Pediatric Condylar Fractures - A Literature Review

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Abstract:
Background: Treatment of paediatric condylar fracture is laced with controversies regarding its management, choices ranging from simple conservative approaches to closed reduction and to open reductions. *Material and Methods*: A thorough search of online database (pubmed) was conducted to include articles between 2010-2020. Prospective and retrospective studies, case series and case reports are included, and articles on animal studies, articles in other languages are excluded to include a total of 33 articles. *Results*: A total of 544 paediatric patients had consular fracture between 2010-2020, of which 66.38% of them were male. Closed reduction (65.99%) was the most used modality in the treatment of paediatric condylar fracture patients. *Conclusion*: Proper selection of treatment modality is of prime importance to obtain long term effective functional results.

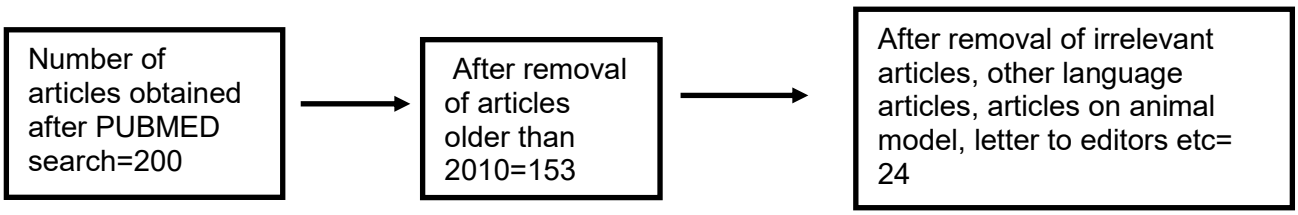
Keywords: Pediatric condyle, Growth, Management

Introduction

Condylar fractures in paediatric population is common and it accounts for 29-52% of mandibular fractures and 11-16% of all facial fractures. Its management still remains a controversy with various surgical and non surgical options[1]. With mandibular condyles being the secondary growth centre in the craniofacial region, any disturbances in normal functioning can lead to an array of problems ranging from TMJ disorders, facial asymmetry affecting adjacent facial structures like the orbit, zygomatic bone, maxilla & the mandible on both the injured and the non-injured sides[2-3]. The most common etiology remains the road traffic accidents causing direct or indirect transmission of forces to the condyle[2]. Malocclusion, temporomandibular joint pain on palpation, some degree of trismus, deviation of the jaw towards the affected side on maximum mouth opening, limitation in lateral excursive movements towards the unaffected side, abrasion or laceration over the chin, external acoustic meatus rupture and bleeding and could also be associated with cerebrospinal leak and otorrhea with skull base fracture[4]. Non surgical options like inter maxillary fixation, guiding elastics, physiotherapy are recommended when especially in paediatric population in cases of high subcondylar or intracapsular fractures and in cases where functional occlusion can be achieved through this treatment modality[2-3]. Surgical options include open reduction, proper repositioning of condylar head and internal fixation. This article reviews the demographics, various treatment modalities used and associated complications.

Material And Methods: A thorough PUBMED database search was performed through search engines by using words like "paediatric" "mandibular condylar fracture". Search revealed a total of 200 articles. After removal of articles older than 2010, a total of 153 articles were considered. Irrelevant articles, articles on animal studies, articles in other languages, articles with out full texts were removed to finally consider a total of 53 articles. Flowchart describing the process of selection is depicted in figure 1.

Figure 1: Flowchart Describing the Selection Process



Results:

A total of 200 articles were obtained on database search and finally 24 full text articles were retained to be considered in the review. Articles older than 2010, articles on animal models, other language articles were excluded. It includes 3 prospective studies, 10 retrospective studies, 2 case series, 10 case reports. The articles were analysed to included the number of patients, gender, age of the subjects, treatment modality used, complications of the treatment and follow-up. The results of the review are presented in table 2.

