

Long Term Follow-up of Children with Facial Asymmetry: A Case Report

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Abstract

Mandibular fractures occur with high incidence among various fractures in maxillofacial region in children. Jaw fractures in children should be approached differently than in adults because bone growth continues throughout childhood. As far as displacement of the fragment is not severe, or if it is condyle that is fractured, closed reduction and additional intermaxillary fixation can be considered. Functional exercise is also required to prevent ankylosis of temporomandibular joint.

Several complications, particularly malocclusion and facial asymmetry due to growth disturbances, can occur after condylar fractures. If growth disturbances take place after mandibular fractures, catch-up growth may occur in some patients, thus, periodic observation is necessary. In case of persistent growth disturbances, functional devices may be used to prevent severe facial asymmetry.

This case report describes the long-term follow-up of two patients with facial asymmetry after mandibular fracture.

Key words : Early mandibular fracture, Condylar fracture, Facial asymmetry, Hybrid appliance

I. Introduction

Mandibular fractures frequently occur from trauma and account for 29 to 40% of fractures in the maxillofacial area[1]. This is because mandible is protruded from the facial bone and is easily exposed to the trauma. It is also due to the anatomical characteristics that external force is not absorbed since bone fusion line is absent here. In children, green stick fractures frequently occur. This refers to the case where one side of a bone is broken when the other side is bent. Open reduction can damage tooth germ in children with fractures, therefore should be conservatively treated[2].

Mandibular fractures may cause various side effects. In par-

ticular, fractures of the mandibular condylar region can cause growth disturbances. Thus leading to functional and aesthetic problems. Previous studies have shown that 75% of children with mandibular condylar fractures experience normal mandibular growth with no malocclusion from trauma[3]. However, it has been reported that 5 - 10% of patients present severe mandibular undergrowth and facial asymmetry[4,5]. Considering that many condylar fractures may not be diagnosed immediately after trauma, children with facial asymmetry and mandibular displacement may have experienced condylar fractures in the past.

Functional appliances can be used to deal with facial asymmetry in growing children. They are referred to as hybrid

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appliance because it uses a combination of components as required. A construction bite is obtained by displacing the mandible in the direction of resolving asymmetry, which causes a change in muscle activity and induces bone deposition in the condylar area[6]. Several authors have reported the treatment of hemifacial microsomia with a hybrid appliance for relieving facial asymmetry[7,8].

This case report describes the long term follow-up of two children with facial asymmetry after mandibular fractures. We observed that asymmetry after the mandibular fracture gradually resolved in the 1st patient. In the 2nd patient, facial asymmetry gradually increased after the mandibular fracture, requiring treatment with a hybrid appliance.

II. Case report

1. Case 1

A 3-year-old boy presented to the Department of Pediatric Dentistry, Hallym University Sacred Heart Hospital, with facial asymmetry. The patient fell out of a stroller a year ago and had facial trauma, but he was not taken to a hospital at that time. Clinically, asymmetry was observed in the frontal face and the mandible was displaced to the left in centric occlusion. More severe left displacement of the mandible was seen on maximal opening. The patient was showed a 4 mm dental midline discrepancy. On the panoramic image, the height of left mandibular ramus was significantly shorter than that of the right mandibular ramus (Fig. 1).

Asymmetry analysis was performed using the OnDemand 3D program (Cybermed, Seoul, Korea) on CBCT (Cone Beam Computed Tomography) images. CBCT image analysis revealed a significant difference in the length of the left and right mandibular ramus. The height of the left mandibular ramus was 20 mm shorter than that of the right. This difference in length seemed to have caused the left displacement of the mandible. The left mandibular ramus seemed morphologically abnormal (Fig. 2). The difference between the left and right maxillary heights and the difference between mandibular body lengths on both sides was all within the normal range of less than 2 mm.

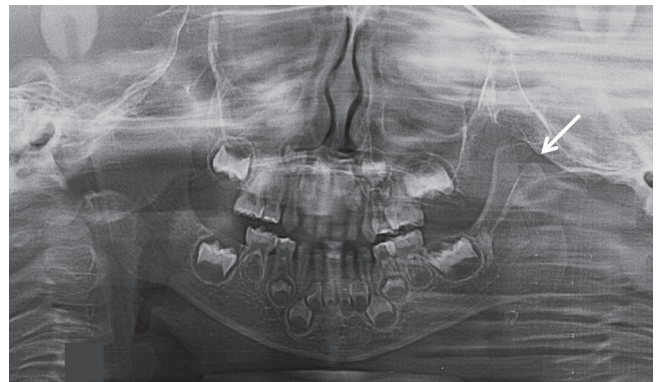


Fig. 1. Initial panoramic view. The shape of the left mandibular ramus is abnormal.

