

Maxillofacial Trauma in Paediatric and Adolescent Patients

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Abstract: Maxillofacial trauma in paediatric patients is always a challenge for the surgeons. Absence of any completely defined protocols has made the initial trauma management in paediatric population very complex. Aim of this study was to perform a retrospective and prospective study to analyse the pattern and treatment of maxillofacial trauma in paediatric and adolescent patients. 100 patients of 0 -18 years age group selected from the OPD of Department of Oral & Maxillofacial Surgery, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow, and Dr. O.P. Chaudhary Hospital & Research Centre, Lucknow, from January 2014 to May 2015 Cases of paediatric and adolescent trauma were selected on the basis of inclusion criteria. This study revealed that the boys are more prone for maxillofacial trauma. Accidental falls and bike accidents were the first two etiologic causes. Children below 5 years of age are exposed to low velocity forces like falls. So soft tissue injuries are mostly seen in this age group like abrasion and laceration. Children above 13 years are more involved in outdoor activities and are exposed to high velocity forces leading to hard tissue injuries like dental fractures or facial bone fractures. Mandible was the most involved bone in facial skeleton injury in which parasymphysis and angle fractures were mostly encountered.

I. Introduction

Paediatric facial injuries are common due to children's high level of activity, decreased parental supervision, and a tendency towards risk taking behaviour. Facial fractures are uncommon injuries in children. Paediatric maxillofacial fractures are present in 1% to 15% of all facial fractures, showing different clinical features when compared with adult patients. The flexibility of the facial skeleton in children, the relative protection offered by the lack of pneumatization of paranasal sinus, and the protection of malar region by prominent buccal fat pad in children contribute to reduce the frequency of these fractures¹

The phenomenal increase in automobiles on the road has led to a tremendous rise in number of road traffic accidents leading to facial injuries of which children are the most unfortunate victims. With the future morphological and anatomical changes in mind the management of these facial injury victims becomes a more complicated and vigorous task for a surgeon.²

Chief causes are falls, violence, sports related accidents and road traffic accidents worldwide. In a paediatric patient the choice of treatment will depend on the complexity of fracture, child's age, teething stages and other concomitant injuries. Causes and incidence of maxillofacial injuries in children vary widely as a result of social, cultural and environmental factors.

The aim of this research was to review and compare the etiology, frequency and distribution of maxillofacial trauma and analyse the changes in the last 5 years in paediatric and adolescent patients treated at Department of Oral & Maxillofacial Surgery, SPPGIDMS, Lucknow.

II. Patients And Methods

This study (Retrospective and Prospective) was carried out on 100 patients of 0 -18 years age group selected from the OPD of Department of Oral & Maxillofacial Surgery, Sardar Patel Post Graduate Institute of Dental & Medical Sciences, Lucknow, and Dr. O.P. Chaudhary Hospital & Research Centre, Lucknow, from January 2014 to May 2015 Cases of paediatric and adolescent trauma were selected on the basis of inclusion criteria.

Falls, sports related injuries and road traffic accidents(RTA) (include car, motorcycle, bicycle and pedestrian related accidents) constituted the frequent causes of facial fractures in

children. While young children usually sustain injuries from low-velocity forces (e.g. falls), older children and adolescents are more likely to be exposed to high-velocity forces (e.g RTA, sports related trauma). The fractures were associated to mandible, maxilla, isolated nasal bone, zygomatic bone and naso-orbito-ethmoid complex. Inclusion criteria consisted of Paediatric and adolescent patients of age 18 years or below, patients with maxillofacial trauma (soft and hard tissue) and other associated injuries and medically fit patients (ASA Grade I and II). Exclusion criteria included patients unwilling to participate in the study, incomplete information about the trauma and post surgical follow-up less than 3 months. Subjects 18 years or younger included in this study were divided into 3 groups according to ages: Group A (0-5 years, infants), Group B (6-12 years, school aged children), and Group C (13-18 years, adolescents).

