Alternative Management Approach of Dislocation and Hemarthroses of the Mandibular Condyle into the Middle Cranial Fossa in a Mixed Dentition: A Case Report and Review of the Literature

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Abstract

This case represents an alternative and more feasible approach to successful reduction of an intact condyle into the middle cranial fossa in a child with mixed dentition. We describe the treatment of a 7-year-old female who fell off her bicycle resulting in right mandibular condyle dislocation into the middle cranial fossa. The patient was taken to the operating room and the right mandibular condyle was manually disimpacted. Brackets and orthodontic bands were cemented on teeth, and inter-arch stainless steel ligatures ties were placed for inter-maxillary fixation for a period of four weeks. Our conservative management was successful resulting in no relapse or ankylosis of the condyle. Orthodontic appliances can provide a good alternative to conventional approaches for maxillomandibular fixation. Arch bars in the mixed dentition are sometimes difficult to stabilize with compromise in maintaining adequate oral hygiene. For a child, orthodontic bracketing is a far more acceptable modality of treatment.

Case Report

Condyle dislocation is defined as displacement of the condyle out of the glenoid fossa while it still remains within the joint capsule [1]. The condyle can be dislocated in many directions, with antero-medial and anterior dislocation being the most common [2-4]. On the contrary, dislocation of an intact condyle into the middle cranial fossa is very rare [2-4,6]. In general the condyle has a large head size compared to the glenoid fossa which makes luxation out of the glenoid fossa much more difficult. Impact to the condyle from trauma more commonly results in ipsilateral or contralateral neck fracture as a defense mechanism preventing the intrusion of the condyle into the brain [6-8]. Despite these characteristics of the condyle there have been cases reported where the intact mandibular condyle has been dislocated into the middle cranial fossa without the condyle fracturing itself. The purpose of this case report is to provide an alternative management of this type of dislocation in a young child in the mixed dentition.

A 7-year-old female fell off her bicycle and struck her chin to the ground on June 15th, 2013. She was taken to the emergency room at a regional hospital where her chin laceration was repaired. According to the patient’s mother she did not have any loss of consciousness at the time of the incident. X-rays of the mandible were done and the patient was discharged home. The next day the mother came to Geisinger Medical Center stating that her daughter felt worse. She was complaining of headaches, jaw pain and dizziness with multiple episodes of nausea and vomiting. A maxillofacial computed tomography (CT) and a head CT were ordered.

Upon clinical examination, the patient had moderate pinpoint tenderness to palpation in the right temporomandibular joint (TMJ) and preauricular area. Swelling and trismus were noted with a maximum incisal opening of 5 millimeters, and a slight deviation of the lower third of the face to the affected side. She was alert and oriented to person, place, and time and neurologically stable. She had no cranial nerve or sensory deficit. In the emergency department Trauma Surgery, Ear Nose Throat, Pediatric Neuropsychology, Oral and Maxillofacial Surgery (OMFS) and Neurosurgery were consulted. Maxillofacial CT revealed a comminuted fracture of the squamous portion of the right temporal bone fracture in the TMJ region and dislocation of the intact right mandibular condyle into the middle cranial fossa (Figures 1a and 1b). The patient was admitted to the Pediatric Trauma Surgery Service. From Neuropsychological and Neurosurgery testing, the patient was found to have normal...
cognitive ability and mental status with no evidence of psychiatric or neuropsychological problems including post-traumatic amnesia.

Five days following the incident, the patient was taken to the operating room by OMFS and Pediatric Dentistry. The right mandibular condyle was manually disimpacted from the right middle cranial fossa without any complication. Occlusion was reestablished with repeatable occlusion demonstrated. Intra-operative radiographs including lateral skull and Towne views were taken to verify the position of the condylar head. Pediatric Dentistry placed orthodontic bands on the maxillary and mandibular permanent first molars. Orthodontic brackets were placed on the maxillary and mandibular permanent central incisors and primary canines. Upper and lower stainless steel arch wires, and inter-arch stainless steel ligatures ties were placed for inter-maxillary fixation (IMF) (Figures 2a and 2b). A post-operative maxillofacial CT was taken and the position of condyle in the glenoid fossa was confirmed (Figure 3). Neurosurgery determined that no further surgical intervention was needed unless the patient became symptomatic indicating a neurological deficit. The patient was kept in the hospital for one day post operatively by Pediatric Trauma Surgery and was followed by OMFS. Post-operatively the patient had continuing headaches and blurred vision in the right eye and was evaluated further by Ophthalmology and Neurosurgery. From their perspective the patient's complaints were consistent with underlying post-concussive symptoms with no changes in vision.

