Endoscope-Assisted Transoral Reduction and Internal Fixation of a Mandibular Subcondylar Fracture with a 3D - Shaped Plate

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ABSTRACT

Introduction: Disadvantages of open reduction of subcondylar fractures include visible facial scars and potential facial nerve damage. Endoscope-assisted procedures have solved these problems, however the anatomical adaptation of osteosynthesis plates to the fractured area is difficult in the limited surgical field. Three-dimensional pre-shaped plates specialized for subcondylar fractures recently became available. They are originally not for endoscope-assisted procedures but it may be useful for endoscopic approach because they are very small and pre-shaped.

Case report: This paper presents a case of 43-year-old male patient with subcondylar fracture. The treatment provided was open reduction and internal fixation of a subcondylar fracture with three-dimensional pre-shaped plates via transoral approach under endoscopic visualization.

Conclusion: The paper highlights contemporary management of subcondylar fracture to avoid complications associated with open reduction and restore the post-operative functions.

Keywords: Endoscope, Subcondylar Fracture, Transoral Approach, 3D-shaped Plate

INTRODUCTION

Condylar fractures account for approx. 35% of all mandibular fractures.[1,2] Condylar fractures are divided into head fractures, neck fractures and subcondylar fractures.[3] Subcondylar fractures are most common, accounting for approx. 60% of condylar fractures.[4]

The treatment for subcondylar fractures has been controversial.[5] A variety of treatment methods have been described to manage subcondylar fractures, including closed treatment with maxillomandibular fixation (MMF) and open reduction and internal fixation (ORIF) with a variety of surgical approaches. Each treatment has its advantages and disadvantages depending on the position of the fracture and the degree of displacement.

Closed treatment with MMF is most widely used to manage these fractures.[5,6] However anatomical reduction is difficult to achieve with this technique, and patients need to tolerate MMF for a long time.

ORIF can achieve anatomical reduction and patients can start functional rehabilitation of the temporomandibular joint and gain functional recovery quicker compared to closed treatment.[6] However, there can be complications associated with ORIF using an extraoral approach, including visible facial scars and potential facial nerve damage.[7]

Due to the introduction of endoscope-assisted procedures, ORIF using a transoral approach without a facial skin incision has become common.[8] However, this procedure is more time-consuming than those using an extraoral approach because it is operated in the limited surgical field using a small, angulated screwdriver under endoscopic visualization.[8] The anatomical adaptation of osteosynthesis plates to the fractured area is particularly difficult. Pre-shaped plates specialized for subcondylar fractures were recently reported.[4] These plates were originally developed for an extraoral approach, but they may be beneficial for a transoral approach because they are very small and pre-shaped for adaptation to the fracture area (Figure-1A).

Here we report our clinical experience in a case of adaptation of a three-dimensional (3D) pre-shaped plate specialized for subcondylar fractures, under endoscopic visualization.

CASE REPORT

A 43-year-old Japanese man was referred to the department of oral and maxillofacial surgery at Okayama University Hospital from an outlying hospital 10 hr after his accidental fall. His laceration of the mental region had already been repaired at the outlying hospital. He exhibited malocclusion and reported pain in both preauricular regions (Figure 1B). A panoramic radiograph (Figure 1C) and computed tomograms (Figure 1D,E) showed a maxillary alveolar fracture, a symphysis fracture, a left subcondylar fracture and right condylar neck and head fractures. The right condylar fracture contained a diacapitular fracture (Figure 1D).

Dental arch bars were placed to the bimaxillary dentition after the reduction of a maxillary alveolar fracture. After a review of the risks and benefits of procedures to treat the fractures, the patient chose to undergo an open reduction and internal fixation of the symphysis fracture and the left subcondylar fracture via an transoral approach. The right condylar neck and head fractures were not treated surgically because the right condylar fracture contained a diacapitular fracture and the patient refused the extraoral approach. The patient understood that his left subcondylar fracture might be treated with a closed treatment if an transoral approach failed.

The operation was performed under general anesthesia by transnasal intubation. After the symphysis fracture was exposed, it was reduced and stabilized with a 4-hole 1.25-mm miniplate at the inferior border and a 1.0-mm miniplate for the superior border (Matrix MANDIBLE, Synthes, Soletta, Switzerland).