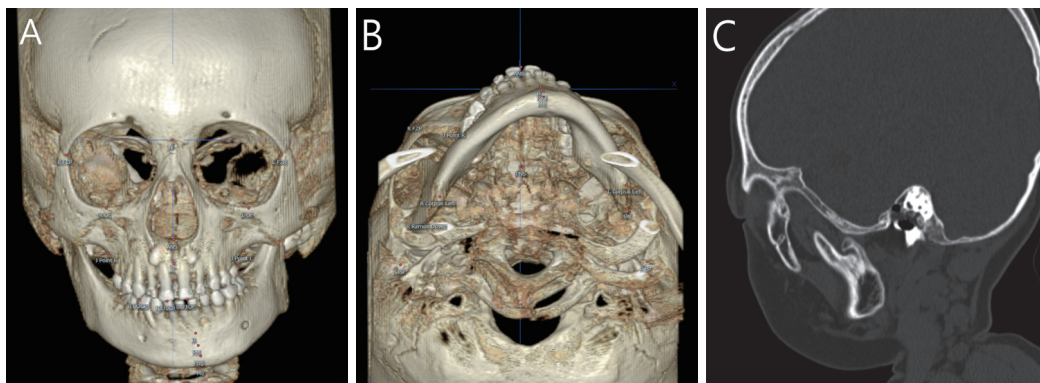


Fig. 2. Initial CBCT view. (A) Mandibular displacement observed in frontal view. (B) Mandibular displacement observed in axial view. (C) Sagittal view from left side. Abnormal morphologies of condyle and ramus are presented.

The patient was presumed to have left mandibular condylar fractures from the untreated previous trauma, but primary side effects such as nonunion of the fracture site did not occur. Although functional appliances have been the primary choice for the correction of facial asymmetry, it is difficult to obtain cooperation in young patients due to their age. The patient was repeatedly instructed not to deviate mandible to the left on mouth opening. After 6 months of follow-up, the patient showed a decrease in mandibular displacement.

Anteroposterior cephalometric images taken 3 years later showed remarkable growth of the left mandibular ramus, and clinical signs of facial asymmetry were significantly reduced. Facial asymmetry was resolved naturally, and the patient was continuously observed without any intervention with function-

al appliance (Fig. 3). 6 years after the initial visit, CBCT images were obtained to analyze facial asymmetry. The difference between the left and right mandibular ramus lengths was less than 2 mm, which can be regarded as normal range (Fig. 4). The position and morphology of mandibular condyle was normal. In the sagittal view, the anteroposterior thickness of the left mandibular condyle appeared somewhat thicker than that of the right mandibular condyle.

There was no displacement of the mandible, and clinical signs of facial asymmetry were hardly seen. The patient had right and left class I molar keys, and the dental midline was consistent. The patient needs continuous observation until growth is complete.