Table 2: Literature Review Results

Article citation	Type of study	Number of patients/ gender	Age	Treatment modality	Complications of treatment	Follow up
Xu y et al[2]	Case report	1	10 years	Closed reduction with orthodontic fixed appliance and elastic traction	None	49 months
Yildirim Y et al[3]	Case report	1-M	18 months	Conservative management	None	14.5 years
Politis c et al[4]	Case report	1-M	4 years	Conservative management	None	-
Liu M et al[5]	Retrospective study	20, 10-M, 10-F	Mean age 7.55+/-0.43years	Removable occlusal splint	Ankylosis (n=1) ADD with reduction (17/24 joints)	1 year

Article citation	Type of study	Number of patients/ gender	Age	Treatment modality	Complications of treatment	Follow up
Zhang L et al[6]	Retrospective study	9 (5-M, 4-F)	Mean 5.7 years	ORIF	TMJ pain(n=2) Retrusion(n=1) Opening deflection and Limited laterotersion (n=1)	69.3months
Wu et al 7	Retrospective study	13 (11-M, 2-F)	Mean-6.85 years	Closed reduction, IMF screws & semi rigid elastic band	Screw loosening (n=3) Mucosa coverage (n=4) TMDs (n=5)	28.6 months
Akbay E et al[8]	Case report	1-M	3 years	Asymmetrical occlusal splint with IMF & botulinum toxin A	None	30 days
Bansal A et al[10]	Retrospective study	100 (69-M, 31-F)	Mean age-6.91+/-3.04 years	Closed reduction (n=77) ORIF (n=23)	Deranged occlusion & mobility in closed group (n=1)	Closed group-1.08+/-0.22 years. ORIF-1.08+/-0.24 years
Barbosa AA et al[11]	Case report	1-F	10 years	ORIF	None	-
Chen Y C et al[12]	Case report	1-M	7 years	Conservative management	None	-
Jabrizi et al[13]	Prospective study	61 (31-M, 30-F)	Mean age-8.3	closed reduction-Arch IMF & arch bar with guiding elastics	TMDs(n=15)	1 year
Zhou H et al[14]	case series	2-M	11 years	conservative	none	1 year
Schiel S et al[15]	prospective study	6 (1-M, 5-F)	Mean-13.4	ORIF-endoscopic	None	18-35 months

Article citation	Type of study	Number of patients/ gender	Age	Treatment modality	Complications of treatment	Follow up
			years			
Cooney M et al[16]	retrospective study	49 (38-M, 11-F)	Mean-12 years	Closed reduction-MMF	TMDs(n=1), Lateral open bite(n=2), deviation(n=1)	1-133 weeks
Zhao Yu-ming et al[17]	Retrospective study	40 (17-M, 23-F)	Mean 8.5 years	Occlusal splint	TMJ clicking (n=1), Lateral deviation (n=2).	1 year
Lesto R et al[18]	Case report	1-M	8 years	Closed reduction-dynamic elastic therapy	none	-
Cascone et al[19]	Prospective study	21 (13-M, 8-F)	Mean - 12.71	Open reduction and External fixation	TMDs(n=1), Visible scar(n=1), Temporary nerve weakness (n=3)	1 year
Grow et al[21]	Case report	1-F	4 years	Transracial Steinmann pin	none	3 months
Ghasemzadeh [22]	Retrospective study	64	8.2 years	Closed reduction	malocclusion (n=5) Facial asymmetry (n=2	Median-81 days
Farber et al[23]	Retrospective study	5 (3-M, 2-F)	6.8 years	IMF with silk sutures, bone screw fixation	none	-
Vasnever et al[24]	Case series	7 (4-M, 3-F?)	6.1 years	ORIF	None	15 months-6 years
Mcgoldrick et al[25]	Retrospective study	44 (39-M, 5-F)	11.4 years	Conservative management	malocclusion (n=2)	196 days

Article citation	Type of study	Number of patients/ gender	Age	Treatment modality	Complications of treatment	Follow up
Mc Nicholas	Case report	1	-	IMF with paramedic palatal fixation	-	-
Kim et al	Prospective study	11 (8-M, 3-F)	mean-7.81 years	K wire & closed external reduction with rubber traction	None	29.3 months
Leuin et al	Retrospective study	83 (61-M, 22-F)	9.1 years	conservative (n=26), Closed Treatment (n=56) ORIF (n=1)	Mild TMDs (n=6), severe (n=24)	-
Elsayed et al	Case report	1-M	6 years	ORIF	none	-

