

# The Prevalent Age Group, Cause and Site of Pediatric Facial Bone Trauma at Two Tertiary Units in Pakistan

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**Background:** The pediatric oro-facial trauma is observed in Indian Subcontinent as well as in developing countries. The school group and teenage group children are frequently involved. Dento-alveolar fractures are common comparative to mandibular fractures whereas middle third of the face is exceedingly rare. The mandible is fractured at variety of sites in pediatric facial trauma. The condylar cartilage, developing permanent teeth and advancing growth, all result in injury at different sites of the mandible and hence the various treatment modalities are required to manage these fractures. In majority, the causes of fractures are accidental falls and road traffic accident (RTA). **Method:** 141 patients presented at Oral and Maxillofacial Surgery Department of Punjab Dental and Children Complex Hospitals, Lahore from September 2003 to December 2005. The age of the patients ranged from infancy to early teenage (>0 years to 15 years) with facial bone injuries. The children were divided into four groups; Group "A" (Infants), Group "B" (Pre-school), Group "C" (School) and Group "D" (Teenage). After initial examination, different radiographs (orthopantomograph, posteroanterior mandible and occipitmentalis views) were utilized to confirm the site and diagnosis. Different treatment modalities depending upon the site, bone involved and age group of the patients were used to manage the fractures. Few patients were managed conservatively. **Results:** The dento-alveolar trauma was noticed frequently in group "C" and "D" and it is 50.35% of the total facial bone trauma. The cause of the trauma in majority of the patients was by accidental falls. 40 patients were of maxillary dento-alveolar trauma and nine were of mandible. Twenty-two children had bi-maxillary dento-alveolar trauma. It was observed that the maxillary trauma was common in skeletal /dental class II div I cases. The next common bony trauma was of the mandible (45.39%). 50% of total mandibular fractures were from group "C". The site of the fracture in these patients was the body of the mandible and frequently associated with mandibular condyles (29%) whereas 9.37% of them had unilateral condylar fractures. This group had the highest frequency of mandibular fractures among facial bone fractures. Group 'D' (20.31%) of total mandibular fractures had high male prevalence (80%). Maxillary fractures were 2.83% of the total facial bone trauma. The patients had Le Fort I or high Le Fort I fractures while one patient (presented 15 days after trauma) had Le Fort III fracture. The Le Fort III patient had fall from double story building and had head injury too. Two patients had trauma due to automobile RTA. All patients of maxillary fracture were from early age group "C" and there was no associated mandibular fracture in these patients. Zygomatic fractures were 1.41% of the total facial bone trauma. One patient had fracture from fall (stairs) and other had RTA. **Conclusion:** The patterns and sites of pediatric facial bone fracture vary within age groups. Majority of facial bone trauma results in school going and early teenage groups with definite male predominance. Dento-alveolar and mandibular fractures are frequent with negligible mid face fractures. The pediatric facial bone fractures should be managed at their earliest to avoid complications.

**Key words:** Accidental falls, road traffic accident, paediatric facial bone fractures.

Children are uniquely susceptible to craniofacial trauma because of their greater cranial-mass-to-body ratio.<sup>1</sup> Number of cases of growing age trauma within oro-facial region have been observed worldwide. The common facial bones are mandible, maxilla, zygoma and nasal. The other bones of the face are less frequently involved in the pediatric facial trauma. The dento-alveolar (teeth bearing bone of maxilla and mandible) fractures are the commonest among all other facial bone fractures and the second most is the lower third of the face.<sup>2,3</sup> Fracture site tend to shift from upper to lower aspect of face with increasing age of the patient.<sup>2,4,5</sup> The etiological factors include falls, motor vehicle accidents, sport activities and child abuse.<sup>6,7</sup> Maxillofacial fractures are more commonly seen in males.<sup>7,8</sup>

In children, the facial bone fractures demonstrate different clinical features due to the less involvement of maxilla or zygoma bones as compared to dento-alveolar

and mandibular fractures. The etiological factors and fracture patterns in patients older than 10 years resemble to those found in adults.<sup>4,5,9</sup> The mandible in children is flail and relatively less plastic to other facial bones. The developing tooth buds, shedding deciduous teeth and incomplete roots of permanent teeth make the mandible more susceptible to injury. The pediatric maxillary and zygomatic bones are relatively small and more plastic in behavior.<sup>5,10</sup> The maxilla of the children has mostly dento-alveolar fracture because the maxillary sinuses are not yet fully developed. Whereas, the developing teeth and prominence of the pre-maxilla make it more susceptible to injury, in children road traffic accidents and fall, the head and face are most vulnerable.<sup>4,11</sup>

The school going children have relatively more maxillofacial injuries as compared to infants and adolescence.<sup>4,12</sup> The socioeconomic status of people in under-developed countries has strong effect on the



outcome of the facial bony trauma. Poverty and unavailability of trained specialists even worsen the treatment outcomes.