III. Results

Age and Sex Distribution

Age of the enrolled subjects ranged between 8 months (0.67 years) to 18 years. Age wise distribution of subjects was as under:

Table 1: Age wise Distribution of Subjects

Age Group (years)	Number	Percentage
Upto 5 years	41	41.00
6-12 years	35	35.00
13-18 years	24	24.00

Proportion of patients aged upto 5 years was found to be highest (41.0%) followed by aged 6-12 years (35.0%) and least in 13-18 years (24.0%), this indicate that children upto the age of 5 years were more prone to traumatic accidents. Mean age was found to be 8.29 \pm 5.19 years (Median age: 7 years).

Table 2: Gender wise Distribution of Subjects

Gender	Number	Percentage
Male	73	73.0
Female	27	27.0

Above data indicate that male children were more prone to traumatic accidents (73.0%) as compared to females (27.0%). Risk for males for traumatic accidents was 2.7 times more as compared to females.

Type Of Injury

Table 3: Type of Injury

	Number	Percentage
Soft Tissue	76	76.0
Hard Tissue	16	16.0
Both (Soft + Hard Tissue)	8	8.0

In approximately two-third of cases (76.0%) only soft tissue was affected while only hard tissue was affected in 16.0% and both soft tissue and hard tissues were involved in only 8.0% patients.

Table 4: Subtypes of Soft Tissue Injuries (n=84)

	Number	Percentage
Laceration	84	100.0
Abrasion	25	29.76

Of the 84 patients in whom soft tissue was affected wound was found to be lacerated in 100.0% while in 25 (28.75%) patients abrasion was found.

Table 5: Subtypes of Hard Tissue Injuries (n=24)

	Number	Percentage
Bony Fracture	14	58.33
Tooth avulsion	3	12.5
Dento-alveolar	3	12.5
Tooth fracture	5	20.83

Out of 24 patients in whom hard tissue was found to be affected, most common injury was bony fracture (58.33%), followed by tooth fracture (20.83%) and dento-alveolar (12.5%) and tooth avulsion (12.5%).

Site Of Injury

Table 6: Site of of Injuries

	Number	Percentage
Extra-oral only	78	78.0
Intraoral only	17	17.00
Both (Extra-oral+Intra-oral)	5	5.00

Majority of the patients had extraoral injury (78.0%) while 17% had intraoral injury and rest 5% had both type of injury (Extraoral+Intraoral).

Table 7: Site of Soft Tissue Injury (n=84)

	Number	Percentage
Frontal	29	34.52
Parietal	10	11.9
Occipital	3	3.57
Temporal	1	1.19
Eyebrow	7	8.33
Nose	4	4.76
Zygoma	6	7.14
Cheek	4	4.76
Upper lip	5	5.95
Lower lip	2	2.38
Ear	1	1.19
Chin	12	14.29

Most common site of soft injury was frontal (34.52%) followed by Chin (14.29%), parietal (11.9%) and least common sites were temporal (1.19%) and ear (1.19%).

Table 8: Site of Bony Fracture (n=14)

	Number	Percentage
Subcondyle	4	28.57
Body	5	35.71
Parasymphysis	6	42.86
Angle	6	42.86
Symphysis	1	7.14

In all the patients enrolled in the study, most affected bone was mandible. Parasymphysis and angle were most common sites of fracture

Etiology of Injury

Table 9: Etiology of Injuries

	Number	Percentage
Animal hit	1	1.00
Assault	2	2.00
Bicycle accident	11	11.00
Bike accident	13	13.00
Car accident	2	2.00
Fall	63	63.00
Sports	8	8.00
	100	102

Most common etiology of trauma was fall (63.0%) followed by Bike accident (13.0%), Bicycle accident (11.0%), Sports (8.0%), Car accident (2.0%), Assault (2.0%) and animal hit (1.0%).

