Orthodontic treatment of an adult male after bilateral condylectomy of the mandible for injuries sustained in a traffic accident

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Abstract: In recent years there have been many reports on studies related to the temporomandibular joint (TMJ) in orthodontic treatment, but an adequate system of diagnosis and treatment has yet to be established, and they often cause considerable difficulty clinically. The patient in this case report sustained generalized contusions, a cerebral concussion, a midline fracture of the mandibular corpus, and bilateral fractures of the condylar process of the mandible when he fell asleep while driving a car and collided with a truck. Because non-surgical reduction was impossible, mandibular condylectomy was performed, and when orthodontic treatment was attempted to improve the open bite that persisted as a sequela of the accident, the favorable results were obtained, as described below. 1. The open bite was corrected by the orthodontic treatment, and the impairment that remained as a sequela resolved. 2. The mandibular condyles were removed during surgical reduction, and the mouth opening disturbance, the TMJ pain, and the TMJ noise resolved. The patient was able to go about his everyday life unimpaired, with hardly any awareness of limitation of jaw movement, and this situation remained unchanged even after the orthodontic treatment was performed. (J. Oral Sci. 40, 1-8, 1998)

Key words: condylectomy; temporomandibular joint; open bite; multibracketed appliance.

Introduction

In recent years there have been many reports on research related to the temporomandibular joint (TMJ) in orthodontic treatment (1-8). However, an adequate system of diagnosis and treatment for the TMJ has yet to be established, and they often cause a great deal of difficulty clinically. Moreover, from time to time cases are encountered that seem impossible in terms of what seemed feasible up to now, and one is sometimes struck with surprise. The patient described in this report fell asleep while driving a car and collided head on with a truck. He suffered generalized contusions, a cerebral concussion, a fracture of the right femur, a midline fracture of the mandibular corpus, and bilateral fractures of the condylar process of the mandible. Because non-surgical reduction of the small bone fragments was impossible, mandibular condylectomy was performed. The open bite that occurred as a sequela of the accident was improved by orthodontic treatment, and restoration of mandibular position was achieved.

Case Report

Patient. A 19-year-3-month-old male.

Chief complaint. Disturbance of occlusion.

Past history. Unremarkable.

Present illness. On December 22, 1987, while driving a car, the patient fell asleep and collided head on with a truck. Because of severe injuries to his entire body the patient was taken by ambulance to a general hospital in Matsudo City and admitted. He was treated for general contusions, cerebral concussion, and a fracture of his right femur, and when his general condition improved was referred to the Department of Oral Surgery, Nihon University School of Dentistry at Matsudo for treatment of the mandibular fractures.

Findings at the time of referral to the Department of Orthodontics

General findings. The patient was of average build, appeared well-nourished, and limped because of the femoral fracture.

Facial findings. The patient exhibited a “bird face” with a receding chin, and a disturbance of mouth closing was observed. Mulberry-like wrinkling of the patients chin was noted, and his lateral profile revealed a “bird face”. Viewed from the front, however, his face was bilaterally symmetrical, and the partial position of the jaw was not particularly noticeable (Fig. 1).
Intraoral findings. The upper and lower anterior tooth area was in an approximately 16 mm open bite position, only the third molars occluded, and the tongue was observed because of the mouth opening. In the upper dental arch the vicinity of the area corresponding to the right lateral incisor seemed to have collapsed slightly in the form the mathematical symbol for less than "<", but the upper right lateral incisor was carious, had turned brown, and part of the incisal edge was fractured. This made the upper dental arch appear to be curved toward the right.

In contrast, in the lower dental arch, because the left lower central incisor had been knocked out in the accident, the lower left lateral incisor made a tipping movement toward the right side, and there was an approximately 1 mm incisal edge gap between it and the right central incisor, with the mandible appearing to be curved in the opposite direction, toward the left.

In any event, a prominent open bite was observed, and functionally, anterior movement and lateral movement of the mouth were almost impossible, and the patients condition suggested that orthodontic treatment would be necessary in the future (Fig. 2).

Panoramic view findings: 18 and 28 had been extracted before the accident occurred and was not present, but all of the other teeth except the lower left central incisor were present, and the patient had been treated for caries. The anterior tooth portion of the mandible between the right central incisor and left lateral incisor had collapsed, and a fracture was observed extending from there to close to the chin on the right, and to the entire area of the upper portion of the chin, both mandibular condylar processes were fractured, the left mandibular process was partially luxated from the base to the medial side, and the right mandibular condylar process was also partially luxated 90 degrees medially (Fig. 3).

Diagnosis. Open bite associated with bilateral mandibular condyle and lower anterior tooth area fracture.