The management of maxillofacial trauma in children is different from adult as pediatric patients exhibit much more liability to emergency management, greater difficulty in clinic and radiological examination, lack of development, state of mixed dentition, faster rate of healing, concomitant intracranial & cervical spine injury more common.<sup>13</sup> The operative intervention may result in greater deformity, some of which may not manifest for several years.<sup>14</sup>

Mandibular fractures are more common relative to maxilla. The mid face fractures are exceedingly rare.<sup>15</sup> At our centers, it has been observed that the maxillofacial bony trauma is mostly caused by accidental falls (trees, stairs and roof tops during kite flying) and road traffic accidents. This study evaluates the common causes, sites and prevalent age groups of the children with facial bone fractures presented in these centers.

#### Material and Methods:

This study is conducted at Oral and Maxillofacial Surgery Departments of Punjab Dental and Children Complex Hospitals, Lahore during September 2003 to December 2005. The children from age newborn to 15 years of either gender presenting with facial bone fractures were included in the study. Previously treated and patients with pathological fractures were not included in the study.

All pediatric maxillofacial trauma patients were documented with demographic profile. A comprehensive history of the patient was recorded along with presenting complaints. The clinical examination diagnosed the case and this was confirmed radiographically by orthopantomograph (OPG), posterior-anterior (PA) face, mandibular lateral oblique, occipitmentalis and submentovertex radiographs, respective to the suspected bone fracture and patient's convenience. In few patients CT scans were also performed. The patients were divided in following four groups depending on the age of the children.

Group "A" (Infants) from >0 to 2 years.

Group "B" (Pre-school) from >2 years to 4 years.

Group "C" (School) from >4 years to 12 years.

Group "D" (Teenage) from >12 years to 15 years.

The data was exclusively gathered to express the age, related habits and patterns of facial bone fractures at that age. The causes of the injury in pediatric trauma are road traffic accidents (RTA), falls, sports and fight. The fall is mainly from height related to rural area and this occurred mostly from the trees. In urban area the cases are related to kite flying and stairs of multistory houses. RTA is mainly from bicycle ride and automobiles.

All patients were managed with either of the treatment modalities; Acrylic splints, Ivy eyelets wiring and intermaxillary fixation (IMF), Eric arch bar splints

with or without IMF, closed reduction with or without IMF, open reduction with or without IMF, closed or open reduction and suspension, open reduction with rigid fixation and conservative management with or without exercise.

The postoperative exercise and pre-auricular massage were recommended in condylar fracture to avoid complications. The open reduction, circumzygomatic and frontomandibular suspension were employed to manage maxillary fractures. The zygomatic bone fractures were treated with open reduction and rigid fixation with 1.5mm miniplates. All patients were assessed postoperatively for 12 weeks with intervals. The intermaxillary fixation (IMF), when performed, was restricted for 2 to 3 weeks and similar was in cases treated with arch bar splints.

#### Results:

The dento-alveolar fractures were noticed frequently in group "C" and "D" and it is 50.35% of the total facial bone trauma. The cause of the trauma in majority of the patients was by falls. The group "C" showed falls on the ground while walking and playing at home (not sports). 5 patients fell from stairs and 3 patients reported falls from trees whereas, group "D" showed falls from height (kite flying) as well as RTA. There were 40 patients with maxillary dento-alveolar trauma and nine were of mandible. Twenty-two children had bi-maxillary dento-alveolar trauma. It was observed that the maxillary trauma was common in skeletal /dental class II div I cases. Only two patients were from group "A" (aged 9 and 11 months) and the upper deciduous central incisors were displaced palatally, they were replaced manually without additional means of stabilization in both patients. The choice of treatment in dento-alveolar trauma was Eric arch bars and half round wires fixed from 1<sup>st</sup> premolar to 1<sup>st</sup> premolar, after reducing dento-alveolar segments.

