Clinical and Retrospective Evaluation of 4.1- or 4.3-mm-Diameter Implants Placed Immediately in the Molar Region: A Preliminary Study

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Purpose: The purpose of this study was to evaluate the clinical and radiographic performance of 4.1- or 4.3-mm-diameter implants placed immediately in the molar region.

Materials and Methods: Twenty-nine patients (14 men and 15 women, aged 21-71 years) received 38 implants that were placed immediately in the molar region. Of the implants, 19 (50%) were placed in the maxilla and 19 (50%) in the mandible. Thirty-eight prostheses (19 single restoration and 19 partial fixed prostheses) were fabricated. The diameter of the implant type was 4.1 mm (15 implants, 39%) or 4.3 mm (23 implants, 61%). Clinical and radiographic assessments of implants, prostheses, and peri-implant tissues were performed at 1 month, 3 months, and 6 months and then every 6 months after definitive restoration.

Results: Kaplan-Meier survival estimates showed a 97.4% probability of implant survival to 36 months. The mean time of implant follow-up was 36 months, with a maximum of 75 months and minimum of 4 months. Cement dissolution occurred in 1 partial fixed prosthesis. Screw loosening occurred in 2 single-crown restorations in 1 patient. No abutment, screw, or implant fixture fractures were observed during the follow-up periods. The mean cervical bone loss of 38 implants measured 0.31 $\pm$ 0.06 mm mesially and 0.31 $\pm$ 0.07 mm distally 1 year after implant installation. There were no significant differences in implant survival and cervical bone loss based on anatomic location, gender, and prosthesis type.

Conclusions: This study describes successful outcomes after the use of 4.1- or 4.3-mm-diameter implants placed immediately in the molar region. Further comprehensive maintenance practices and follow-up schedules are required.

J Oral Maxillofac Surg 74:489-496, 2016

Dental implant therapy has now been widely accepted as a predictable treatment option for replacing missing teeth in partially and totally edentulous patients.[1] However, dental implant use may be restricted when there are limitations imposed by the geometry and volume of the alveolar bone.[2] This is especially true in the posterior region of the upper and lower jaw because of the higher occlusal forces, poorer bone quality, and often limited bone quantity.[3,4]

Efforts to increase implant success rates have included alterations in implant diameter, length, and design and surface treatments intended to increasing the pace and degree of osseointegration. The 5-mm-diameter Brånemark implant (Nobel Biocare, Zürich-Flughafen Switzerland) introduced in 1993[5] provided wider bone-implant contact (>35%) than implants with a regular diameter. The wide-diameter implant showed good initial fixation even in regions of poor

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Received April 10 2015

Accepted October 19 2015

0278-2391/15/01417-2

http://dx.doi.org/10.1016/j.joms.2015.10.017

bone density and better adaptation with the wide-diameter extraction socket in the posterior region. However, clinical outcomes proved disappointing, with failure rates of 9 to 24% being reported within 5 years.[6,7] Later studies using an improved implant design with modified implant surface and adapted drilling protocol reported greater than 1% failure after 3 years.[8]

Regular-diameter implants in the molar region with alveolar bone resorption have many advantages, including a reduced need for bone grafting because of the low probability of bone dehiscence and perforation. The minimally invasive surgical procedure lessens traumatic damage to bone. Immediate retrial with a wide-diameter rescue implant also is possible when the regular-diameter implant fails to achieve osseointegration. Despite these advantages, little is known about the use of regular-diameter implants in the molar region.

The typical scenario involves waiting for ossification for a certain period after extraction to permit osseointegration before implantation is contemplated. Problems with this approach include esthetic discomfort, loss of masticatory function, and inappropriate bony shape caused by bone resorption and change. Immediate implant placement has been amply studied ever since the first report of an immediate implant placement case in the extraction socket over 35 years ago.[9] Some studies reported a similar success rate to delayed implant placement.[10,11] The advantages of immediate implant placement reportedly include reductions in the number of surgical interventions and in the treatment time required.[12,13] It also has been suggested that ideal orientation of the implant,[14,15] preservation of the bone at the extraction site,[16-18] and optimal soft tissue esthetics may be achieved.[12]

In this study, the prognosis of 4.1- or 4.3-mm-diameter implants placed immediately in the molar region was evaluated retrospectively by clinical and radiographic examination.

Materials and Methods

Twenty-nine patients received the 4.1- or 4.3-mm-diameter implant in the molar region and were included in this retrospective study. The patients were treated between August 2007 and February 2012 at the Department of Oral and Maxillofacial Surgery, Yeouido St. Mary's Hospital, Seoul, Republic of Korea. The study was approved by the Institutional Review Board of the Catholic University of Korea (SC14RASI0070). The inclusion criteria were requirement for implant treatment in the molar region of the maxilla and mandible to support a fixed prosthesis, implant placement simultaneously with tooth extraction, and no use of removable partial dentures during the healing period.

GENERAL HEALTH STATUS

Eighteen patients were healthy, and 7 patients were receiving routine medication for cardiovascular problems. One patient was receiving controlled treatment for diabetes, and 6 patients were receiving medication for osteoporosis, rheumatoid arthritis, or hepatitis.

PRESURGICAL PREPARATION

Before the implant installation, all patients underwent an oral examination including assessments for dental caries and periodontal and soft tissue diseases. Treatment was performed as appropriate. Panoramic radiographs and computed tomography scans were taken before implant installation.

IMPLANT INSERTION SURGERY

To reduce the risk of infection, 625 mg of amoxicillin (Moxicle; Daewoong, Seoul, Republic of Korea) was given 1 hour before surgery and for 5 days after surgery (625 mg 3 times per day). The surgical procedures were performed with patients under local anesthesia. After a full-thickness flap was elevated, a careful tooth extraction was performed to preserve the septal bone between roots. Drillings were performed into the septal bone according to the manufacturer's written surgical protocol (Oneplant [Warantec, Seoul, Republic of Korea] or Dentium [Dentium, Seoul, Republic of Korea]; sandblasted with large grit and etched with acid surface) by 1 experienced implant surgeon, and the implants were placed in such a manner that their upper surfaces were in line with the septal bone. The buccal and lingual surfaces of the implant fixture were contacted with bone. If a horizontal gap (>2 mm) occurred on the mesial and distal aspects of the implant fixture, horizontal ridge augmentation with Biocera (Oscotech, Seoul, Republic of Korea) was performed simultaneously with implant placement; this occurred in 16 implants placed in the mandible. The blood clot was retained without bone graft in 22 implants. Barrier membranes were not applied. The installation of 11 implants was conducted by the lateral approach for maxillary sinus membrane elevation using xenogenous bone (Biocera; bovine porous bone mineral coated dually with biocompatible calcium phosphate). Final tightening of the fixture into bone was performed with a torque wrench, and the primary stability was more than 35 N-cm. During the 1-stage surgical procedure, after implant insertion, healing abutments were installed and the flaps were adjusted to the implant and sutured with resorbable suture material (No. 4/0 Vicryl; Ethicon, Somerville, MA), whereas during the 2-stage