Surgical treatment before orthodontic treatment and the results. The patient was admitted to the Department of Oral surgery of Nihon University School of Dentistry at Matsudo. An O-splint was applied to the temporomandibular joint, and traction reduction was attempted with a 3 days O-band. Mouth closing movements became possible, but because lateral movement could not be performed well and there were no prospect of improvement, one week later, under general anesthesia, a pre-auricular incision was made on both sides, and surgical reduction of the mandibular condylar process fractures was attempted.

However, since small fragments produced as a result of the accident were involved in fibrotic or osteoid ankylosis on both sides, and movement was impossible, a Risdon incision was made on the right side and downward traction was exerted on the mandible at the gonial angle, but it was impossible to move the joint. It had also been hoped to reduce the anterior mandible, but because it was judged to be impossible, there was no choice but to dissect and remove the small fragments on both sides.

The stumps of the mandibular condyles were then restored with a bone bar, and surgery was performed closed, without inserting any intermediate orthoses. Since the occlusal relationship and the mouth opening range were normal when this was done, O-band traction was performed for a week, but no particular measures were taken to treat the fracture of the anterior tooth.
portion of the mandible. While the open bite associated with the receding mandible persisted after removing the O-band, because it had improved to 7 mm from about 1 cm at the time of the initial examination, traction was tried for another week.

However, the correct mandibular position was not maintained when the O-band was removed, but when the jaw was set in a relatively correct position and intraoral fixation was performed for 20 days, the open bite improved from about 8 mm to 5 mm. When O-band traction was applied for about 3 months thereafter, new bone growth was observed at the stumps in the mandibular condyle fracture areas on both sides, the mouth opening range had become about 4.2 cm, and both anterior movement and lateral movement of the mouth could now be performed without any impairment of the patient’s daily activities.

When he was examined in the prosthodontics department, many aspects of the patient’s condition were unknown, but since his oral function was good, it was decided to avoid treatment that would affect the TMJ and surrounding muscles. Judging that moving the teeth and alveolar area would not affect them greatly, it was decided to perform orthodontic treatment by a team approach with the oral surgery department (Figs. 4 and 5).

Orthodontic treatment and the results of treatment

Age at the time of orthodontic treatment. 22 years and 3 months.

Facial findings. The patient’s facial findings were almost unchanged from those obtained at the initial examination (at the time of injuries); he had a receding chin, exhibiting a “bird face”. However, the patient was able to close his mouth, in contrast with the fact that his upper and lower lips kept open at the initial examination.

Intraoral findings. The open bite, about 16 mm at the initial examination, was improved to about 2 mm, with a Class-I occlusal relationship in the molar tooth area. The root canal treatment of the upper right lateral incisor, which was collapsed at the initial examination, was complete, while the incisal edge was reduced to give a

Fig. 4 Remove a mandibular condyle and small fragments.

Fig. 5 A lateral cephalometric radiograph of after condylectomy of mandible.

Fig. 6 Intraoral view at the beginning orthodontic treatment.
near horizontal line, resulting in a short tooth crown. In the lower anterior area, the space produced by extraction of the left lateral incisor was already eliminated, showing a good arrangement of the teeth although there was slight torsion of the bilateral central incisors as compared with the condition at the initial examination (Fig. 6).

**Lateral roentgenographic cephalogram at the beginning of orthodontic treatment.** As the result of maxillary cephalometric analysis, SN to FH 6°, SN to Palatal 9°, SN to Mandibular 52.5°, FH to occlusal 15°, FH to mandibular 47°, SNA 85°, FH to NA 90°, Convexity 22°, SNB 74°, SN Pog 73.5°, FH to NB 80°, Facial angle 79°, Y-axis 74°, Gonial angle 147°, ANB 11°, Palatal to Mandibular 43.5°, FH to upper central incisor 106°, FH to lower central incisor 38.5°, upper to lower central incisor 111.5°, Mandibular to lower incisor 95°, NP to upper central incisor 22mm, NP to lower central incisor 15 mm. The values of both SNA and FH to NA were found to be higher than the mean values for normal occlusion, although they remained within the range of 1 S.D.

On the other hand, in the mandible, the values of SNB, SN Pog, FH to NB, Facial angle and Y axis were all lower than the mean values for normal occlusion by more than 1 S.D., demonstrating severe mandibular recession. In addition, the ANB and Gonial angles were as great as 11 and 147 degrees, respectively (mean 2.56 and 118.84 degrees, respectively, in normal occlusion), and there was a high angle of FH to the mandible. These features contributed to a lateral profile of Class II division 1. Thus, bird face deformity was also apparent from the skeletal analysis (Fig. 7).