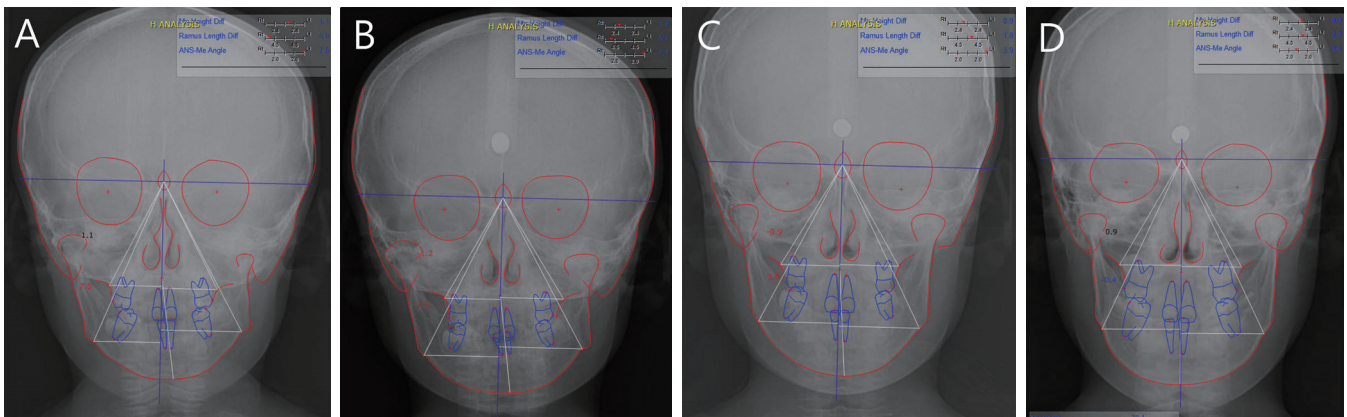


Fig. 3. A series of Anteroposterior cephalometric radiographs. (A) Initial radiograph, (B) 1 year later radiograph, (C) 3 year later radiograph, (D) 4 year later radiograph. The growth of left mandibular condyle is seen and asymmetry is almost resolved.

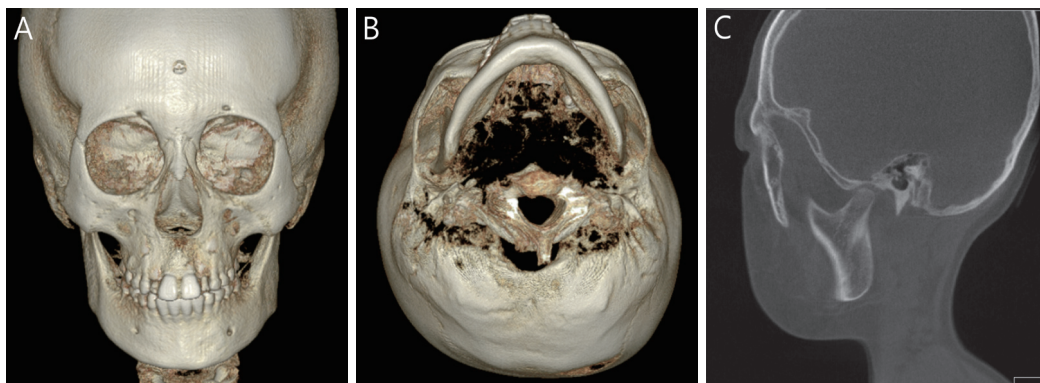


Fig. 4. CBCT view after 6 years. (A) Mandibular displacement is decreased in frontal view. (B) Mandibular displacement is within the normal range in axial view. (C) Normal growth has occurred in the left condyle and mandibular ramus.

2. Case 2

A 3-year-old girl presented to the Department of Pediatric Dentistry, Hallym University Sacred Heart Hospital, for facial fracture by car accident. Panoramic and CT (Computed Tomographic) images were taken for the diagnosis (Fig. 5).

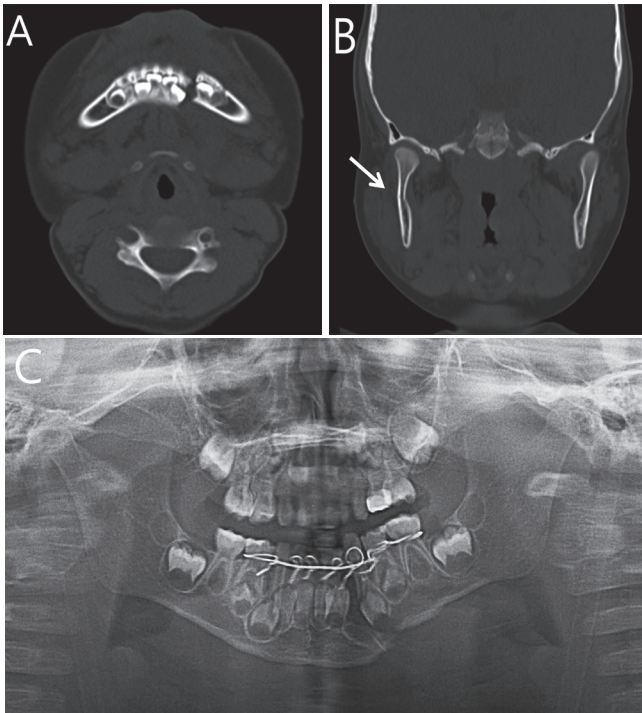


Fig. 5. (A) Facial CT view after mandibular fracture. CT view showing fracture of left mandibular parasymphysis. (B) Green stick fracture of Right condyle. (C) Panoramic view after intermaxillary fixation.

