Conservative orthodontic treatment for a patient with a unilateral condylar fracture

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Trauma to the mandible often causes condylar fracture. This article reports the conservative treatment of a 10-year-old girl with a unilateral condylar fracture, highlighting the diagnostic aspects involved and the strategy used. The conservative approach used for this patient—bionator followed by full fixed orthodontic appliances—provided adequate esthetic and functional results. The outcomes throughout the 7-year follow-up and the remodeling process of the condyle observed in the panoramic radiographs proved the success of this treatment. (Am J Orthod Dentofacial Orthop 2012;141:e75-e84)

The proportion of condylar fracture among all mandibular fractures ranges from 17.5% to 52%.1-7 Condylar fracture is probably the maxillofacial trauma with the most controversial opinions on the classification, diagnosis, and therapeutic management, which have raised discussions and arguments in the literature.2,6,8-12

There are 2 types of fracture—intracapsular and extracapsular—yet for practical purposes, the anatomic level of the fracture is divided into 3 sites: condylar head (intracapsular), condylar neck (extracapsular), and the subcondylar region.3,13,14 Depending on the direction of the causal force, the position of the jaw at the time of the accident, the activity of the lateral pterygoid muscle, and the whole trauma to the mandible, the fractured part can remain in place, or can be partially or completely displaced.12 Usually, the displaced fragments are directed medially or anteromedially.5 According to Lindahl,13 condylar head displacement is more frequent in children.3

The principal causes of condylar fractures in growing children vary according to age, with bicycle accidents the most common,3,7,13-18 especially in patients aged 6 to 12 years.5,6,19 The clinical consequences of condylar trauma directly depend on the child’s age at the moment of the lesion, growth potential, and extent of the fracture.6 Experimental studies and clinical observations have shown large adaptive changes in fractured condyles, as well as in contralateral condyles, that can cause functional disturbances and alterations in dentofacial growth.12,20 The consequences of these fractures on maxillofacial growth and occlusal development might be as severe as mandibular deficiency, asymmetry, retrusion, or ankylosis.3,12,18,21 It is known that there is a better potential for bone remodeling when fractures affect the higher regions of the mandible; a poor potential is noted in the lower regions, with luxation of the fragment and a greater tendency for facial asymmetry.16,21

The treatment depends on the patient’s age, coexistence of other mandibular or maxillary fractures, whether the condylar fracture is unilateral or bilateral, the level and displacement of the fracture, the state of the dentition, and the dental occlusion. The treatment planning depends on the characteristics of each patient and the type of fracture, varying from conservative treatment comprising observation, analgesia, and a soft diet, to maxillomandibular fixation or functional appliance therapy,8,10 up to surgical intervention.1,3,4,9,12,14,16,18 In growing patients, with growth potential of the condyle, most authors recommend conservative therapy.3,14,18

This report describes a pediatric patient with a unilateral condylar fracture who was treated conservatively with functional appliances. Satisfactory remodeling of the condylar process and possible repositioning of the temporomandibular fossa by apposition occurred, and normal occlusion and jaw movements were obtained.17

DIAGNOSIS AND ETIOLOGY
A 10-year-old girl received an orthodontic evaluation for a left condylar fracture resulting from a bicycle accident.
Fig 1. Pretreatment facial and intraoral photographs.

Fig 2. Pretreatment dental casts.
accident. The trauma had occurred 12 days earlier and was diagnosed in an emergency service at a hospital. The immediate therapy consisted of antibiotics, anti-inflammatory analgesic medications, a soft diet, and physiotherapy (open-close movements). Clinically, a mild midline shift on opening and occlusal contact on the fractured side were noted (Fig 1). The patient showed a straight profile, facial asymmetry with a mandibular shift to the left side, and articular displacement during opening and closing. Analysis of her occlusion showed a Class I dental pattern and the mixed dentition period (Fig 2). The maxillary incisor midline coincided with the facial midline, and the mandibular midline was shifted to the left by approximately 3 mm, with a functional crossbite on the left side. Overjet was 2 mm, and overbite was 0 mm. Panoramic and posteroanterior radiographs and 3-dimensional reconstructions with computed tomographs confirmed the transverse

Fig 3. Pretreatment posteroanterior skull radiograph, panoramic radiograph, and computer tomographs confirm the diagnosis of vertical intracapsular fracture of the left mandibular condyle with dislocation.
The fracture of the neck of the left mandibular condyle at a 90° angle and medial displacement, without other alterations of the facial bone structures (Fig 3). The cephalometric measurements are presented in Figure 4 and the Table.

