



## Protrusive maxillomandibular fixation for intracapsular condylar fracture: a report of two cases

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**Abstract** (J Korean Assoc Oral Maxillofac Surg 2017;43:331-335)

Clinical limitations following closed reduction of an intracapsular condylar fracture include a decrease in maximum mouth opening, reduced range of mandibular movements such as protrusion/lateral excursion, and reduced occlusal stability. Anteromedial and inferior displacement of the medial condyle fragment by traction of the lateral pterygoid muscle can induce bone overgrowth due to distraction osteogenesis between the medial and lateral condylar fragments, causing structural changes in the condyle. In addition, when conventional maxillomandibular fixation (MMF) is performed, persistent interdental contact sustains masticatory muscle hyperactivity, leading to a decreased vertical dimension and premature contact of the posterior teeth. To resolve the functional problems of conventional closed reduction, we designed a novel method for closed reduction through protrusive MMF for two weeks. Two patients diagnosed with intracapsular condylar fracture had favorable occlusion after protrusive MMF without premature contact of the posterior teeth. This particular method has two main advantages. First, in the protrusive position, the lateral condylar fragment is moved in the anterior-inferior direction closer to the medial fragment, minimizing bone formation between the two fragments and preventing structural changes. Second, in the protrusive position, posterior disclusion occurs, preventing masticatory muscle hyperactivity and the subsequent gradual decrease in ramus height.

**Key words:** Mandibular condyle closed fracture reduction, Maxillomandibular fixations

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### I. Introduction

Although much controversy surrounds the treatment of intracapsular condylar fracture in adults, open reduction is considered superior to closed reduction in regard to restoration of vertical dimensions, condylar mobility, and articular disc positions<sup>1</sup>. In addition, open reduction and internal fixation have been reported to result in less crepitus, lateral deviation, occlusal disturbances, and disparity in ramus height than closed reduction<sup>2</sup>. However, even if open reduction is

successful, destruction of the disc-ligament system can result in irregular reduction in the range of mandibular movement, with a prevalence of up to 40%<sup>2</sup>.

Conventional closed reduction for the treatment of intracapsular condyle fracture involves induction to maximum intercuspsation, followed by maxillomandibular fixation (MMF) for a set period<sup>3</sup>. However, premature occlusal contact and deviation on the affected side during mouth opening can occur with such treatment. In cases of bilateral comminuted condylar fracture, patients might experience limited mouth opening ( $\leq 35$  mm) and discomfort associated with a limited protrusive movement<sup>4-7</sup>.

To resolve these problems associated with conventional closed reduction, we designed a novel method for closed reduction through protrusive MMF.

### II. Cases Report

We established inclusion criteria. Among the cases of intracapsular fractures according to the Loukota classification<sup>8</sup>,

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the patients who were not contraindicated<sup>9</sup> for MMF with comminuted fracture in which the fracture segment was displaced medially.