The patient was diagnosed as having fracture on the left parasymphysis of the mandible and right greenstick fracture of mandibular condyle. The patient underwent intermaxillary fixation after closed reduction under general anesthesia that remained fixed for 20 days. At the end of fixation, mandibular movements were immediately trained to prevent condylar ankylosis.

4 years after the fracture, all permanent teeth except the 2nd molar were erupted. However, the left mandibular lateral incisor involved in the mandibular fracture line, was extracted due to absence of root formation.

The mandible displaced to the left as the patient grew, and the patient gradually showed facial asymmetry. CT images obtained at the 1st visit were analyzed, but there was no discrepancy in the length that caused facial asymmetry. All the differences between maxillary heights, mandibular ramus length and mandibular body length of both sides were within normal range. These results suggest that facial asymmetry occurred since the mandibular fracture.

4 years after the fracture, CBCT images were obtained to follow-up for fracture site and analysis facial asymmetry. The left parasymphysis site was healed with irregular contour and the right condyle showed normal shape (Fig. 6). Clinically, the patient had no symptoms of TMJ disorders. The length of the left mandibular ramus was 10 mm shorter than that of the right. This resulted in left displacement of the mandible and facial asymmetry.

Considering the age of the patient, the degree of facial asymmetry rapidly increased during the maximal growth spurt (Fig. 7). To prevent further facial asymmetry, Treatment with hybrid appliances was initiated after the 4 year follow-up (Fig.

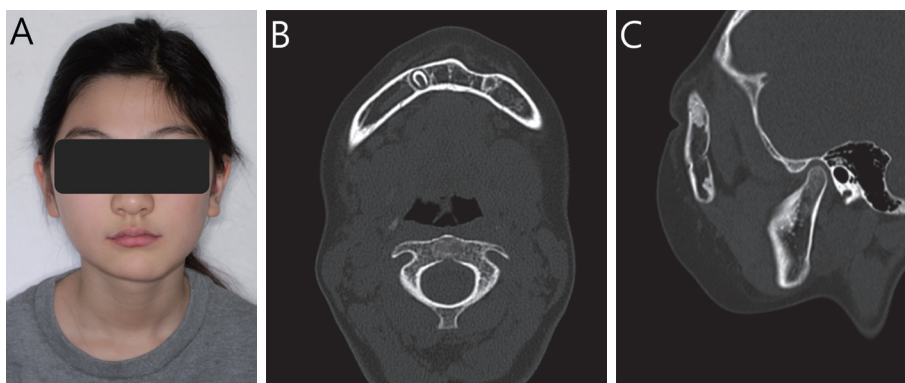


Fig. 6. Clinical photo and 3D CT view after 4 years. (A) Facial asymmetry is seen in frontal photo. (B) The left parasymphyseal region is healed with irregular contour. (C) No specific findings on right condyle.

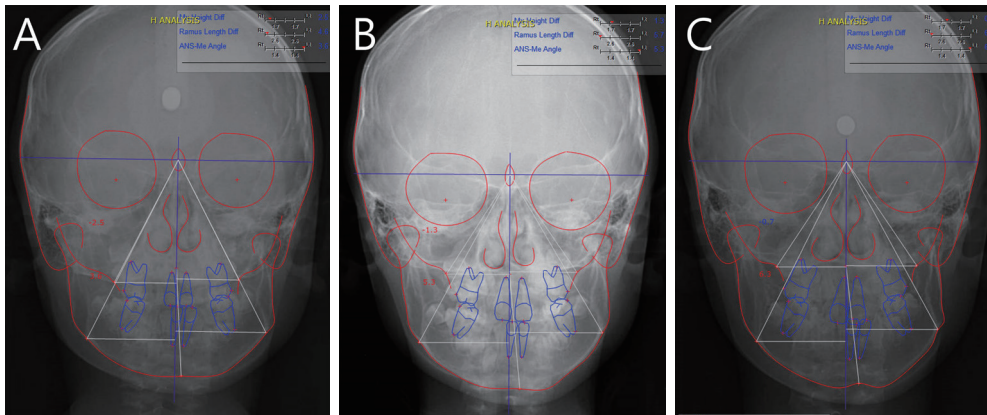


Fig. 7. A Series of Anteroposterior cephalometric radiographs. (A) 3 years after trauma, (B) 4 years after trauma, (C) 6 years after trauma. From this time on, a hybrid appliance was used.