Non-Surgical Management:
A total of 20 articles described the use of conservation methods or non surgical closed reduction methods in the treatment of paediatrics condylar fractures (n=530). Conservative treatment included soft diet, early mobilization, and close observation of the occlusion and is indicated in cases with normal occlusion[13]. Closed reduction is recommended in cases with deranged occlusion and is treated by the application ofeither orthodontic fixed appliances or intermaxillary fixation with arch bar and 0.012-inch wire for 7 to 12 days or arch bar and elastics without rigid intermaxillary fixation for 7 to 12 days followed by functional exercises.Most of them showed no significant difference between the treatment options[14]. Occlusal splints that are semi rigid given for 1-3 months, to be worn 24hrs a day until the restoration of previous occlusal relationship. The factors determining the thickness of the splint include age, developmental stage of the dentition, level of the fracture and degree of dislocation. In patients treated with closed reduction, mouth opening exercises are advised from 3rd week after injury till 6months, which includes protrusive movements, contralateral excursions and vertical opening exercises[17]. One of the articles described the use of 0- silk sutures that are tied around individual erupted molars and canines in both the mandible and maxilla and on obtaining the Centric occlusion the silk sutures are tied tightly to each other. Suture removal is done on clinical evidence of fracture healing [24]. Few articles presented cases in which IMF screws were placed to provide closed reduction with either rigid fixation or elastic tractions. One article used asymmetrical occlusal splints as a treatment modality followed by administration of botox to correct the persistent condylar angulation by injecting into the muscles of mastication like the masseter, temporalis and the medial pterygoid muscle. With the purpose of blocking the downward traction of the mandible resulting from the masseter and temporalis and medial traction by the medial pterygoid muscle. Percutaneous via extra oral Injections into the masseter and temporalis, while transoral approach for themedial pterygoid showed significant recovery and fusion of condyles by day 30 [8]. Another article described the use of paramedic palatal screw fixation in order to provide inter arch fixation circum-mandibular wire placement around the mandible and a wire looped around the maxilla as a superior point of fixation. Drill osteotomy initiated approximately 1cm behind the central incisors towards the piriform aperture. Wire placement through the drill hole is used to anchor the maxilla so as to achieve maxillomandibular fixation by twisting it with the circummandibular wire [27].

Surgical Management:

6 articles described the use of ORIF for the treatment of condylar fractures. It was indicated in cases with displacement of condyle into cranial fossa or displacement of >30 degrees. The fractures segments were stabilised using Titanium plates and screws or bioresorbable plates. The implanted titanium plates had to be removed within 4-6 months to prevent growth restriction by the hardware in contrast to bioresorbable plates that didn't need a second surgery for its removal. Approaches used were either pre auricular or retromandibular approach and placement of 2 plates of 1.5 mm with 4 holes[6,10,11,25,31].One study used a transoral approach for endoscopic assisted open reduction and internal fixationusing mini-plates with an aid ofa 30 degreeangled 4-mm-diameter Hopkins endoscope[15].

Other Methods:

Cascone et al, described the use of external fixation (n=21) in the treatment of paediatric condylar fractures, given the evidence of long term complications with closed reductions and concerns associated with implanted hardware used following ORIF affecting the growth, they described the use of open reduction and external fixation with insertion of 2 pairs of pins, 1 on the condylar head, and 1 at the level of the mandibular angle. The recommended distance between the pins in each unit not >1 cm. They reported good morphologic and functional parameters in the long term and TMD in a single patient [19].

Grow et al, presented a case of bilateral condylar fracture along with symphysis fracture where following manual closed reduction, transfacial Stein man pin is placed through the angles of the mandible, followed by circumm and ibular wire placement. Maxillomandibular fixation maintained for 2 weeks. Attainment of full range of jaw motion, facial symmetry with class 1 occlusion and absence of deviation or pain on full oral excursion noted at the end of 3 months along with radiological evidence of complete healing of the fracture [21].

Kim et al, described the method of closed reduction with threaded kirschner wire and external rubber traction. Threaded kirschner wire insertion into the fractured condylar segment percutaneously within a 5–7 mm anterior portion of the tragus or in the tarsal notch area. After the insertion of the threaded kirschner wire into the displaced condylar segment and primary closed reduction, bending of the exposed distal tip of the kirschner wire and application of rubber traction is done. This customised equipment is made using a plastic cup, foam dressing material, a rubber band and a wooden tongue depressor [28].

