). The margins of the block were packed with bone chips, which were curetted from the donor area, apical to the recipient site. The top of the block bone graft was covered with a resorbable barrier membrane (Gore-Resolut, W.L. Gore and Associates Inc., Flagstaff, AZ, USA) that had been previously trimmed in compliance with the region borders (Figs. 2 and 4). Full thickness flap was primarily closed and sutured with 4.0 silk suture, and the operation area was covered with periodontal dressing. In the postoperative period, the patient was

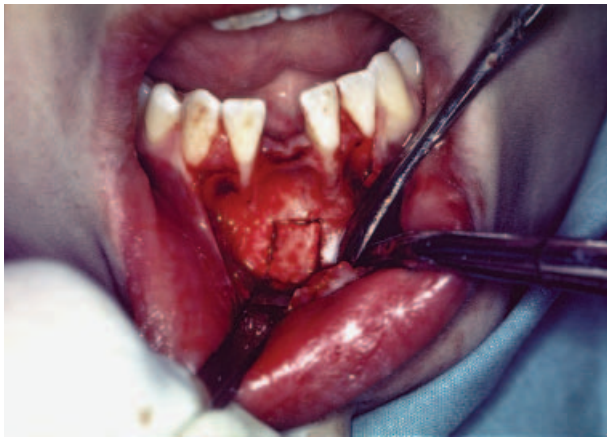

Fig. 1. Harvesting the block bone graft from the apical side of the edentulous area.

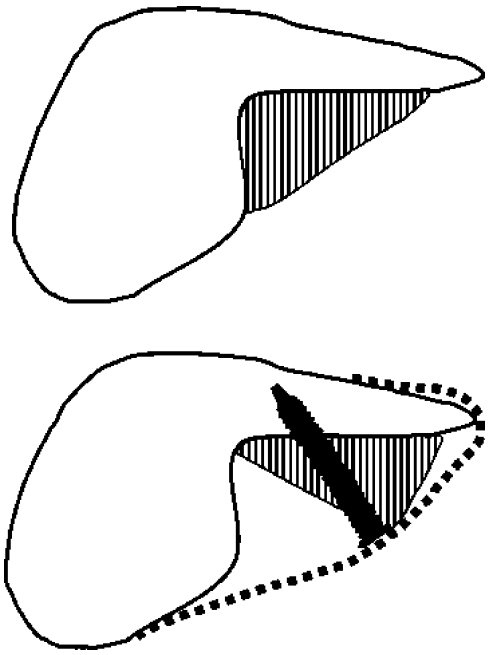

Fig. 2. Schematic drawing of the upside down osteotomy.

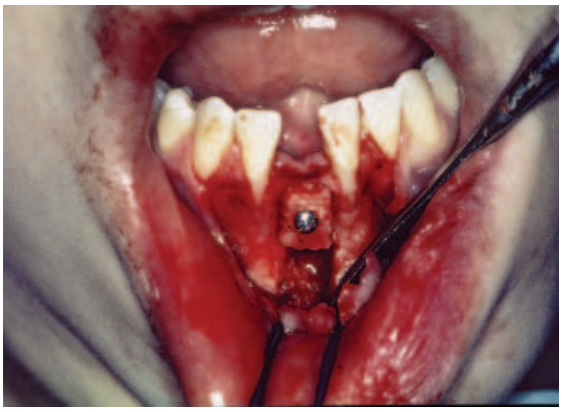

Fig. 3. Securing the flipped bone graft with titanium screw.

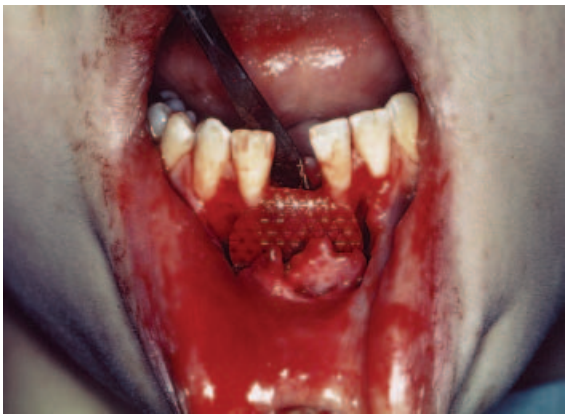

Fig. 4. Resorbable membrane was placed on the bone graft.

prescribed 100 mg doxycycline per day and 0.2% chlorhexidine gluconate mouth wash. Sutures were removed 10 days after the surgery. The patient was seen every 2 weeks in the first 3 months. During this period, surgical area remained primarily closed and no complication was observed. As the edentulous region was at the anterior region, at the end of the first month, the patient's dentition was completed with a temporary denture connected to the adjacent teeth with composite for esthetic reasons. Titanium screw was removed 6 months after the surgery.