IV. Discussion

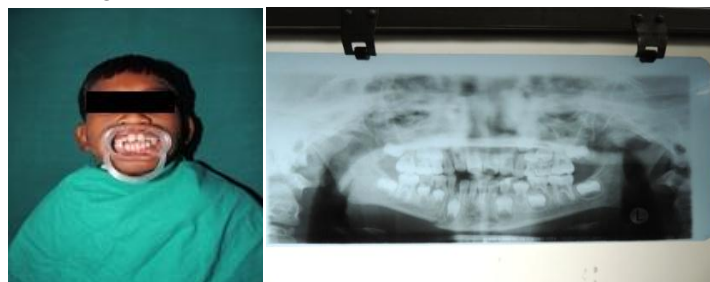
Several investigations about paediatric maxillofacial injuries have been performed to recognize their patterns and treatments. Some factors such as geographical location and socioeconomic status are related to the causes of injuries.¹

In our study, patients from 0-18 years of age were evaluated similar to other studies.^{1,3,4} According to World Health Organization, those with 0-18 years of age are considered children. But age related differences are there within this age group, like the etiology of trauma and its treatment. Protected environment of their families are provided to children less than 5 years of age which lead to minimal frequency of accidents.

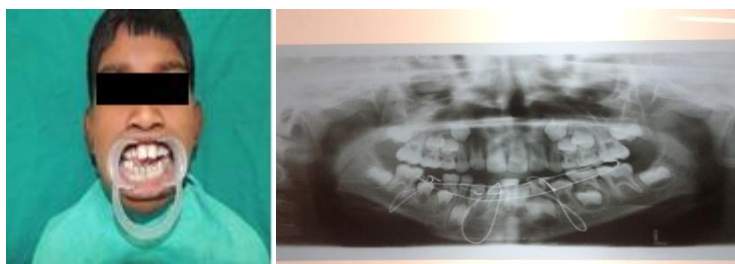
Also the frontal prominence protects the small projection of face due to lack of completion of paranasal sinuses development and presence of deciduous dentition. So, the craniofacial ratio in children is 8:1, which is 2:1 in adults. Therefore in case of children, cranium fracture is more likely to occur than a facial fracture in older children or adolescents. In maxillofacial trauma, it is also seen that boys are more involved than the girls with ratios varying from 2:1 to 6:1.^{1,3} Our results were similar to that of the previous reports. According to our study, there was rise in maxillofacial fractures with age, with maximum frequency in adolescents. Relationship between etiology and age was recorded. In patients younger than 6 years, low or middle energy trauma was seen (mostly due to falls) whereas in patients above 12 years, high energy trauma (due to road traffic accidents) were recorded. Only 2 patients below 6 years of age were reported with facial fractures (**Fig.-1& Case 1**).

Case 1) ROHIT KR - #RT parasymphysis

PREOP-



POST OP



(Fig.-1)

In our study mean age was 8.29 years which was lower than that recorded in other studies^{6,7}. Also maximum incidence of facial fractures were detected in age group of 13-18 years. Soft tissue injuries mostly recorded in 0-5 years of age compared to other studies as in dental University of Japan where 81 paediatric fractures seen in children below 15 years during a period of 14 years and a study in Nigeria showed an incidence of 40 paediatric patients below 11 years of age treated in a teaching hospital over a period of 11 years.⁸ (**Fig.-2 & case 2**).

(Case 2) Laceration



(Fig.-2)

Male: female ratio was found 2.7:1 compared to reports by Gassner et al. (2004)⁹ and Iatrou et al. (2007)¹⁰ which showed male:female ratio to be 1.8:1. We found that 73% of the paediatric trauma cases reported were boys which supported findings of other studies. It seems so because boys are more active and shows their involvement in more dangerous activities due to their more aggressive nature.

As found in our study, Falls were the most common etiology of paediatric maxillofacial fractures in 0-5 years of age group (Group A) and 6-12 years of age group (Group B); registering 85% and 65% respectively, thus leading to soft tissue trauma like laceration or abrasions(**Fig.-3 & case 3**).

Case 3) Laceration



(Fig.-3)

This report was in confirmation with reports of **Oji (1998)**⁸, **Wymann et al. (2008)**⁵ and **Scariot et al. (2009)** but in (Group C) 13-18 years of age group the most prevalent cause was Bike accidents resulting in dental fractures and bony fractures frequently.

Motor Vehicle Accidents were shown as most common etiology of facial fractures in majority of studies reviewed⁷. Increasing road traffic in Europe is probably the cause of increasing incidence of facial fractures by Motor Vehicle Accidents as reported in studies by Wymann et al. (2008). Reluctance to helmet use, raising speed limits, decreasing tolerance and roaring competitions among young men could explain the increase in incidence of maxillofacial trauma and particularly mandibular fracture.

