Introduction

The most reliable results in dental implant surgery are expected in enough pristine bone with full housing of the dental implant. If the residual alveolar ridge is too thin to place dental implant, bone grafting is the only choice for successful dental implant rehabilitation (1, 2). Anterior maxillary area is critical site for dental esthetics. Dental implant in the anterior maxilla is quite challenging because of high demand of esthetics and poor quantity of residual bone. Buccal bone plate is quickly resorbed after extraction (3). When patient had worn denture for long time in the maxilla, we can expect severe alveolar bone resorption. Predictive treatment in severely resorbed anterior maxilla is block bone graft and delayed or immediate implant installation (4).

Ramal bone is commonly used because it is easy to harvest and has enough strength for screw fixation (5). However, shape of ramal bone is straight, so it should be trimmed according to the defect morphology. Surgical stent for ramal bone graft could be made with 3 dimensional rapid prototype (3D RP) models, however, it is quite expensive to take 3D computed tomography (CT) scan and fabricate RP model. Intraoperative molding of the surgical stent makes it easy for ramal bone graft.

In this case, bone wax was used to make surgical stent for ramal bone graft. Dental implant surgery with simultaneous ramal bone graft was performed in a Korean female and surgical technique is reviewed.

A Case Report

A 58-year-old female was referred from local dental clinic for treating radiolucent lesion in the anterior maxilla in March 2010. Patient received prosthetic treatment of the anterior maxilla more than 10 years ago. I knew that #13 was impacted; however, she had not experienced any symptom associated with impacted canine. The bridge was mobile so she wanted dental...
implant in the anterior maxilla. Initial panoramic radiograph showed impacted canine of #13 and radiolucency lesion in the crown area of #13 (Fig. 1). She agreed removal of the bridge and extraction of #13. Operation was performed under local anesthesia. Buccal flap was elevated and cyst and #13 impacted canine tooth were removed. Bone was not grafted to the defect area.

Six months after extraction, flap was opened for implant surgery. Bone defect was obvious and thin buccal plate and crestal bone was found. Installation of the implant in #12 area was not possible because of bone defect (Fig. 2). Block bone graft was the choice of treatment for implant installation.

Bone wax was molded to adapt to the defect site (Fig. 3). Bone wax was easily shaped to fit into the defect. This bone wax was used as a stent for block bone graft. Right side ramal bone was selected for bone harvest because at least 5 mm was required to housing dental implants. Patient wanted one stage surgery under general anesthesia.

Ramal bone was harvested with drill and reciprocating saw. Bone wax stent was used as surgical guide. About 1.5×1.0 cm sized ramal bone was harvested (Fig. 4). There was no damage of inferior alveolar nerve during ramal bone harvest. Bone thickness was 4.0 mm in average.

Two dental implants (Implantium, Dentium Co., Suwon, Korea) were installed after fixation of the ramal bone. Two titanium screws (Leibinger, Stryker, San Diego, USA) were used for fixation. Roots of adjacent tooth were marked before fixation.

**Fig. 1.** Initial panoramic radiograph showing impacted canine (#13) with cystic change.

**Fig. 2.** Bone defect in the anterior maxilla.

**Fig. 3.** Bone wax for surgical stent of ramal bone harvest.

**Fig. 4.** Ramal bone harvest with surgical stent of bone wax.

**Fig. 5.** Ramal bone graft and simultaneous implant installation with guide bone regeneration.
of the ramal bone to prevent root and dental pulp damage. Gap between ramal block bone and dental implants was filled with autogenous bone power from ramal bone and absorbable collagen membrane (Ossgide, Bioland, Osong, Korea) was overlaid to cover bone powder (Fig. 5).

Second surgery was performed six months later. Complete healing was observed. Impression was taken and final prosthodontic treatment was inserted (Fig. 6). Buccal area was fully augmented with autogenous block bone. Adjacent teeth were intact and patient was fully satisfied with the prosthodontic treatment.

Discussion

Horizontal bone graft is required when jaw bone has bone defect. Guided bone regeneration is often used to cover small bone defect during implant surgery. However, when bone defect is severe due to previous operation, block bone graft is the only choice (6). Iliac bone has been used widely for augmentation of the alveolar ridge for several decades (7). However, it has several complications such as gait disturbance, fracture of the anterior iliac spine or hematoma formation. And endochondral bone tends to resorb faster than intramembranous bone. Intraoral bone graft was chosen for bone augmentation recently. Ramal bone was the graft of the choice for ridge augmentation horizontally or vertically. Ramal bone is intramembranous bone which showed resistant to resorption (8).

Surgical stent is useful when harvesting bone. Exact size of the bone is one of the requirements for bone integration. Bone graft should be fit into the defect site without bone gap is very important for initial angiogenesis (9). 3D RP model is useful to measure the bone defect in the maxilla and mandible. Exact size of the RP model with native jaw bone is one of the advantages in making surgical plan. Especially intraoral bone graft is planned, measuring and mock surgery is possible with RP model. However, it is quite expensive and patient required CT scan taking for RP model fabrication.

Bone wax is easily molded and fit into the surgical defect area. It is cheap and biocompatible. If there are some leftover, there is usually no problem. Three-dimension measurement is quite easy with bone wax. It could be used efficiently when bone defect is small.

Conclusion

Bone wax could be used for surgical stent for small bone defect. It is easily molded and adapted to the surgical defect.

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