Nine months after the augmentation procedure, the CT examination of the area revealed that the width of the crest was 7 mm, and the height of the crest was in good relation with the cementoenamel junction of the adjacent teeth (Figs. 5 and 6). An implant with 13 mm length and 3 mm diameter (Branemark®, Nobel Biocare AB, Göteburg, Sweden) was placed in order to replace the missing tooth (Figs. 7 and 8).

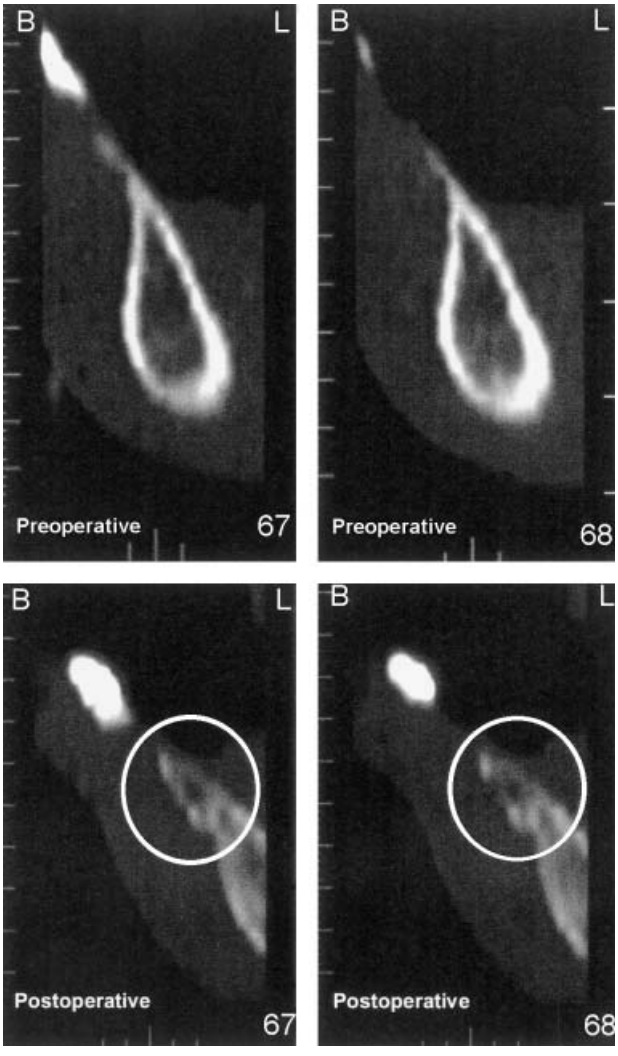

Fig. 5. Computed tomography images of the edentulous ridge before and after the ridge augmentation.

Fig. 6. Exposed ridge 9 months after the augmentation procedure, prior to implant placement.

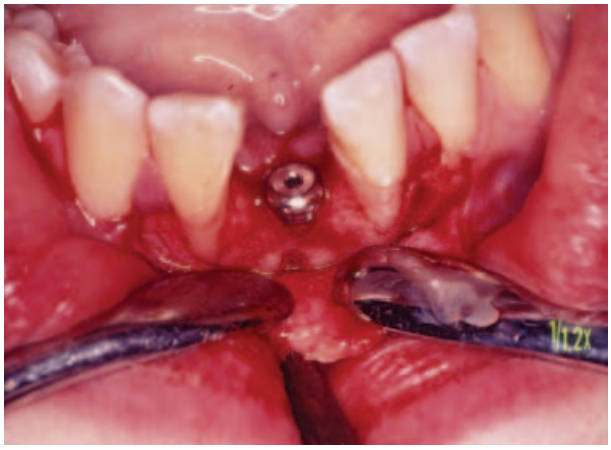

Fig. 7. Implant with cover screw placed.

Discussion

Implant therapy is performed primarily in order to replace the missing teeth and associated structures. When the implants are used in partially and fully edentulous patients with defective and deficient bones, bone reconstruction is required in order to accomplish a natural esthetics. Misch et al. (6) indicated that the minimum dimensions of an alveolar bone has to be 5 mm in width and 7–10 mm in height in order to place an implant with predictable results.