The next common bony fractures were of the mandible (45.39%). The Group "A" (4.68%) had chin (symphysis) fractures and the cause was fall from hands and bed. They had displaced fractures and the fracture line run almost vertically between the only erupted deciduous central incisors to the lower border of mandible. These patients were treated with open reduction and microplates (1.1mm) fixation. Group 'B', (25.8%) of the total mandibular fracture, had mostly body fractures with 3 patients having associated high condylar fractures. The case of the trauma narrated by the parents was falls, mostly from the stairs or roofs. Only two patients gave the history of RTA. Group "B" was treated with occlusal acrylic splints and in five patients, Eric arch bar splints was used on the lower jaw without IMF. Two bilateral condylar fractures with no occlusal disturbance of this group were treated conservatively (no active treatment) and found no TMJ complications during six month follow up. 50% of total mandibular fractures were from group "C". The site of the fracture in these patients was the body of the



mandible and frequently associated with mandibular condyles (29%) whereas 9.37% of them had unilateral condylar fractures. This group had the highest frequency of mandibular fractures among facial bone fractures. The occlusal acrylic splints were used to treat body with condylar fractures or condyles alone. Five patients of high condylar fractures with either no or minimum occlusal disturbance, were conservatively managed. Early mobilization was advocated in them to avoid late complications. Group 'D' (20.31%) of total mandibular fractures had high male prevalence (80%). The etiology was mostly RTA and fall from height while kite flying. The fractures in this group were bilateral mandible and strong association between angle and opposite body or parasymphysis and opposite condyles were seen in these patients. Miniplates rigid fixation, Transosseous wiring and Eric arch bar splints were used to managed these patients according to the need of the fracture.

Maxillary fractures were 2.83% of the total facial bone trauma. The patients had Le Fort I or high Le Fort I fractures while one (presented 15 days after trauma) had

Le Fort III fracture. The Le Fort III patient fell from double story building and received head injury too. Two patients had trauma due to automobile RTA. All patients of maxillary fracture were from early age group "C" and there was no associated mandibular fracture in these patients. Open reduction and suspension was done without intermaxillary fixation.

Zygomatic fractures were 1.41% of the total facial bone trauma. One patient had fracture from fall (stairs) and other had RTA (bicycle). One patient was from group "C" and the patient of RTA was from group "D". The site of fracture was at frontozygomatic suture and zygomaticomaxillary buttress (sinus wall) areas in both patients and rigid fixation was performed after reduction of fragments.

The qualitative data was shown as percentage (%) for sex, etiology and site and the means and standard deviations were computed for quantitative variables for age and management modalities. The presenting age groups, gender, site and etiology of trauma are shown in table 1 and 2 respectively.

Table 1: Age groups of patients with facial bone fractures

Group	Age	Male	Female	Dento-alveolar	mandible	Maxilla	Zygoma	Total	Group %
A (Infants)	>0 to 2year	3	2	02	03	00	00	5	3.54
B (Pre-school)	>2 to 4 years	23	19	09	16	00	00	42	29.78
C (School)	>4 to 12 years	40	14	26	32	02	01	54	38.29
D (Teenage)	>12 to 15years	29	11	34	13	02	01	40	28.36
Total	-	95	46	71	64	4	2	141	100

Table 2: Facial bone injuries showing site, male to female ratio and etiology of trauma

S. No.	Bone Fractured	Male	Female	Causes of Injury					Total	%
				fall	sports	RTA	Fight	Others		
1	Dento-alveolar fracture	39	32	39	6	17	4	5	71	50.35
12	Mandibular fracture	51	13	33	3	26	1	1	64	45.39
3	Maxillary fracture	3	1	2	0	2	0	0	4	2.83
4	Zygomatic fracture	2	0	1	0	1	0	0	2	1.41
5	Pan facial fracture	0	0	0	0	0	0	0	0	0
6	Total	95	46	75	9	46	5	6	141	100
7	Percentage	67.37	32.62	53.19	6.38	32.62	3.54	4.25	100	100