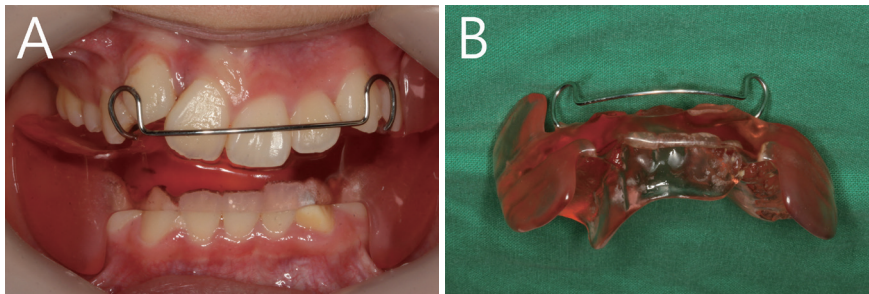


Fig. 8. Clinical photographs. (A) Frontal view of Intraoral photographs. (B) Hybrid appliance.



Fig. 9. Clinical photographs. (A) Before the use of hybrid appliance. (B) 3 years after using hybrid appliance. There is a decrease in facial asymmetry. (C) Intraoral photo before the use of hybrid appliance. (D) 3 years after using hybrid appliance.

8). The patient showed skeletal class II tendency with mandibular undergrowth. The mandible was moved 4 mm forward and 4 mm to the right to obtain the construction bite. The left buccal shield was included to the appliance in order to obtain the skeletal growth of the left mandibular ramus, and selective grinding on the left bite block was performed for left molar extrusion. The patient was instructed to use the hybrid appliance for at least 12 hours a day.

After using the hybrid appliance for 2 years, the length of the left mandible was 9 mm shorter than that of the right. The mandible was still displaced to the left but has shown a clinical decrease. Facial asymmetry no longer increased after using the hybrid appliance (Fig. 9).

The patient will receive comprehensive orthodontic treatment and will be evaluated for the need to undergo orthognathic surgery after jaw growth is completed.

III. Discussion

This case report describes the long-term observation of two patients with facial asymmetry after mandibular fracture.

The goal of treatment for mandibular condylar fractures in children is to restore normal jaw function, maintain normal occlusion, and induce normal mandibular growth and development. Most authors have suggested conservative treatment of mandibular fractures in children, particularly fractures of the condylar area. This is a non-surgical approach and includes observation, soft diet intake, early mobilization, physiotherapy, intermaxillary fixation, and functional appliance use. Conservative treatment produces satisfactory long term outcomes in terms of proper functioning of the mandible, stability of the occlusion, and esthetics. Serious asymmetry due to condylar fractures is rare, and it causes impaired mandibular development only in 15 - 20% of patients[9-12].

Children's bones are more flexible and resilient when they experience trauma because the compact bone is relatively thinner than that in adults. Therefore, children tend to experience greenstick fractures or incomplete fractures without large displacements. Children may also be less likely to complain of pain or changes in occlusion due to fractures. For this reason, it is possible that the diagnosis will not be made immediately after the fracture occurs. In the 1st case, the patient did not visit dentist immediately after injury. The patient's history of trauma and radiographic and clinical findings suggest that fractures occurred in the past.

Various complications may occur after mandibular fracture, including malunion, malocclusion, and ankylosis. Growth disturbance may also occur especially after mandibular condylar fracture, as a result of direct damage to the condyle or limited function by scarring or fibrosis of surrounding tissue. Regarding the 1st case, since time has passed after the fracture occurred, it is difficult to know exactly where the fracture occurred then. Radiologically, the left mandibular ramus and left condyle fracture are conjectured. On the otherhand, the 2nd case showed a fracture of the mandibular symphysis and a green stick fracture of the right condyle. In both cases, Patients have developed facial asymmetry since trauma, therefore asymmetry may be associated with mandibular fracture. Most cases of asymmetry caused by condylar fractures are due to inhibition of growth on the injured side. If there is severe scar tissue presented to restrict the movement of the condyle after injury, the mandibular growth is limited. In the 2nd case,

a green stick fracture occurred in the right condyle, but the growth disturbance was found in the left condyle. This may be due to a left parasymphysis fracture.