Complications:

Complications Of Trauma:

A total of 5 articles mentioned about the complications arising from the trauma to the condyles, 1 article reported a case with inferior alveolar nerve entrapment in a medially displaced condyle with concomitantly enlarged lateral pterygoid process causing compression of the inferior alveolar nerve. This lead to a clinical presentation of rubbing and chewing of the right side of the lower lip causing superficial ulcerations, resulting from the hypoesthesia of the lower lip [4].

One article presented a case with bloody otorrhoea following bilateral condylar fracture. Cases with head trauma present with a similar presentation of bloody otorrhoea as a sign of skull base fractures. Given the close proximity of the external auditory canal to the Mandibular condyle, patients can present with bloody otorrhoea in condylar fractures too[12].

3 articles reported cases with TMJ ankylosis is patients with un treated trauma to the condyles. All the cases presented with progressive limitation in mouth opening and were treated with resection of the ankylotic mass under GA flooded by Interpositional arthroplastywith postoperative physiotherapy to prevent reankylosis, all the cases recovered with adequate mouth opening following surgery [23, 32, 33].

Complications Post Treatment:

It includes incomplete remodeling of the condyle, following conservative management [2]. Increase in severity of damage and delayed functional exercises, there could be sustained anterior disc displacement [5]. The temporomandibular joint (TMJ) pain and click were found in some cases 1 year after surgery and disappeared 2

years later. One patient had an opening deflection and a limited laterotrusion at the subsequent visit [6]. In patients treated with ORIF, requiring second surgery for removal of plate or loose screws [16].

Discussion:

Condylar neck fracture, followed by intracapsular fracture are the most common type of fractures. Structural weakness at the condylar neck region results in unilateral fracture following direct impact and there is no intracranialdisplacement. Bilateral condylar fracture mostly results from indirect forces transmitted to the condyles from a blow to the mandible. A radiographic investigation provides with a definitive diagnosis of condylar fractures[2].

Treatment of condylar fractures is variable and controversial. Both surgical and non surgical methods are available for management of condylar fracture. In paediatric patients, the nonsurgical approach is generally preferred especially for intracapsular or high subcondylar fractures. There are few absolute indications for surgical treatment: nonsurgical treatment cannot reestablish the pretraumatic occlusion, stability of the occlusion is limited, fractured segment is displaced into the middle cranial fossa, and patient preference. In the absence of these factors, nonsurgical approach can be considered, and whenever a nonsurgical method is as effective as the surgical one, the former is preferred[3].

Restitution remodeling is evident in children where skeletal remodeling is seen in the proximal segment after condylar fracture with complete return to normal skeletal relations in patients treated with displaced condylar fractures. Experimental studies have shown that the glenoid fossa becomes shallow and grows downwards to adapt to the new condylar position. Treatment protocol involves physiotherapy with guiding elastics for 6 weeks which allows for limitation in mouth opening and result in satisfactory functional results [3].

According to the Position paper from the IBRA Symposium on Surgery of the Head e The 2nd International Symposium for Condylar Fracture Osteosynthesis, Marseille, France 2012 Even though the faculty members fully agreed that “There is for now, no clear consensus concerning the way to treat fractures occurring in growing children”, they preferred non-surgical treat- ment in the first 5-6 years (here selected cases only). They agreed that children >12-13 years of age and adults required the same treatment strategy, and the treatment decision was based rather on biological than chronological age, especially in girls. While some faculty members advocated ORIF for severely displaced and dislocated fractures even in younger children (<6 years old) and the earlier stages of the deciduous dentition, the majority supported non-surgical treatment modalities. The decision to perform ORIF in children relied on factors influencing facial growth and appropriate age for ORIF[1]. Preauricular and submandibular/ angular approaches were most selected for open reduction. three-dimensional (3-D) plates, e.g. the trapezoidal osteosynthesis plate (Modus TCP 2.0, Medartis, Basel, Switzerland) or two straight 4-hole miniplates were preferred for fixation of condylar base and neck fractures. 3-D special plates were indicated for the lower condylar neck area [1].

Conclusion: Condylar fracture in pediatric population is ringed with controversies regarding the management due its uncommon presentations along with presence of primary teeth, permanent tooth buds as well as growth. Though acceptable remodeling can be achieved using conservative therapy, dislocated or displaced fractures are successfully treated using surgical intervention in older children.Proper selection of treatment option is necessary for effective and long term success of the management.

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