At the patient's one-week follow-up appointment with OMFS, the patient's light wire fixation was changed to elastic fixation for three weeks (Figure 2b). The patient was followed up on a weekly basis. At one month follow-up, the elastic fixation was removed. Orthodontic appliances were left affixed to the mixed dentition. Following release of the elastic traction, the patient had marked limited and painful opening with maximum incisal opening of five millimeters. The patient also continued to complain of occasional headaches, however the blurred vision had resolved. A maxillofacial CT was performed again and revealed bone like deposition around the condylar head, which appeared reactive in nature without gross displacement into the skull. Based on these findings possible hemarthrosis with subsequent ankylosis of the condyle was suspected (Figures 4a and 4b). Based on the clinical presentation and radiographic findings the patient was taken back to the operating room for manipulation of the TMJ under general anesthesia. On August 13th, 2013 the patient was evaluated intraoperative to ascertain the movement of the right condyle including translator movements. Following manual manipulation of the TMJ the patient was opened to 30 mm. After the patient was stabilized in Post Anesthesia Care Unit, she was discharged to home and followed-up as an outpatient.
The patient began physical therapy after the second operation and progressed quite well without pain or significant restriction of motion with a stable occlusion. The patient was followed up inconsistently over seven months due to multiple broken appointments. In her last visit the orthodontic appliances were removed. Upon clinical examination the TMJ was non tender and without click or crepitus bilaterally with maximum mouth opening of more than 20 millimeters with mild deviation to the ipsilateral side.

Discussion

There are multiple factors that predispose a patient to displacement of the condyle into the middle cranial fossa, including the morphology of the condyle, such as a small and/or rounded condylar head [5,6]. Impact with an open mouth, unopposed posterior occlusion, temporal bone pneumatization, and congenital anomalies can all increase the risk of displacement of the condylar head into the middle cranial fossa [1,3,9-13].

According to Rosa, et al. [13] there have been approximately 56 cases of displacement of the condyle into the middle cranial fossa with 37 of those cases reported in detail [13]. Of the reported cases there have been very few reports of this injury in young children with a mixed dentition (Table 1). Eleven cases of children under twelve years of age with intrusion of the intact condyle into the middle cranial fossa are represented in table. The case reports that involved fracture of the condyle, such as a small and/or rounded condylar head [5,6].

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This may be due to underdeveloped medial and lateral poles of the condyle in younger patients [11,14,15].

Signs and symptoms during clinical presentation of patients with condyle displacement into the middle cranial fossa immediately following the injury are valuable diagnostic clues to ensure prompt identification and treatment of this injury. Common clinical presentations include facial asymmetry with chin deviation towards the affected side, malocclusion, trismus, anterior open bite, pain in the preauricular region, and cerebrospinal fluid leakage or bleeding from the ear on the injured side [10,11,13,14,16-19]. Neurological deficits can also manifest in these types of injuries including facial nerve injury, hearing loss and loss or altered state of consciousness [6,20-24].

For definitive diagnosis CT imaging has become the gold standard of imaging for this type of fracture [1]. For optimal treatment many factors need to be considered on an individual basis including the patients age, treatment delay, extent of condyle displacement into the middle cranial fossa, neurological symptoms and involvement of adjacent vital structures including the middle meningeal artery, posterior cerebral artery, and dural tears [3,19]. Different treatment options have been presented based on these factors from closed to open reduction with or without reconstruction of the glenoid fossa.

According to Kroetsch, et al. [14], closed reduction is a safer procedure as it minimizes neurological injury. They state that open reduction should be reserved for cases where other factors exist; such as if there has been a delay in the patient's treatment and diagnosis, or closed reduction has failed. Neurological consultation is an important consideration as some patients may not initially present a neurological deficit but may develop deficits in a delayed manner. Similarly, in young children, closed reduction has been advocated for injuries that are diagnosed early within a four week post injury period where there is none urological deficit [10,11,13,17,22].

In our case we chose to do closed reduction of the condyle and IMF utilizing orthodontic brackets. The patient did not have any neurological deficit and no significant fracture of the condylar itself. Of the reported cases of this injury in children with a mixed dentition no study was found to use orthodontic brackets to manage elastic IMF in the healing phase (Table 1). Our approach considers two important factors; one is the psychosocial aspect of using arch bars for IMF and secondarily the difficulty of placing arch bars in children with mixed dentition. Utilizing orthodontic brackets for IMF was much more feasible and acceptable to the patient and parent in this case.

Some authors have suggested to reconstruct the glenoid fossa in order to prevent recurrence of displacement of the condyle back into the middle cranial fossa [14,15]. Defacianis, et al. [25], reported unsuccessful results ten days after an immediate closed reduction in a 6-year-old girl which led to open reduction and reconstruction of the glenoid fossa after seven months. However, the study did not disclose if there was a post-operative maxillofacial CT taken which would have indicated if the condyle had been successfully reduced in the first attempt, potentially eliminating the need for an open reduction procedure. In our case report the patient had no recurrences, and no problem with joint function or facial asymmetry. However, despite a short period of IMF as the initial management, a hemorrhoses did develop [26,27].
Conclusion

Use of orthodontic appliances can provide a good alternative to conventional approaches for maxillomandibular fixation. Our conservative management was successful resulting in no relapse or ankylosis of the condyle. However, a second procedure was required in this case due to patient non-compliance with physiotherapy.