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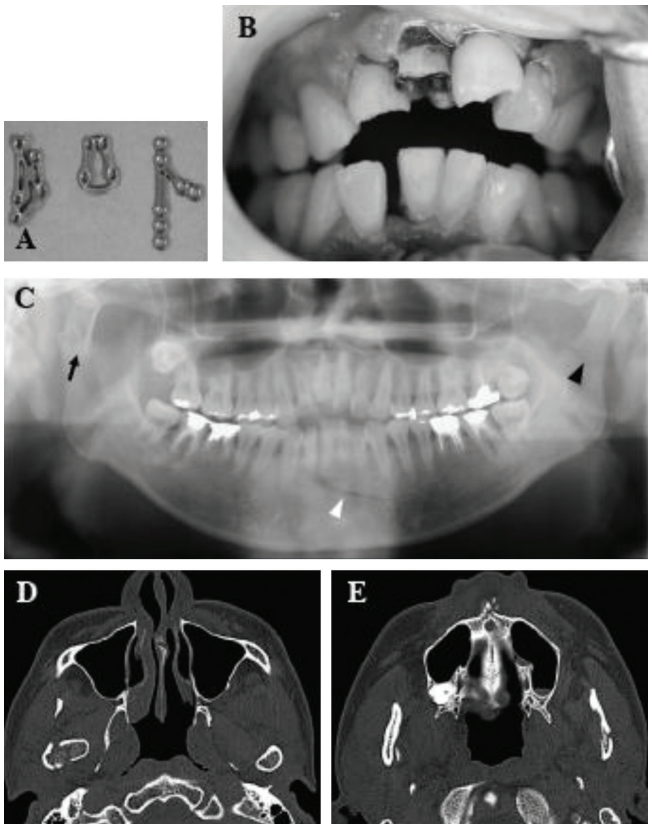

Figure-1: A: Specially designed 3D plates for subcondylar fractures. Left to right: Strut plate, trapezoidal plate and lambda plate. **B:** Preoperative intraoral photograph showing the space between the lower lateral incisors, the anterior open bite and impacted upper central incisors. **C:** Preoperative panoramic radiograph showing the symphysis fracture (white arrowhead), the left subcondylar fracture (black arrowhead) and right condylar neck fracture (black arrow). **D,E:** Computed tomograms showing the right diacapitular fracture and left subcondylar fracture.

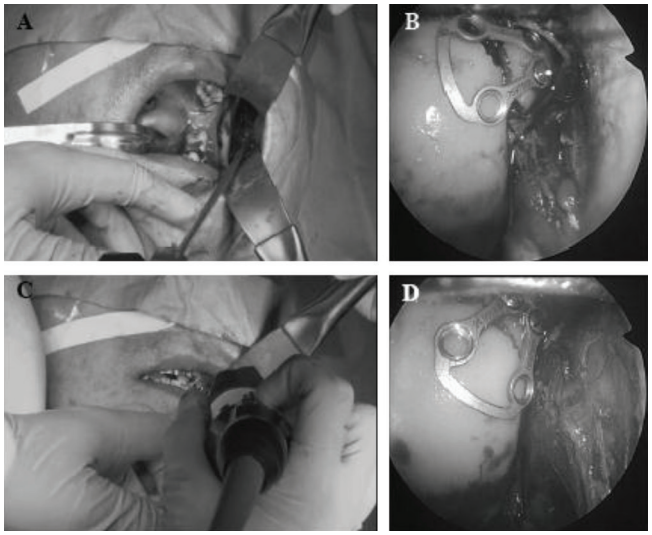

Figure-2: A: Intraoperative view showing the visualized fracture site with Bauer retractors and endoscope. **B:** Intraoperative endoscopic view of the fracture site showing that the plate was secured to the proximal segment. **C:** Intraoperative view showing reduction by manipulating the segments. **D:** Intraoperative endoscopic view of the fracture site showing final reduction of the proximal segment.

