USE OF ACRYLIC OCCLUSAL SPLINT AND DIRECT BONDED BRACKETS FOR INTERMAXILLARY FIXATION IN THE TREATMENT OF UNILATERAL PARASYMPHYSEAL AND CONDYLAR FRACTURES: A CASE REPORT

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ABSTRACT
The aim of this case report was to present the treatment method used for a 22-year-old male patient with a history of mandibular fracture due to an assault. Unilateral parasympyseal and condylar fractures were diagnosed on the computerized tomography (CT) images. The patient had a deviated open bite on the right side due to the injury. After preparing an acrylic occlusal splint according to the preinjury occlusion and direct bracket bonding, intermaxillary fixation (IMF) in combination with open reduction was planned for the patient. IMF was achieved with intermaxillary elastics. Four weeks after surgery, IMF was released and a few training elastics were kept for stability. Four months after injury, brackets and arch wires were removed. The patient experienced minimal discomfort. No signs of complication were observed during the healing period. The fractured segments were in good approximation. The occlusion of the patient was returned to the preinjury position. One year after injury, clinical evaluation showed that the occlusion was stable and healing at the fracture sites was good.

Key words: Acrylic Occlusal Splint, Condylar Fracture, Direct Bracket Bonding, Intermaxillary Fixation, Parasympyseal Fracture.
INTRODUCTION
Mandibular fractures are among the most common types of facial fractures which can be caused by assaults, traffic accidents, falls, sport accidents, and underlying pathologies.1-3 The treatment of mandibular fractures has still been a matter of debate. Although indications for open and closed reduction of mandibular fractures were described,4 there has been no decisive study about the superiority of open versus closed reduction.5,6 A correct occlusion is critical for reduction of bone segments regardless of surgical technique used because abnormal malocclusion after injury is a common problem. To achieve a proper dental alignment and provide stability in the fractured segments, a period of intermaxillary fixation (IMF) is needed.7 IMF is applied by using different methods such as arch bars, looped wires, splints or orthodontic brackets with/without intermaxillary elastics or wires. Arch bars and looped wires are difficult to apply in the oral cavity and they are not comfortable for patients as they are bulky. An IMF technique applied by an acrylic occlusal splint in combination with bracket bonding and intermaxillary elastics was used as a reliable method in recent studies.7,8 The aim of this case report is to present the treatment of a patient with a history of unilateral parasymphyseal and condylar fractures due to an assault.

CASE REPORT
A 22-year-old male patient who suffered from mandibular fractures was referred to the Department of Orthodontics with a history of assault. The patient was medically clear. Clinical examination showed a vertical fracture line (parasymphyseal fracture) between mandibular right canine and lateral incisor and a deviated open bite to the right side. The fractured segments were separating from each other when opening the mouth and the segments were approaching each other when closing the mouth. He presented a limited mouth-opening. He was unable to occlude in centric relation (Figure 1). Radiographic examination (panoramic radiograph and computerized tomography (CT) images) showed a left subcondylar fracture, in addition to a right parasymphyseal fracture. The patient did not have significant dislocation of the condylar head (Figure 2).

An old photograph showing the patient’s smile and teeth was asked for returning the interarch relationship to the preinjury position (Figure 3). Dental impressions of both jaws were taken, and surgical model setup of the mandible was made to obtain the preinjury occlusion. An acrylic occlusal splint was prepared in such a way that the preinjury occlusion was established. The teeth are rinsed and dried with airflow. After acid etching and bonding agent application, the brackets were bonded to the maxillary and mandibular teeth with composite resin. Passive orthodontic arch wires (0.016x0.022 inch stainless steel wire) were bent and inserted into the bracket slots. In the mandible, the arch wire was cut between the right canine and lateral incisor for manipulating the fractured segments during the surgery. Crimpable surgical hooks were added to the arch wires to apply intermaxillary elastics (Figure 4).

Following the presurgical preparation, the dislocated segments were replaced by bone pliers with the guidance of the acrylic occlusal splint under general anesthesia. The patient’s occlusion fitted perfectly when the occlusal splint was placed on the teeth. The fixation of the parasymphyseal fracture was achieved by titanium plates, in addition to the wire fixation at the dentoalveolar region (Figure 5). The condylar fracture was treated with closed reduction. One day after surgery, the acrylic occlusal splint was placed on the teeth and intermaxillary elastics were positioned to guide the mandible back to the preinjury position (Figure 6). During the period of IMF, the patient went on a liquid diet and took oral care with a tooth brush and mouth rinse. The patient was examined weekly. Four weeks after surgery, the acrylic occlusal splint and intermaxillary elastics were removed, and a few training elastics were kept for intercuspation and stability. Then, the elastic force was reduced gradually. The patient was advised to eat a soft diet and to do mouth opening exercises to achieve jaw function.