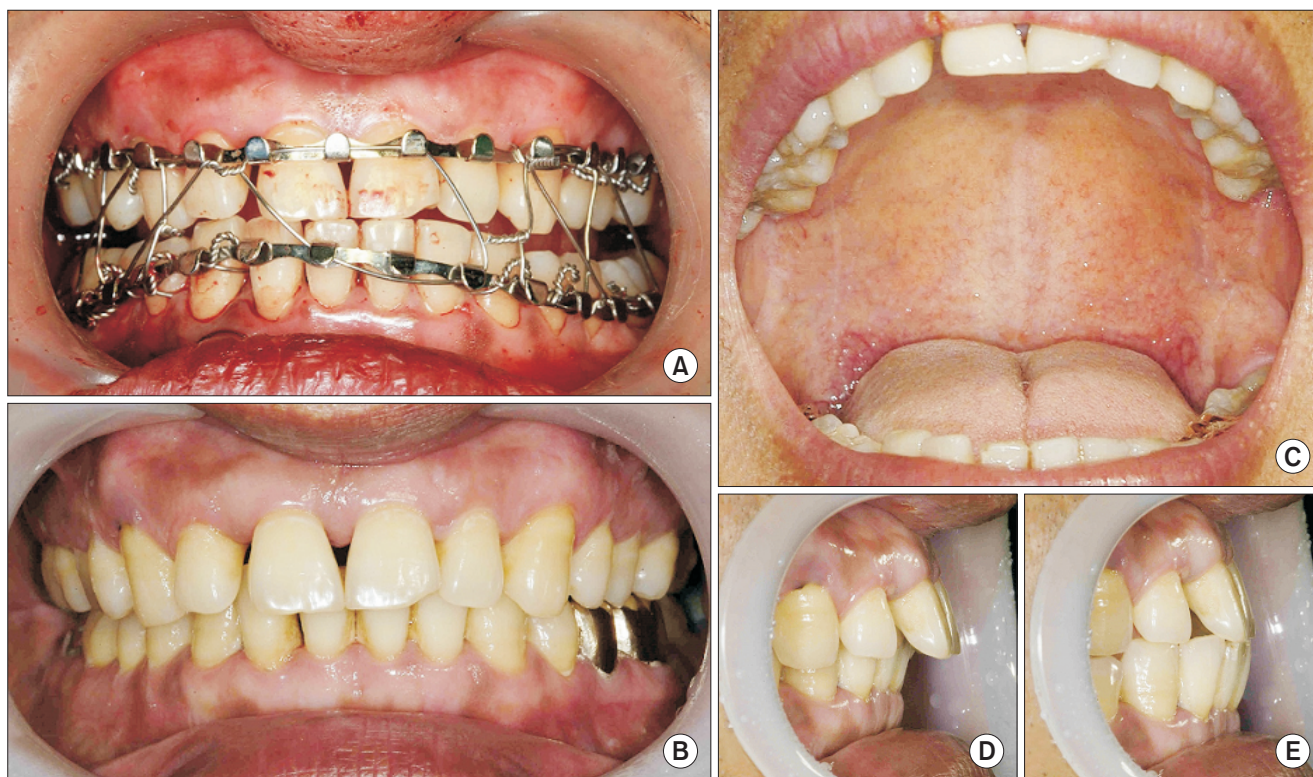
According to our criteria, two adult male patients were included in this study. A 37-year-old man was diagnosed with symphysis and bilateral intracapsular condylar fracture after a traffic accident. Also, a 42-year-old man injured in a fall was diagnosed with symphysis and right intracapsular condylar comminuted fracture with displacement.

An Erich arch bar was applied under general anesthesia, and open reduction and internal fixation were performed for the symphysis fracture in both patients. After confirming proper occlusion, the mandible was protruded forward to form an edge-to-edge bite or crossbite, and MMF was performed using wires in the Class II direction in order to prevent setback after confirming disclusion of the posterior teeth.(Fig. 1, 2) All procedures were performed by the authors.

The patients were discharged four days after surgery with no notable events, and the protrusive MMF was removed two weeks after surgery. The patients were recommended to avoid mastication until one month after surgery and to open