For the left subcondylar fracture, an intraoral incision was made in the buccal vestibule, similar to the incision for a sagittal

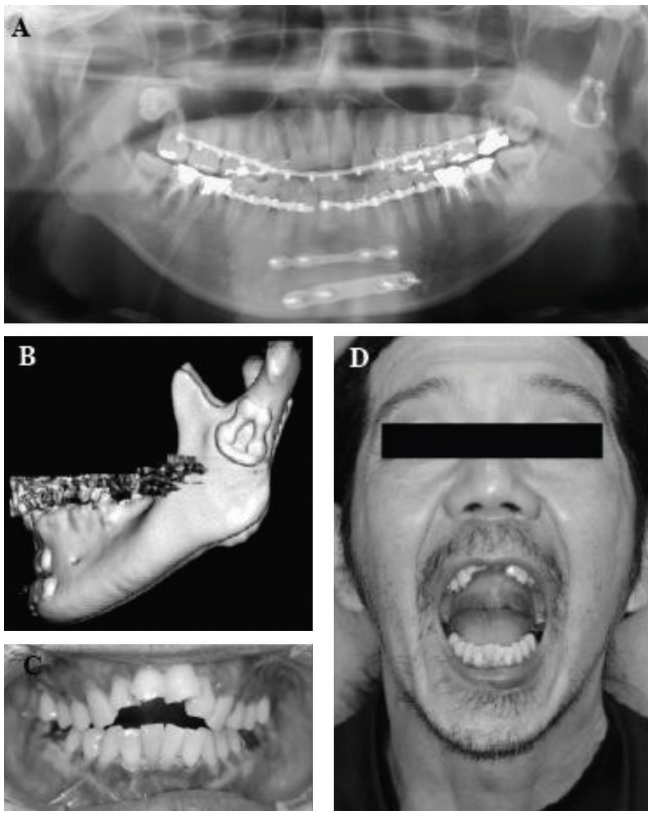

Figure-3: A: Postoperative panoramic radiograph showing the symphysis fracture and the left subcondylar fracture reduced and stabilized with miniplates. **B:** Postoperative 3D computed tomogram showing the left subcondylar fracture stabilized with the 3D plate. **C:** Intraoral photograph showing stable occlusion 6 weeks postoperatively. **D:** Facial photograph showing good mouth opening 6 weeks postoperatively.

split ramus osteotomy, and a subperiosteal dissection was done to expose the condylar process. The periosteum and the masseter muscle were released from the mandibular ramus, and the insertion of the temporalis muscle was stripped from the coronoid process.

The lateral surface of the ramus from the sigmoid notch to the angle was visualized with Bauer retractors, similar to the procedure for an intraoral vertical ramus osteotomy. A 70°-angle endoscope (Olympus, Tokyo) was used to allow visualization of the subcondylar region through the intraoral wound. Once the dissection and approximate reduction were achieved by manipulating the segments into position, a 3D 4-hole 1.0-mm trapezoidal plate (Matrix MANDIBLE Subcondylar Plate, Synthes) was secured to the proximal segment by two screws under endoscopic visualization (Figure 2A,B). The plate assisted in the final reduction of the proximal segment (Figure 2C,D).

The patient was placed in maxillomandibular fixation, and the distal segment was stabilized by placing two screws through the plate using endoscopic visualization. The time needed to perform the reduction and fixation of the subcondylar portion of the procedure was approx. 80 min. Before the patient's extubation, the maxillomandibular fixation was removed. The patient was subsequently seen 14 days postoperatively and then again approx. 6 weeks postoperatively.

Postoperative radiographs confirm adequate reduction of the fractures and good position of the condylar process (Figure 3A,B). The patient regained his premorbid occlusion, with an

anterior open bite that had been noted previously by the patient (Figure 3C). His maximal opening was 40 mm without deviation on function (Figure 3D).

DISCUSSION

Considerable controversy exists regarding the indication for ORIF of subcondylar fractures.[9] There seems to be some benefit in ORIF for significantly displaced unilateral subcondylar fractures and moderately displaced bilateral subcondylar fractures.[5] An osteosynthesis procedure using two miniplates placed along the rim of the sigmoid notch and the posterior border of the ramus is the most reliable procedure for subcondylar fractures.[4] However, it is quite difficult to place two miniplates in the small condylar segment in a transoral approach to the subcondylar fracture.[4]

Specially designed 3D plates for subcondylar fractures were developed.[4] These 3D-shaped plates have improved mechanical strength and osteosynthesis stability by connecting the two plates into one plate. Although they were originally developed for an extraoral approach, their smaller size and pre-shaped architecture improves handling in a transoral approach as well. This is the first report about our clinical experience using a specially designed 3D plate for a subcondylar fracture under endoscopic visualization.

CONCLUSION

The specialized plates and techniques used in the present case may enhance the fixation of subcondylar fractures, which used to be untreated or managed in closed treatment. Further clinical evaluations of these specialized plates and endoscopic techniques are necessary to determine their efficacy.

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