Full Mouth Reconstruction With Dental Implants in the Conservative Treatment of Bilateral Condylar Fractures: A Clinical Letter

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INTRODUCTION

The treatment of unilateral mandibular condylar fracture is more controversial than any other procedure in the field of maxillofacial trauma. Comparisons of the common treatment methods, including surgery or invasive treatment and conservative or noninvasive treatment, have been well addressed in the literature.1,2 The condylar fracture healing process may be affected by occlusal stability; however, long-term changes in the condylar form and occlusal function after conservative/noninvasive treatment of bilateral condylar fracture have not yet been reported.3 In recent years, dental implantation has been widely used as a prosthetic treatment approach to achieve occlusal reconstruction. In cases involving condylar process fractures, reports of the fracture treatment process have been published independently of reports concerning the implant treatment, which is performed after the surgical procedure to repair the fractures.4 To date, there is no long-term follow-up report that describes the treatment of the condylar process fracture together with an account of the implant treatment and occlusal function in the same patient.

In this case letter, the patient presented with bilateral mandibular condylar neck fractures that resulted from a traffic accident. Conservative treatment was performed before fixed implant-supported prostheses were placed in the maxilla for occlusal reconstruction. This paper discusses the healing process of the injury and evaluates the bite forces and Gothic arch tracing. This paper also presents follow-up observations at 5 years and 4 months after the placement of the final implant superstructure and at 6 years and 8 months after the bilateral mandibular condylar fractures were incurred.

CLINICAL REPORT

An 18-year-old woman sustained multiple injuries from a traffic accident, including head damage, fractures of the mandible and the bilateral mandibular condylar processes, and tooth fractures, including damage to the maxillary alveolar bone. Plastic surgeons placed a titanium plate at the site of the median mandibular fracture for fixation, and the patient was transferred to the oral and maxillofacial surgery department. At the time of the transfer, tooth numbers 5 to 9 were lost, and number 10 was replaced in the original position. Bilateral intracapsular condylar fractures were observed: there were isolated bilateral mandibular condylar head fragments (hereafter referred to as small bone fragments), and both fragments were medio-inferiorly displaced. Conservative treatment with intermaxillary fixation was performed 1 day after the injury. Six weeks later, the patient started manually assisted mouth opening exercises. Three weeks afterward, the maximum mouth opening (MMO) was 28 mm; therefore, occlusal reconstruction for functional recovery began with the placement of implant-supported prostheses. There was bilateral temporomandibular joint pain when the patient attempted to open her mouth. Tooth numbers 3, 4, 12, 13, and 14 had fractures in the crowns and roots, and numbers 29 and 30 had crown fractures (Figure 1a). Orthopantomograph images showed the absence of intact mandibular condylar heads in the mandibular fossa. Sharp edges were identified on the bilateral condylar necks, suggesting the presence of fractures (Figure 1b).

Three months after the injury, tooth numbers 3, 4, 12, 13, and 14 were extracted, and an immediate denture spanning tooth numbers 3 to 14 was inserted. Approximately 2 weeks after the denture placement, the MMO was 38 mm and the tapping position was stabilized. Two months after the denture insertion, the MMO was greater than 40 mm and the opening-closing movement track became linear. The temporomandibular joint pain also disappeared. A computerized tomography (CT) scan was performed using an imaging template that was fabricated using a diagnostic wax-up. The CT data were imported into the SimPlant (SimPlant, Materialise Dental Japan).
In the mandibular condylar necks, fractures resulted in medial displacement (Figure 2a). Considering the tooth positions in the imaging template, the implantation plan was reviewed at tooth numbers 3, 4, 5, 7, 10, 12, 13, and 14, which were identified as the appropriate sites for the prosthetic placements. However, the alveolar bone width at the anterior teeth and the alveolar bone height in the molar region were insufficient. Four months after the denture insertion, an autologous bone graft for the anterior teeth and the bilateral maxillary sinuses was performed under systemic anesthesia. The scan taken 10 months after the injury showed sufficient bone width and height for placement. The CT image also showed fusion of the right condylar head with the inside of the base of the mandibular condyle, presenting a morphological similarity to a native condyle (Figure 2b).