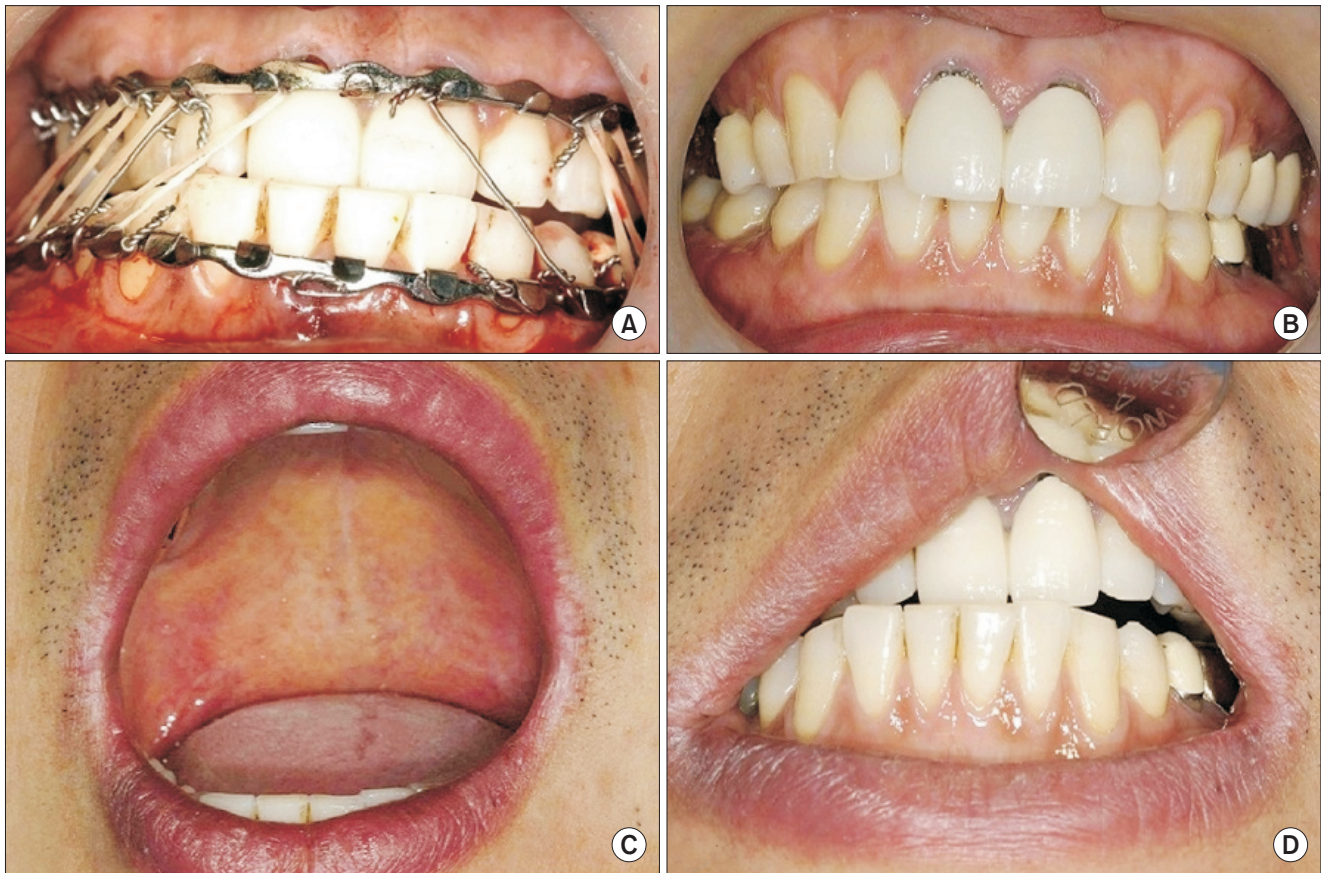
their mouths only to perform mouth opening exercise. The posterior teeth did not achieve a maximal intercuspal position spontaneously on the day of MMF removal, but stable posterior occlusion was observed three weeks after surgery and maintained at the six-month follow-up visit.(Fig. 1, 2) Mouth opening was  $\leq 10$  mm on the day of MMF removal but increased with time. Panoramic and computed tomography images were obtained at the six-month follow-up, and all data were analyzed by the authors. The mandibular condyle maintained its shape, which was close to normal in appearance, while exhibiting slight narrowing of the articular space.(Fig. 3, 4) Posterior ramus height (distance from the condyion to gonion) at pre-operation and postoperation six-month follow-up was measured with OnDemand 3D Application (Cybermed Inc., Seoul, Korea). The measurements of posterior ramus height are given in Table 1. Clinically, occlusion was favorable without premature contact of the posterior teeth, and mandibular movement was not limited including lateral excursion and protrusion without deviation in both patients. The measurements of mandibular movement are given in Table 2.

Due to the retrospective nature of this study, it was granted a written exemption for patient consent by the Institutional



**Fig. 1.** Clinical photographs of the patient with bilateral intracapsular condylar fracture. A. Protrusive maxillomandibular fixation state. B. Maximal intercuspation. C. Mouth opening with a maximum of 45 mm. D. Overjet of 6 mm. E. An edge-to-edge protrusion of 6 mm after 6 months.

Yeong Kon Jeong et al: Protrusive maxillomandibular fixation for intracapsular condylar fracture: a report of two cases. J Korean Assoc Oral Maxillofac Surg 2017



**Fig. 2.** Clinical photographs of the patient with right intracapsular condylar fracture. A. Protrusive maxillomandibular fixation state. B. Maximal intercuspation. C. Mouth opening with a maximum of 46 mm. D. Protrusion of 10 mm after 6 months.

Yeong Kon Jeong et al: Protrusive maxillomandibular fixation for intracapsular condylar fracture: a report of two cases. *J Korean Assoc Oral Maxillofac Surg* 2017



**Fig. 3.** Cone-beam computed tomography of the bilateral intracapsular condylar fracture. A. Preoperative coronal view of the bilateral intracapsular condylar fracture. B. Immediately after protrusive maxillomandibular fixation (MMF). C. Coronal view of 6 months after protrusive MMF.