**TREATMENT OBJECTIVES**

The treatment of these fractures was aimed at reestablishing normal mandibular growth and occlusal development.

**TREATMENT ALTERNATIVES**

According to international guidelines, the indications for nonsurgical treatment include condylar fracture in growing children; thus, conservative orthodontic treatment was recommended. Since 12 days had already elapsed, maxillomandibular fixation was not indicated anymore. The initial treatment planning comprised placement of an orthopedic asymmetric bionator appliance, followed by full orthodontic treatment with fixed appliances to correct the asymmetry, maintain function, and prevent ankylosis.

**TREATMENT PROGRESS**

For fabrication of the asymmetric bionator, a constructive bite was recorded by positioning the patient’s

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**Table. Cephalometric summary**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Pretreatment</th>
<th>Posttreatment</th>
<th>7 years</th>
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<tr>
<td>SNA (°)</td>
<td>77</td>
<td>78</td>
<td>78</td>
</tr>
<tr>
<td>SNB (°)</td>
<td>74</td>
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<td>76</td>
</tr>
<tr>
<td>ANB (°)</td>
<td>3</td>
<td>2</td>
<td>2</td>
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<td>1-NA (mm)</td>
<td>4</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>1:NA (°)</td>
<td>20</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td>1-NB (mm)</td>
<td>4</td>
<td>5</td>
<td>5</td>
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<tr>
<td>1:NB (°)</td>
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<td>31</td>
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<tr>
<td>1:1 (°)</td>
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<td>121</td>
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<td>24</td>
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<tr>
<td>S-L1 (mm)</td>
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<td>2</td>
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<td>—1</td>
<td>—4</td>
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<td>FMIA (°)</td>
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<td>Co-Gn (mm)</td>
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<tr>
<td>Pog-NPerp (mm)</td>
<td>—8</td>
<td>—6</td>
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</table>

AIFH, Anterior facial hieght; Occl:SN, occlusal plane angle.
mandible anteriorly and inferiorly and to the right until the midline shifted 3 mm to the right.6,8,17 The patient received information on oral hygiene and was instructed to use the appliance continuously both day and night, removing it only for eating and cleaning.10,14 The bionator was used for 13 months, during which the patient returned for orthodontic maintenance sessions at regular 4-week intervals (Fig 5).8

After therapy with the bionator, the midline was overcorrected to the right side by 1 mm. Afterward, fixed edgewise appliances with 0.022 × 0.028-in slot brackets were placed in both arches in a typical sequence of archwires, starting with 0.0175-in coaxial, followed by 0.016-in, 0.018-in, 0.020-in, and 0.019 × 0.025-in stainless steel archwires (3M Unitek, Monrovia, Calif), to eliminate the maxillary and mandibular crowding and provide alignment and leveling to optimize the occlusion, given the good temporomandibular joint function. This second treatment stage was concluded in 32 months. After that, a canine-to-canine lingual retainer was bonded in the mandibular arch, and a removable circumferential retainer was placed in the maxillary arch. From this moment on, the patient was placed in a retention control program with periodic visits.

TREATMENT RESULTS

Good esthetic results and dental relationships were achieved. The dental midlines were coincident to each other and with the facial midline (Figs 6 and 7). From a functional standpoint, the patient exhibited lateral and protrusive mandibular movements. The right
condyle had good to excellent anatomy. Bifid condyle formation of the left condyle was noted (Fig 8, B). The superimposition and cephalometric analysis showed proper mandibular positioning and a normal jaw relationship (ANB, 2°; Wits appraisal, −4 mm) (Table; Figs 8, left, and 9). At treatment completion, the patient had no clinically significant facial asymmetry and no symptoms of pain in the condylar region.