Five months after the bone grafting, the first stage of implant surgery was performed using 8 screws (Screw-Vent Implant, Zimmer Dental, Carlsbad, Calif) in total. Two months later, a second stage implant procedure was performed. One month later, a provisional restoration was designed and fabricated to establish occlusal vertical dimensions identical to those of the immediate denture. The occlusal stability was reconfirmed, and metal-ceramic crowns (prepared based on the provisional restoration) were placed accordingly (Figure 3a and b). One month after the superstructure placement, maintenance was performed: subsequent maintenance followed once every 3 months for 1 year, and has been performed annually since the end of the first year.

Three years and 2 months after the superstructure placement, the MMO was greater than 40 mm. There was no jaw clicking, pain, or discomfort. At this time, a cone-beam computerized tomography (CBCT) scanning examination (Trophy Max, YOSHIDA, Tokyo, Japan) was performed and the occlusal condition was evaluated using a sensitive occlusal pressure sheet (Dental Prescale Fujifilm, Tokyo, Japan). The CBCT scan data revealed that no significant absorption occurred in the bone surrounding the implants. The image showed fusion of the right condylar head with the inside of the base of mandibular condyle, presenting a morphological similarity to a native condyle. The left condylar head fused with the inside of the base of mandibular condyle, and part of the left condylar head had flattened (Figure 2c). The average total occlusal bite force was 610 ± 140 N, upon 3 evaluations. Five years and 4 months after the superstructure setting, CBCT scanning and occlusal evaluation were performed again (Figure 2d). The average total occlusal bite force was 716 ± 46 N, after 3 evaluations. An example of a typical occlusal balance, evaluated with a sensitive occlusal pressure sheet, is shown in Figure 2a. The patient’s center of occlusal balance was shifted to the left side. Using a tracing plate in upper jaw, intraoral Gothic arch tracing was also performed to evaluate the border movement of the mandible (Figure 4b). The right side shift was relatively smooth compared to the left side shift. This tracing showed the relatively symmetric movement of the mandible.

**DISCUSSION**

The most important challenge in the treatment of condylar fractures is the recovery of jaw movement, including recovery of masticatory function. The treatment involves both surgical and conservative procedures, the latter often chosen to treat intracapsular condylar fractures.\(^6\) In this case, conservative treatment was performed to avoid the potential surgical risk of injuries to tissues, including the nerves. Three-dimensional imaging revealed that the mandibular condylar head morphologically changed, which caused condylar head displacement. However, despite this displacement, note that there were no major symptoms present in the jaw joint, and jaw movement sufficiently recovered to affirm a good clinical outcome.

Ellis and Throckmorton\(^2\) stated that skeletal, neuromuscular, and dental adaptations occur during functional recovery. According to their report, skeletal adaptation begins shortly after the injury and continues for several months. Thus, the partial flattening and morphological changes observed in the condylar heads in this case may have resulted from condylar head adaptation. In this case, we chose fixed implant-supported prostheses as the final implants instead of a denture. Given the expected subsidence of the denture, it appeared too difficult to achieve stable occlusion with such an apparatus. In contrast, fixed implant-supported prostheses can achieve a long-term stable occlusion. In light of the patient’s age, fabrication of a removable denture would have complicated many aspects of her life, including her mental well-being. The patient also strongly preferred the fixed prostheses.

Arnett et al\(^3\) stated that unstable occlusion triggers condylar head compression at the point of central occlusion, inducing osteo-absorption in the condylar heads and mandibular fossae. Furthermore, Okeson\(^6\) stated that stable occlusion minimizes the potential damage to the constitutive elements of the masticatory system. Unfortunately, we did not achieve a...
satisfactory occlusal bite force immediately after the injury in this case; however, the patient developed a sufficient occlusal bite force at 3 years and 2 months after the superstructure placement. These results were comparable with those observed in noninjured Japanese patients. Furthermore, the tapping point was sharp and the mandibular side shift was relatively symmetric. Thus, the implant treatment likely achieved a stable occlusion, reducing the potential risk of jaw and oral structure collapse of the jaw, thereby maintaining mid-term oral functions.
ABBREVIATIONS

CBCT: cone-beam computerized tomography
CT: computerized tomography
MMO: maximum mouth opening

REFERENCES


FIGURE 3. Clinical photograph (a) and orthopantomography (b) at 3 years and 2 months after the superstructure setting.

FIGURE 4. Occlusal evaluation at 6 years and 8 months after the injury and 5 years and 4 months after superstructure setting. A typical pressure-sensitive sheet measuring occlusal force and balance (a). Intraoral Gothic arch tracing (tracing needle in lower jaw) (b). The white bar indicates 1 cm. R indicates right side; L, left side; and F, front side border movement of the mandible.