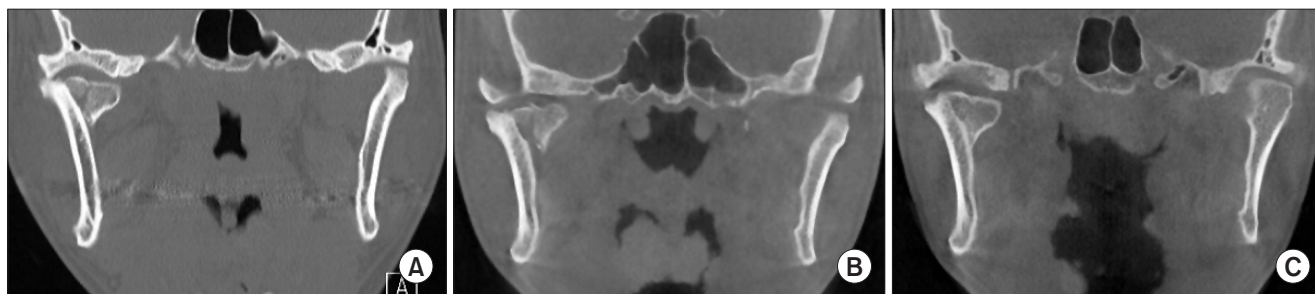
Yeong Kon Jeong et al: Protrusive maxillomandibular fixation for intracapsular condylar fracture: a report of two cases. *J Korean Assoc Oral Maxillofac Surg* 2017

Review Board of Wonkwang University Dental Hospital (WKDIRB201607-02).

### III. Discussion

Clinical limitations following closed reduction of an intracapsular condylar fracture include a decrease in maximum mouth opening, reduced mandibular range of motion includ-

ing anterior guidance, and reduced occlusal stability. These problems are thought to be due to structural changes in the osseodiscoligamentous complex<sup>5,10</sup>. When an intracapsular condylar fracture occurs, the medial condyle fragment undergoes anteromedial and inferior displacement due to traction by the lateral pterygoid muscle, which creates a gap between the medial and lateral condylar stumps<sup>4,10-12</sup>. Such traction can induce bone overgrowth due to distraction osteogenesis be-



**Fig. 4.** Cone-beam computed tomography of the right intracapsular condylar fracture. A. Preoperative coronal view of the unilateral (right) intracapsular condylar fracture. B. Immediately after protrusive maxillomandibular fixation (MMF). C. Coronal view of 6 months after protrusive MMF.

Yeong Kon Jeong et al: Protrusive maxillomandibular fixation for intracapsular condylar fracture: a report of two cases. J Korean Assoc Oral Maxillofac Surg 2017

**Table 1.** Posterior ramus height (mm) at preoperation and postoperation six-month follow-up visit in patients with intracapsular condylar fracture treated with protrusive maxillomandibular fixation

	Case 1		Case 2	
	Right	Left	Right	Left (non-injured site)
Preoperative	63.14	64.52	56.26	65.41
Postoperative 6 mo	63.13	64.50	56.25	65.38

Case 1: bilateral condylar fracture, Case 2: unilateral condylar fracture.

Yeong Kon Jeong et al: Protrusive maxillomandibular fixation for intracapsular condylar fracture: a report of two cases. J Korean Assoc Oral Maxillofac Surg 2017

**Table 2.** Range of mandibular movement (mm) from maxillomandibular fixation (MMF) removal to the six-month follow-up visit in patients with intracapsular condylar fracture treated with protrusive MMF

	Case 1				Case 2		
	2 wk	1 mo	3 mo	6 mo	1 mo	3 mo	6 mo
Maximum mouth opening	<10	25	40	45	30	39	46
Protrusion			6	6	6	8	10
Right excursion			4	6	5	11	16
Left excursion			4	7	5	9	10

Case 1: bilateral condylar fracture, Case 2: unilateral condylar fracture.

Yeong Kon Jeong et al: Protrusive maxillomandibular fixation for intracapsular condylar fracture: a report of two cases. J Korean Assoc Oral Maxillofac Surg 2017

tween the medial and lateral condylar stumps, causing structural changes in the condyle<sup>4,12</sup>.

When MMF is performed in the maximum intercuspal position, persistent interdental contact causes masticatory muscle hyperactivity, even after the MMF is removed, leading to a decrease in the vertical dimension and premature posterior teeth contact<sup>11,13</sup>. However, in growing patients, limitation in mandibular movement or decreased ramus height on the affected side rarely occurs as a result of a comminuted fracture<sup>14</sup>. One reason could be that the volume and activity level of the masticatory muscles become excessive with aging<sup>15</sup>. Injection of botulinum toxin has been reported to be useful in decreasing masticatory muscle hyperactivity in condylar fracture patients, but the attempts at treatment had been limited to cases of subcondylar and condylar neck fractures<sup>16</sup>.

Accordingly, we performed protrusive MMF in cases in-

volving anteromedial and inferior displacement of the medial condyle fragment in intracapsular condylar fractures. This novel method has two main advantages. First, in the protrusive position, the lateral condylar fragment can be deviated in the anteromedial and inferior directions closer to the medial fragment, minimizing bone formation between the two fragments and structural changes<sup>4</sup>. Second, in the protrusive position, posterior disclusion is achieved, preventing masticatory muscle hyperactivity and subsequent gradual decrease in ramus height<sup>11,13,17</sup>.