Four months after injury, brackets and arch wires were removed (Figure 7). No signs of complication were observed during the healing period. The patient was able to open his mouth normally. The occlusion of the patient was functional without any complaints related to TMJ such as pain, ankylosis and internal derangements. The fractured segments were in a satisfactory approximation and remained in reducted position (Figure 8). One year after the injury, the clinical evaluation showed that the occlusion was stable and healing at the fracture sites was good (Figure 9).

DISCUSSION
For the diagnosis of the mandibular fractures, different radiographic imaging methods are used. 92% of mandibular fractures are diagnosed in the panoramic radiograph.9 However, a CT scan is more useful than panoramic radiograph if the patient has multiple injuries and the quality of panoramic radiograph is not good enough to
diagnose the fracture. Wilson et al.\textsuperscript{10} reported that CT scan was more sensitive in diagnosing mandibular fractures than panoramic radiograph. In our case, CT scans were used in addition to panoramic radiograph to screen the subcondylar region clearly.

It was reported that the indications for open reduction and internal fixation of mandibular fractures include symphyseal and parasymphyseal fractures, displaced body and angle fractures, and certain condylar fractures.\textsuperscript{4} Closed reduction was advised for the treatment of the mandibular condyle fractures where the condyle is minimally displaced and the height of the ramus is normal.\textsuperscript{11} Combined parasymphyseal and condylar fractures make it difficult to obtain the preinjury arch form when fixing the fractured segments. If the plate is not bent to the curve of the mandible when plating a parasymphyseal fracture, then a concomitant subcondylar fracture is displaced.\textsuperscript{4} Open reduction in combination with IMF facilitates to align the fractured segments, restore the interarch relationship to the
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Splints or orthodontic brackets. Arch bars have long been used as key attachments for the fixation of fractured segments. However, arch bars may damage the gingival and periodontal tissues. Lloyd et al.\textsuperscript{16} used a new technique, vacuum-formed splints with intermaxillary elastics in their case and ensured the retention of the splint by cementing it on the teeth. However, the removal of the splint bonded to all teeth requires a significant force to debond and may cause discomfort for the patient. Terai and Shimahara\textsuperscript{14} reported that the advantages of thermoforming plates were clarity, smoothness on the surface and ease of cutting. Theoretically, bonding brackets on to the teeth alone and applying elastic traction may cause the extrusion of the teeth. IMF technique using an acrylic occlusal splint in combination with bracket bonding and intermaxillary elastics helps to hold fractured segments together without tooth extrusion during the healing period.

For patients suffering from mandibular fractures, oral hygiene with direct bonded bracket fixation is superior to controls using arch bars.\textsuperscript{17} To bond and debond the brackets are painless as there is no need to apply excessive force. Acrylic occlusal splints are cheap, rigid, easy to fabricate, easily adjusted, translucent, and well-tolerated by the oral mucosa. Also, retention of the acrylic occlusal splint is acceptable. Jackson and Wetmore\textsuperscript{18} reported that of the various splint materials, acrylic was the easiest, fastest, and least expensive one.

Occlusion may be maintained with intermaxillary elastics or wires. We preferred to use elastics to provide a favourable tension and guide the teeth into preinjury occlusion. In the literature, 1-6 weeks of intermaxillary fixation was reported.\textsuperscript{11} Our patient had four weeks of intermaxillary fixation because the less the IMF, the better the postoperative TMJ function\textsuperscript{7}. In this case, no signs of complication were observed one month after surgery and during the healing period. There were no premature contacts and overeruption of any teeth.

\begin{figure}[h]
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\includegraphics[width=0.8\textwidth]{Image6.png}
\caption{Intermaxillary fixation after surgery.}
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\begin{figure}[h]
\centering
\includegraphics[width=0.8\textwidth]{Image7.png}
\caption{The patient's occlusion after removing of the brackets.}
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\begin{figure}[h]
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\includegraphics[width=0.8\textwidth]{Image8.png}
\caption{Panoramic radiograph four months after injury.}
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\centering
\includegraphics[width=0.8\textwidth]{Image9.png}
\caption{The patient's occlusion one year after injury.}
\end{figure}
Silvennoinen et al. showed a 13% rate of malocclusion in their series of patients with condylar fractures treated by closed reduction. Longwe et al. reported that the percentage of complications in patients with mandibular fractures treated via miniplate fixation was 1%. The patient had a crossbite on the right side and the mandibular midline was shifted before the trauma. We offered a detailed orthodontic treatment plan to the patient. However, he did not accept the orthodontic treatment. One year after surgery, the patient was only examined clinically because he refused radiological examination. His occlusion was clinically stable. Assael stated that complications should be evaluated by looking at whether the patient has pain, reduced function, and an unfavourable clinical appearance, rather than radiographic criteria.

IMF with an acrylic occlusal splint in combination with bracket bonding and intermaxillary elastics was useful for the treatment of multiple mandibular fractures. An acrylic occlusal splint and orthodontic brackets in combination with intermaxillary elastics enabled substantial interdigititation of the dentition. The patient experienced minimal discomfort. However, it requires time to prepare the acrylic occlusal splint, to bond the brackets and bend the wires to fit perfectly into the bracket slots.

REFERENCES