On the other side in Malaysia, the increased value of motor vehicle accidents is mainly due to maximum use of 2 wheelers because it is the chief vehicle for transport to work and school. Also the minimum age to obtain a driving license is 16 years (**Rahman et al., 2007**). Whereas in our study we found Motor Vehicle accident represented to be the second most common cause of paediatric maxillofacial trauma accounting to be 15%.

Just as the result obtained in majority of studies, most frequently encountered in paediatric population was mandibular fracture. (**Posnick et al., 1993; Iida and Matsuya, 2002; Gassner et al., 2004; Ferreira et al., 2005; Ogunlewe et al., 2006; Imahara et al., 2008; Scariot et al., 2009**)⁷. Most commonly involved mandibular region was found to be parasymphysis compared to studies performed by **Ferreira et al., 2005; Rahman et al., 2007; Muñante-Cárdenas et al., 2010** where condylar fracture was the most frequent fracture. Lack of paranasal sinus pneumatization, osseous flexibility, thick adipose tissue together led to the absence of midfacial fractures including LeFort and Naso-Orbito-Ethmoidal fractures(**Posnick et al., 1993**). Along with this, patients with these kind of fractures are generally associated with cranium injury which are usually referred to any Level III trauma centre for being evaluated neurosurgically.

Mono-Mandibular fixation using arch bar, acrylic splint or stent or any thermoplastic material may be the only acceptable treatment option in any edentulous newly born with mandibular body or symphysis fracture. In partially edentulous (5-12 years) patients, this procedure is partially useful in case of Greenstick or minimally displaced mandibular fracture. These patients usually need Circum-Mandibular wires or any kind of skeletal suspension which should be maintained for 3-4 weeks. Lack of anatomic reduction and functional restriction were the chief disadvantages seen.

By the age of 2 years atleast 10 teeth are present in each dental arches. So, Maxillo-mandibular fixation can be achieved. Yet due to insufficient height of contour of deciduous teeth may require support of acrylic, skeletal suspension or circum mandibular wiring. Below 2 years and above 6 years of age, resorbed or missing teeth limits the use of this technique. Child tolerance, nutrition and airway problems and subsequent compliance are the major pitfalls of this technique.

As per our experience, resorbable plates show significant soft tissue inflammation, especially in peri-orbital region which lead to immobile soft leathery tissues. Semi-rigid fixation using small (1.0-1.3 mm outer

diameter) titanium plating system provides the best fixation. The hardware may then be removed after 2-3 months as their effect on child's growth is yet not clear.

In our study no surgical intervention for condylar fracture was provided. Although **Iatrou et al. (2010)** documented that open reduction and internal fixation provided satisfactory quick management of pediatric fracture, we achieved good results even with maximum patients getting treated conservatively without any reported major complication.

V. Conclusion

This study shows that the frequency of soft tissue maxillofacial trauma in paediatric patients increases with increasing age. Boys were the most common victims of maxillofacial trauma due to their involvement in more aggressive activities. The first two most common etiologies of paediatric maxillofacial trauma were falls and bike accidents.

As children younger than 5 years are more exposed to low velocity forces like falls, soft tissue injuries like abrasion and laceration were the mostly encountered trauma. Injuries below 5 years age were primarily craniofacial rather than maxillofacial due to their higher cranium to face ratio which is 8:1. Children above 15 years shows maximum involvement in outdoor activities and also they are more prone to high velocity force induced trauma like Road Traffic Accidents which mostly led to hard tissue injuries like dental fracture or fracture of facial bones.

Mandible was the most commonly involved maxillofacial bone in which parasymphysis and angle were the frequently involved regions. Trauma in paediatric patients below 5 years of age were mostly managed conservatively. For treating a jaw fracture, 2 principles which are important are: short duration of fixation with early mobilization and regular physiotherapy exercises. Emphasis on preventive measures for indoor and outdoor activities of the child must be made. Maxillofacial trauma victims in growing phase should be examined periodically to check any developing facial asymmetry or malocclusion. This study supports the view that a number of trauma related factors vary from country to country.

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