In addition to concern about the risk of worsening the patient’s condition by performing orthodontic treatment, instead of improving it, this was a relatively difficult case because of open bite, the severe mandibular recession and the three incisors. Thus, taking the greatest possible caution in regard to treatment and giving priority to the patient’s present condition, it was decided to perform treatment with a multibracketed appliance, in view of the possibility of discontinuing orthodontic treatment at some point.

Because of the patient’s severe mandibular recession and maxillary protrusion, the treatment plan was to only perform 14 and 24 extraction, to eliminate the feeling of protrusion by moving the maxillary anterior tooth area back, and to attempt to make it congruent with the mandible. Moreover, in regard to tooth movement, because it was decided not to apply excessive force, treatment was performed by the straight arch wire technique, chiefly with round memoried wire. Because of the risk that intraoral anchorage and extraoral anchorage might have a direct effect on jaw movement, it was decided not to use them, and to complete treatment in a short time it was elected to position the midline of the upper and lower jaw at the center of the crowns of the lower central incisors in relation to the maxilla.

First, after attaching brackets and bands, except the 12 where the upper crowns were fractured, the maxilla alone was leveled with 0.016 inch memoried wire. The reason for starting the operation with the maxilla is that the upper dental arch is an integral part of the skull, and it seemed that the effect on the TMJ would be relatively minor. There are changes in occlusion associated with movement, however, treatment was carried out with the greatest of care. Since the patient himself was in the same unimpaired condition as before, after leveling the maxilla, posterior movement of the anterior tooth area was achieved by extracting 14 and 24, moving 13 and 23 distally, and performing en mass movement with 0.016 × 0.025 inch rectangular wire. An ideal arch was then created by bending 0.016 × 0.025 inch rectangular wire, and after attaching it, treatment of the mandible was begun (Figs. 8 and 9).
Since non-extraction treatment of the mandible was being performed, after attaching the bracket and band, it was leveled with 0.016 inch memoried wire. After attaching 0.016 inch round wire and 0.018 inch round wire, an ideal arch was created for the mandible with 0.016×0.025 inch rectangular wire, and it was installed.

During this period the patient’s cooperation with treatment was poor. He often canceled appointments, and that was an obstacle to treatment. Nevertheless, because of the fact that it had been possible to place an ideal arch in the maxilla, good congruence had been achieved between the upper and lower jaw, no particular root resorption had occurred, opening and closing movements of the mouth could be performed almost the same as in an uninjured person, and there was no impairment of the patient’s daily activities, active treatment was concluded, and a Begg-type retainer was installed (Figs. 10 and 11).

Maximum mouth opening was 4.2 cm, treatment time was 2 years 5 months, a minimum retention time of 4 years was set, and a long-term follow-up was scheduled. Later, the retainer was inserted, and follow-up examinations were performed every 3 months. The patient moved far away about 2 years after the start of retention, however, and at the present time, after 3 years 2 months of retention, he is being examined once a year. Nevertheless, his daily activities are completely unimpaired, and the treatment process appears to be proceeding well (Figs. 12 and 13).
Lateral roentgenographic cephalogram after orthodontic treatment. The result of maxillary cephalometric analysis, SN to FH 6°, SN to Palatal 13°, SN to Mandibular 53.5°, FH to occlusal 16°, FH to mandibular 47°, SNA 84°, FH to NA 90°, Convexity 26°, SNB 74°, SNPog 72.5°, FH to NB 80°, Facial angle 79°, Y-axis 74°, Gonial angle 145°, ANB 10°, Palatal to Mandibular 45.5°, FH to upper central incisor 100°, FH to lower central incisor 47°, upper to lower central incisor 130°, Mandibular to lower central incisor 85°, NP to upper central incisor 19 mm, NP to lower central incisor 15 mm.

The patient’s skeletal type remained almost the same as that in the beginning of orthodontic treatment; although there were slight decreases in ANB and gonial angles, they were not sufficient to produce a significant improvement. With regard to the occlusal type, open bite was improved by lingual inclination of the lower anterior tooth axis and labial inclination of the upper anterior teeth. However, the upper anterior tooth axis was more deviated from the normal occlusal mean rather than approximating it. Thus, there was also no sufficient improvement in the occlusal type (Fig.14).

Discussion
Statistics show that mandibular fractures frequently occur in the condylar process, and many cases are treated in the Department of Oral Surgery of this University. In the past, non-surgical treatment was selected to treat such cases in the hope of restoring normal function, however, there has been a recent trend toward interest in surgical treatment as well. We have encountered three patients, including the present patient, in the Department of Oral Surgery, Nihon University School of Dentistry at Matsudo, and the number of cases is expected to increase in the future.