Spongious part of bone resorbes rapidly, and labial and lingual cortexes join together, causing labial concavity after an extraction as a result of a periapical infection or advanced periodontal destruction, or as a result of trauma. Autogenous bone grafts, demineralized freeze-dried bone allografts (DFDBA), or synthetic graft materials are used in the treatment of localized bone defects. It takes a long time for graft materials, such as DFDBA or hydroxyapatite (HA), to produce bone in sufficient quality and quantity for an ideal implant support. It has been shown that DFDBA and HA graft materials are replaced by new bone in considerable amount of time, or even sometimes remain intact for years. Becker et al. (9) had indicated that when DFDBA was applied to the defects around implant, new bone formation and bone implant contact was not accomplished, and instead of bone, bone-like dense structure was formed. Alternatively, when autogenous bone graft was applied, better clinical and histologic results were achieved.

Mandibular ramus and symphysis, extraction sites, and retromolar sites are the main areas for harvesting autogenous bone grafts from intraoral regions. Autogenous bone grafts rapidly become revascularized and have a short healing period and low volume loss. New bone formation with autogenous bone grafts increases the chance of osteointegration of the implant, thus providing better interfacial stress transmission on implant loading (4, 7, 10, 11). The healing period for bone grafts of

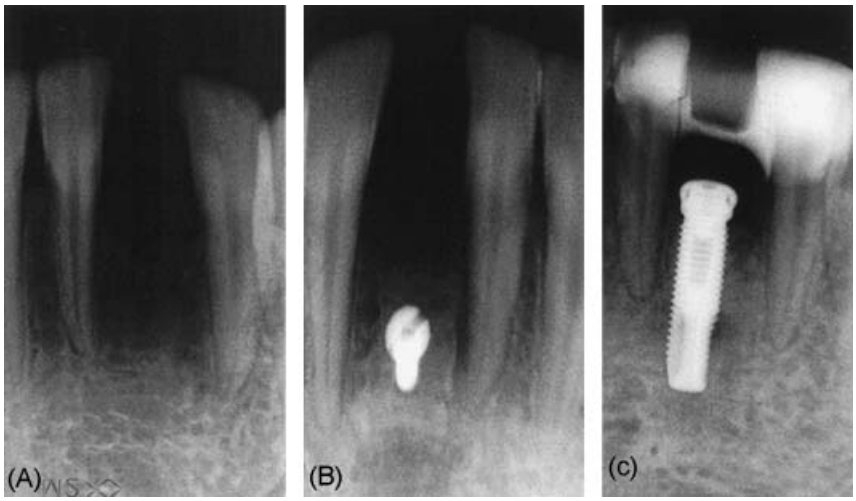

Fig. 8. Periapicalradiograph of the area. (A) Before augmentation; (B) 6 months after augmentation procedure; (C) implant is in the place. The radiolucent area apical to the implant indicates the donor site for the block bone graft.

endochondral origin is usually 6–9 months (14). However, a 4-month healing period has been found to be adequate in clinical studies on mandibular bone grafts (6). The shorter healing time was based on the hypothesis that membranous bone grafts revascularize earlier than endochondral grafts (15, 16). The rich vascularity of the maxillary cortex in comparison to the mandible allows a more rapid angiogenesis of the graft and increases the success rate. Cortical bone contains very few arterioles, whereas cancellous bone has an intensely vascular network. Mandibular donor bone grafts, which are primarily cortical bones, exhibit little volume loss and show good incorporation at short healing times (6, 10).

Harvesting symphysial autogenous bone grafts has many advantages: they have corticocancellous structure, the area is close to the operation site, they cause less postoperative complication, and provide cancellous bone chips that may fill the space between the graft and the bone to which the graft is applied (6, 7, 10, 13, 17). In this case, the bone block was taken from the symphysis area just underneath the operation site, and no second wound was created. Flipping the block bone graft upside down and fixing the wide base of the block in a way that becomes the edentulous crestal bone increased the width. As a result, the area was 7 mm in width after the healing period, which was adequate for implant therapy. We believe that flipping a bone block graft harvested from edentulous area upside down may provide a successful result in partially edentulous ridges in both maxilla and mandible. Also, if the area is long enough, this bone block might even be fixed with implants which would shorten the treatment period.

Along with this procedure, resorbable or nonresorbable barrier membrane might be used with bone shavings, which would support the gap between overlay graft and the jaw.

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