CBCT images can be analyzed to determine which part of the jaw has caused the facial asymmetry. In both cases, facial asymmetry was noted as the mandible was shift laterally. Ahn *et al.*[13] found the various causes of mandibular deviation. They found that the causes of mandibular deviation were the differences between the left and right maxillary heights, mandibular ramus lengths, mandibular ramal inclinations in frontal and lateral views, and mandibular body lengths[13]. In this case report, we compared the differences between the left and right maxillary height (Orbitale - Mesiobuccal cusp tip of upper 1st molar), mandibular ramus length (Codylon - Gonion), and mandibular body length (Gonion - Menton). In both patients, mandibular deviation occurred from marked difference in the length of the left and right mandibular ramus. The mandible is displaced to the shorter side of the ramus, and mandibular displacement is more pronounced at the mouth opening.

No orthodontic treatment was performed in the 1st patient, but the length of the left mandible increased rapidly 4 years after the trauma. As a result, most of the facial asymmetry decreased naturally. However, asymmetry does not decrease naturally in all cases. If there is a functional problem such as condylar ankylosis or muscle regression due to soft tissue scarring, growth disturbance become more severe. Catch-up growth on the shorter side is unlikely to be expected during late adolescence or adulthood, where the potential growth of the mandible decreases. Some of the reports claim that condyle has excellent restorative capacity in children under age of 12 and flattening of the articular fossa is followed[9,10,14].

As discussed in the 2nd case, hybrid appliance can be used in children who still have growth potential, but no natural improvement in facial asymmetry is observed. There have been various clinical and experimental studies on whether functional appliances affect mandibular growth. Animal studies and clinical observations have shown that external stimuli affect condylar growth[15,16]. Several authors have reported that fixed and removable functional appliances promote the remodeling of the TMJ bone structure in patients with abnormal condyles and facial asymmetry. Kahl *et al.*[17] used a hybrid appliance in five patients with hemifacial microsomia and achieved occlusal enhancement and decreased facial asymmetry in all patients. Further, the amount of muscle and soft tissue as well as bone was considerably compensated after using the hybrid appli-

ance[7,15,17,18].

However, it is difficult to accurately predict the effect of the appliance, and patient cooperation is still important. The degree of initial asymmetry, the age at the start of treatment and the state of dental malocclusion are also factors affecting treatment efficacy. Quantitative analysis on the amount of asymmetry between pre-treatment and post-treatment with appliance will be necessary in the future.

IV. Summary

Facial asymmetry can occur as a complication of mandibular fracture in a growing child. However, it can be resolved by stimulating the growth of the fracture site in growing patients. To reduce asymmetry during growth, a hybrid appliance can be used to obtain skeletal growth and dental compensation. Patients with facial asymmetry need to be followed up until the completion of jaw growth, and orthognathic surgery may be needed in some cases.

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국문초록

안면 비대칭을 보이는 아이의 장기 추적 관찰 : 증례보고

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하악의 골절은 아이들의 악안면 영역 골절 중 높은 빈도로 발생하며, 성장기의 환자에서 악골의 골절은 성인의 골절과 구별된 처치가 필요하다. 골편의 변위가 심하지 않다면 비관혈적 정복술과 추가적인 악간 고정을 시행할 수 있으며 악관절 강직을 예방하기 위한 기능적 운동이 필요하다.

하악의 골절 이후 여러 합병증이 발생할 수 있다. 특히 과두 골절의 경우, 골절 이환 측에서 성장장애를 일으켜 부정교합과 안면비대칭을 야기할 수 있다.

하악의 골절 이후 성장 장애가 발생한 경우, 환자에 따라 catch-up growth가 일어날 수 있으므로 주기적인 관찰이 필요하다. 성장 장애가 지속되는 경우엔 안면 비대칭이 심해지는 것을 방지하기 위해 기능성 장치의 사용을 고려할 수 있다.

본 증례에서는 하악의 골절 이후 안면비대칭을 보이는 2명의 환자를 장기적으로 관찰하고 의미 있는 결과를 나타내고 있기에 이를 보고하는 바이다.