Compared to conventional MMF, change in the protrusive position can cause functional and aesthetic discomfort to the patient; thus, it is necessary to explain this possibility prior to surgery or protrusive MMF. The protrusive MMF is maintained for two weeks to allow formation of soft calluses 2 to 3 weeks after the fracture and that are thought to pos-

sess enough strength to partially resist a decrease in ramus height caused by increased masticatory muscle activity after MMF removal<sup>18</sup>. We have experienced cases of premature posterior contact from a decrease in ramus height after MMF removal in patients who underwent protrusive MMF for only one week; therefore, the duration of protrusive MMF was changed to two weeks. Posterior occlusion revealed a state of disclusion immediately after MMF removal, but as the activity of the masticatory muscles increased, the posterior teeth returned to the proper occlusion in both patients. The possibility of tooth extrusion and concomitant malocclusion during protrusive disclusion should be considered; however, we think that a two-week period is too short to produce tooth extrusion.

The results suggest that protrusive MMF can be a useful alternative to reduce the occurrence of posttreatment complications in patients with intracapsular condylar fracture.

### Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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### References

1. Kermer Ch, Undt G, Rasse M. Surgical reduction and fixation of intracapsular condylar fractures. A follow up study. *Int J Oral Maxillofac Surg* 1998;27:191-4.

2. Hlawitschka M, Loukota R, Eckelt U. Functional and radiological results of open and closed treatment of intracapsular (diacapitular) condylar fractures of the mandible. *Int J Oral Maxillofac Surg* 2005;34:597-604.
3. Miloro M, Ghali GE, Larsen PE, Waite P. *Peterson's principles of oral and maxillofacial surgery*. 3rd ed. Shelton: PMPH-USA; 2012:445-6.
4. Long X, Goss AN. A sheep model of intracapsular condylar fracture. *J Oral Maxillofac Surg* 2007;65:1102-8.
5. Hlawitschka M, Eckelt U. Assessment of patients treated for intracapsular fractures of the mandibular condyle by closed techniques. *J Oral Maxillofac Surg* 2002;60:784-91; discussion 792.
6. Takenoshita Y, Ishibashi H, Oka M. Comparison of functional recovery after nonsurgical and surgical treatment of condylar fractures. *J Oral Maxillofac Surg* 1990;48:1191-5.
7. Brandt MT, Haug RH. Open versus closed reduction of adult mandibular condyle fractures: a review of the literature regarding the evolution of current thoughts on management. *J Oral Maxillofac Surg* 2003;61:1324-32.
8. Loukota RA, Eckelt U, De Bont L, Rasse M. Subclassification of fractures of the condylar process of the mandible. *Br J Oral Maxillofac Surg* 2005;43:72-3.
9. Walker RV. Condylar fractures: nonsurgical management. *J Oral Maxillofac Surg* 1994;52:1185-8.
10. Li Z, Djaj KA, Li ZB. Post-traumatic bifid condyle: the pathogenesis analysis. *Dent Traumatol* 2011;27:452-4.
11. Assael LA. Open versus closed reduction of adult mandibular condyle fractures: an alternative interpretation of the evidence. *J Oral Maxillofac Surg* 2003;61:1333-9.
12. Liu CK, Liu P, Meng FW, Deng BL, Xue Y, Mao TQ, et al. The role of the lateral pterygoid muscle in the sagittal fracture of mandibular condyle (SFMC) healing process. *Br J Oral Maxillofac Surg* 2012;50:356-60.
13. Dawson PE. *Functional occlusion: from TMJ to smile design*. St. Louis: Mosby Elsevier; 2007.
14. Cascone P, Sassano P, Spallaccia F, Rivaroli A, Di Paolo C. Condylar fractures during growth: follow-up of 16 patients. *J Craniofac Surg* 1999;10:87-92.
15. Alajbeg IZ, Valentic-Peruzovic M, Alajbeg I, Cifrek M. The influence of age and dental status on elevator and depressor muscle activity. *J Oral Rehabil* 2006;33:94-101.
16. Canter HI, Kayikcioglu A, Aksu M, Mavili ME. Botulinum toxin in closed treatment of mandibular condylar fracture. *Ann Plast Surg* 2007;58:474-8.
17. Williamson EH, Lundquist DO. Anterior guidance: its effect on electromyographic activity of the temporal and masseter muscles. *J Prosthet Dent* 1983;49:816-23.
18. Sarmiento A, Latta LL. Functional fracture bracing. *J Am Acad Orthop Surg* 1999;7:66-75.