**DISCUSSION**

The treatment of condylar fractures depends on the fracture level, the extent of the injury, the degree of
displacement, the size and position of the fractured condylar segment, the malocclusion and mandibular dysfunction, the completeness of the dentition, any concomitant facial fractures, and the patient’s age. A wide diversity of opinions exists on the treatment of these fractures; yet all of them aim to reestablish the initial occlusal relationship and the physiologic function of the temporomandibular joint. After a condylar fracture, growth problems arise when there is scarring in the area, restricting the growth movements so that the mandible cannot be pulled forward on one side. Unilateral condylar fracture or unilateral temporomandibular joint ankylosis during active growth affects normal growth at one side, thereby leading to an asymmetric malocclusion. In growing patients, when a unilateral condylar fracture occurs, it is sufficient to restore mandibular movements to obtain facial growth and prevent the development of facial asymmetry. Surgery is not indicated in most pediatric patients with a condylar fracture. Treatment is aimed at restoring normal joint function, occlusion, and symmetry. The masticatory adaptations that occur after conservative treatment lead to functional reconstitution of the joint by condylar regeneration and remodeling with adaptive changes even in patients with a severe displacement. In this context, in younger patients, a condylar fracture should be addressed as early as possible to restore optimal function, because any disturbance to the condylar cartilage will result in alteration of mandibular development. In growing patients, with growth potential of the condyle, treatment involves a conservative approach, usually with conventional functional appliances, with or without 1 to 3 weeks of maxillomandibular fixation. Remodeling can be interpreted as a process directed to meet the demands of function and growth. Although injuries to the condylar cartilage and gross condylar head displacement in children can reduce the capacity for complete remodeling and often result in mandibular deformities, it can be assumed that...
a (genetic) guidance system will rebuild the condylar process, and the velocity of this growth is governed by a combination of intrinsic (cell-derived) and local extrinsic (environment-modified) factors. The clinical findings in this case suggest that external factors, such as functional appliances, might influence and guide the mandibular growth after a condylar fracture, and that these appliances can play a role in enhancing the metabolism, allowing proper mandibular positioning, rendering posterior vertical dimension support, disimpaction and uprighting of the condylar process, stimulating the remodeling of the condyle and soft tissues of the temporomandibular joint, keeping normal muscle function, promoting compensatory growth, and guiding normal development of the occlusion.

The design of a functional appliance is based on specific treatment objectives and favors an individualized treatment plan. For this patient, an asymmetrical bionator with a constructive bite in a protrusive, 3 mm to the right side, and slightly open position, enabled proper mandibular positioning and bilateral function for condylar remodeling. The bionator was chosen over other devices because it is a commonly used appliance for functional treatment, in part due to a number of favorable characteristics that include relatively easy construction. Its design removes much of the bulk when compared with other activators, and the mandibular incisors are capped to control their tendency to tip facially. Note the good positioning of the incisors achieved after treatment (Table; Fig 9, A and C). The treatment approach indicated for this child allowed facial growth to proceed normally (Table; Fig 9). The patient’s age was a positive factor in the healing potential; this agrees with previous reports because anatomic and functional reestablishment are better when the fracture occurs at an early age.

The remodeling process of the condyle could be clearly seen in the panoramic control radiographs or the computed tomographs. The findings presented here (Fig 8) are in accordance with previous

Fig 10. Long-term (7 years) facial and intraoral photographs.
studies, which have shown that the remodeled condyle consists of 2 portions: a medial part, probably the remainder of the small fragment, and a lateral part, probably representing callus formation.1,6,12,15,18,21,26,27 Most patients with a bifid condyle have no temporomandibular joint dysfunction or clinical symptoms, which are associated with normal function and thus do not require treatment.1,6,21,26 The records and superimpositions of the cephalometric tracings at treatment completion (red line) and a follow-up period of 7 years (brown line) show the stability of the harmonious facial profile and occlusion (Figs 10-12).

CONCLUSIONS

Conservative therapy with an asymmetric bionator and fixed appliances proved to be an efficient method for mandibular repositioning, avoiding vertical collapse, stimulating favorable condylar and soft-tissue remodeling, and allowing growth compensation in our pediatric patient. An adequate esthetic and functional result was obtained.

Fig 11. Long-term (7 years after appliance removal) radiographs. Note the discrete modification of the left mandibular condyle head.

Fig 12. Superimposition of cephalometric tracings at treatment completion (red line) and 7 years posttreatment (brown line) on the sella-nasion plane at sella. The patient had a stable occlusion.
REFERENCES