The use of orthodontic appliances affords clinicians options regarding elastic traction especially in the immediate post-traumatic

<table>
<thead>
<tr>
<th>Year</th>
<th>Authors</th>
<th>Gender/ Age</th>
<th>Unilateral or Bilateral</th>
<th>Mechanism of Injury</th>
<th>Number of days prior to surgical intervention</th>
<th>Operation</th>
<th>Duration of stabilization (days)</th>
<th>Glenoid Fossa reconstruction</th>
<th>Neurologic deficit</th>
<th>Follow-up</th>
<th>Post Operation/ relapse</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Magge et al.</td>
<td>F/12 U</td>
<td>Unilateral</td>
<td>Fell off bike and struck her chin</td>
<td>Immediate</td>
<td>Closed reduction of intact condyle with MMF</td>
<td>30</td>
<td>yes</td>
<td>NS</td>
<td>1 year</td>
<td>Slight deviation of jaw to the right from loss of lateral pterygoid function</td>
</tr>
<tr>
<td>2006</td>
<td>Rosa et al.</td>
<td>F/5 U</td>
<td>Bilateral</td>
<td>Possible MVA 3 years prior</td>
<td>NS</td>
<td>Open reduction separating condylar neck and leaving the head in middle cranial fossa</td>
<td>none</td>
<td>no</td>
<td>NS</td>
<td>not reported</td>
<td>Not reported</td>
</tr>
<tr>
<td>2005</td>
<td>Cillo et al.</td>
<td>M/7 U</td>
<td>Bilateral</td>
<td>MVA and struck chin on the ground</td>
<td>Immediate</td>
<td>Open reduction by temporal craniotomy and MMF</td>
<td>21 days</td>
<td>yes</td>
<td>no</td>
<td>6 months</td>
<td>Deviation to the right on wide opening</td>
</tr>
<tr>
<td>2001</td>
<td>Kroetsch et al.</td>
<td>F/6 U</td>
<td>Unilateral</td>
<td>MVA and struck chin on the window</td>
<td>Immediate</td>
<td>MMF</td>
<td>14 days in MMF then 14 days in training elastics</td>
<td>no</td>
<td>no</td>
<td>24 months</td>
<td>Slight deviation to the left, progressive facial asymmetry</td>
</tr>
<tr>
<td>2002</td>
<td>Baron et al.</td>
<td>F/8 U</td>
<td>Bilateral</td>
<td>Fell off bike and struck her chin</td>
<td>Immediate</td>
<td>Closed reduction of intact condyle with MMF requiring secondary treatment with open reduction</td>
<td>10 days</td>
<td>yes</td>
<td>no</td>
<td>10 months</td>
<td>Improvement in facial asymmetry, mouth opening and deviation</td>
</tr>
<tr>
<td>1990</td>
<td>Baldwin et al.</td>
<td>M/10 U</td>
<td>Unilateral</td>
<td>Chin blow by an opponent's knee in a game</td>
<td>Immediate</td>
<td>Failed closed reduction with manipulative reduction secondarily used Ferguson gag between teeth on ipsilateral side of the injury with MMF and elastics</td>
<td>14 days</td>
<td>no</td>
<td>no</td>
<td>24 months</td>
<td>Degenerative changes of condyle</td>
</tr>
<tr>
<td>1989</td>
<td>Paulette et al.</td>
<td>F/11 U</td>
<td>Unilateral</td>
<td>Fell off bike and struck her chin</td>
<td>7 days</td>
<td>Closed reduction using towel clip with MMF with wires and elastics</td>
<td>unknown</td>
<td>no</td>
<td>no</td>
<td>10 months</td>
<td>Minimal deviation</td>
</tr>
<tr>
<td>1985</td>
<td>Copernhaver et al.</td>
<td>F/9 U</td>
<td>Bilateral</td>
<td>Fell off bike and struck her chin</td>
<td>2 days</td>
<td>Closed reduction using a molt mouth prop and secondary directed manual reduction with MMF</td>
<td>21 days in MMF then 14 days in training elastics</td>
<td>no</td>
<td>no</td>
<td>8 months</td>
<td>Minimal deviation and slight resorption of condyle after 8 months</td>
</tr>
<tr>
<td>1983</td>
<td>Ihalainen &amp; Tasanen</td>
<td>F/11 U</td>
<td>Unilateral</td>
<td>Fell off bike and struck her chin</td>
<td>Immediate</td>
<td>Closed reduction with manipulation, no MMF</td>
<td>N/A</td>
<td>no</td>
<td>no</td>
<td>18 months</td>
<td>Mild deviation, progressive remodeling of condyle</td>
</tr>
</tbody>
</table>

Table 1: Reported Cases of Intrusion of Intact Mandibular Condyle into the Middle Cranial Fossa for patients under age of 12.
period. Arch bars in the mixed dentition are sometimes difficult to stabilize with compromise in maintaining adequate oral hygiene. For a child, orthodontic bracketing is a far more acceptable modality of treatment. The importance of long-term follow-up with clinical examination and CT imaging cannot be overstated particularly in children under age 10 as ankylosis and/or facial asymmetries are potential sequel following condylar injury in the growing patient [1].

Acknowledgements

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