Fig. 12 Three years and two month after of retention time.

lateral profile view  front view

Fig. 13 A facial appearance during retention time.

Fig. 14 Lateral roentgenographic cephalogram after orthodontic treatment.
The reason few of these cases have been treated surgically in our hospital is that many of the patients with fractures at this site have displaced fragments, the fact that in young persons, who form the largest group of patients, restoration of adequate function is almost always possible by non-surgical treatment modalities, and that surgical methods of treatment are sometimes complicated by facial paralysis, scars, and postoperative infection as sequelae. Thus, we have been reluctant to aggressively treat those patients surgically.

However, the recent trend has been for approaches to surgical treatment to become generally more popular (9-12), and as in our own patient, when there is a large fracture associated with luxation and displacement, it is often impossible to hope for adequate recovery of function by non-surgical therapy, and surgical treatment is more advantageous in terms of rehabilitation as well. Accordingly, we have been moving in the direction of adopting a policy of more aggressive surgical treatment in our hospital as well. We suspect that the recent development of new surgical equipment and materials has also contributed to the background that has generally been attracting interest in surgical treatment. Be that as it may, depending on the procedure, methods of fixing small fragments using lag screws, mini-plates, Kirchner wire, and so forth, are used in almost all of the surgical procedures for treating fractures at this site, and there are few cases in which small fragments are removed surgically, as in the case described here.

In our patient, methods of fixing the small fragments as in ordinary cases were considered initially, but because the fracture was complex and it seemed that it would be difficult to restore function by such methods, condylectomy was performed. Moreover, there have been reports (13-16) of cases in which there was hardly any impairment of ordinary oral function in TMJ disorder patients in whom mandibular condylectomy and reconstruction were performed, despite the fact that the joint structure was completely destroyed.

When Kurita et al (13), investigated TMJ pain and noise with an MKG in 7 patients with mandibular condylar process fractures in whom fracture fragment removal was unavoidable, and reported finding that they were very small and that mouth opening was almost always satisfactory, but that there was slight limitation of TMJ motion. Tominaga et al. (14) also reported on patients with mandibular condylar fractures and described results of treatment similar to those reported by Kurita et al. (13), i.e., that while the patient’s condition was good after treatment, there was slight limitation of TMJ motion. In addition, in their report on cases of mandibular condylectomy, Tsuchida et al. (15) also stated finding that although there was no impairment of the patient’s daily activities, there seemed to be a slight loss of the functional action of TMJ motion.

However, in our own patient, the disturbance of mouth opening, TMJ pain, and TMJ noise improved after mandibular condylectomy, the patient’s open bite was improved by orthodontic treatment, and hardly any limitation of TMJ motion came to be noticed. We think that the reason these satisfactory results with no impairment of the patient’s daily activities were achieved is the advantage of planning the patient’s anatomical and functional recovery by a team approach between oral surgery and prosthodontics. However, while the patient’s profile revealed a receding mandible as a result of the condylectomies, it was better than immediately after the accident. Nevertheless, a slight resemblance to a “bird face” persisted, and there seemed to be a limit to improvement by orthodontic treatment alone (Fig. 15). In any event, while it cannot be said to be apparent from this case alone, it appears better to improve malocclusion remaining as a sequela in cases such as ours by, with the greatest of care, performing orthodontic treatment with orthodontic force on the teeth and alveolar area without applying forces that act as an orthopedic force, such as extraoral anchorage. In this case, orthopedic force cause mandibular displacement of the patient (1,5,6).

**Conclusion**

This was a case of a patient who fell asleep while driving a car, collided with a truck, and suffered general contusions and a cerebral concussion as well as fracture of the mandibular corpus and bilateral mandibular condylar process fractures. Because non-surgical reduction was impossible, treatment consisted of surgical treatment by mandibular condylectomy and orthodontic treatment of an open bite that remained as a sequela.

The results were good both anatomically and functionally. Satisfactory therapeutic results with no impairment of daily activities were observed, and we arrived at the conclusions below.

1. Condylectomy was unavoidable in the patient described above, and even though a surgical method of reduction was performed, unimpaired daily living was achieved.
2. Orthodontic force was applied in our patient, mainly by moving teeth and the alveolar area without any use of orthopedic force. In this case, orthopedic force cause mandibular displacement of the patient. Improving the malocclusion that remained as a sequela by orthodontic treatment yielded good results both anatomically and functionally, and the patient was also clearly pleased.

**References**