**Discussion:**

The pediatric facial bone trauma requires special attention for many differences, when compared to adults. The children are more difficult to examine clinically as well as to added diagnostic tools. The pediatric facial bones heal in very short time so they should be diagnosed and managed at earliest after injury. The maxillofacial injuries in children are rare and they tend to increase with age, older children sustained facial bone fractures with yearly 14% with every year of age.<sup>16</sup> Accidental fall is most common case of facial trauma in children.<sup>16,17</sup> There is lower incidence rate in facial bone fracture in females, with male to female ratios ranging from 2:1 to 6:1.<sup>18</sup>

The greatest concern when treating the pediatric patients is the effect of the injury or treatment on growth and development. Closed reduction with maxillo-

mandibular fixation for 2 to 3 weeks is effective to reestablish occlusion in minimally displaced fractures.<sup>19</sup> Post operative infection, mal-union or nonunion are rare in children because of their greater osteogenic potential and faster healing rate. Unwanted operative intervention including unnecessary internal fixation, inadequate treatment or haemotoma and infection may lead to great long term deficits and deformities in children than adults.<sup>20</sup>

The study took place at maxillofacial surgery department of two tertiary centers of Lahore to evaluate and determine the trend, site and age frequency in pediatric facial bony trauma. The patients were presented from local as well as, referrals from vicinity areas of all over the province. Fifty percent of the total patients with facial bone were seen of dento-alveolar out of them 56.03% were of maxilla and only 12.67% were mandibular dento-



alveolar fractures. The maxilla had been observed more prominent in majority of these patients (skeletal / dental class II division I) and right side was mostly involved. The common cases were accidental falls and RTA in our study. Alveolar bone injuries in children are frequent (5 to 65%). They are common whilst mid face fractures are the least common in children.<sup>21</sup> The dento-alveolar injuries are high (56.3%) in children comparative to other facial bones.<sup>22</sup>

The patterns of mandibular fractures in children vary due to related habits and socio-economic status of the patients. The mandibular trauma is exceedingly high in school age (group 'C') showing 50% (32) of all patients with male predominance (90%). The fracture of mandible occurs in greater frequency than those of the middle third of the face in children.<sup>1,9,23</sup> There is higher incidence of condylar fractures in younger children and remarkable increase in angle fractures in older patients.<sup>23</sup> Incidence of TMJ ankylosis is reported in 1 to 7% of the condylar fractures.<sup>20</sup> The remodeling of TMJ after the condylar fractures in childhood trauma, can be seen in the OPG without complain of pain and joint in fully functional after short time. Conservative treatment of dislocated condylar proven fracture in children results in satisfactory long term outcome of jaw fracture, despite a high frequency of radiological aberrations soft tissue diet with immediate immobilization seems to be the treatment of choice. The difference in ramus height of the two sides is observed in 52% of the frequently (80%) after the condylar dislocation.<sup>24</sup> Open reduction and internal fixation of pediatric facial fractures is indicated in complex mandible, mid face and orbital fractures. The effect of rigid fixation on facial skeletal growth is not completely understood and best results are archived after unilateral displaced fracture in children less than 8 years than the older one<sup>13,24</sup>.

In our study the maxillary fractures were 2.83% and zygomatic fractures were only 1.41% of the total pediatric facial bone trauma. The results of this study coincide with the international studies. The maxilla and zygomatic bones are the least frequently injured pediatric facial bones (1.2 to 20%).<sup>1,19,21,25</sup> Maxillofacial injuries, particularly, mid face fractures in children are rare and the incidence increasing with the age above 5 years. Similarly our study showed that children with these fractures were non significant till the age of 15 years. Accidental falls and RTA resulted in these rare fractures and which were extremely unusual presentation at our centers.

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Fig. 1: Healed # mandible with facial scars

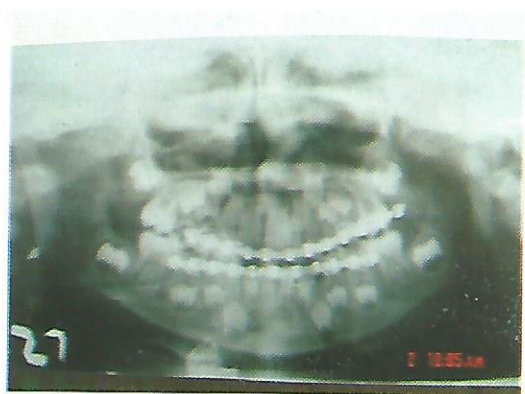


Fig. 2: Eric arch bar treated for condylar fracture



Fig. 3: Mandible with parasympyseal fracture

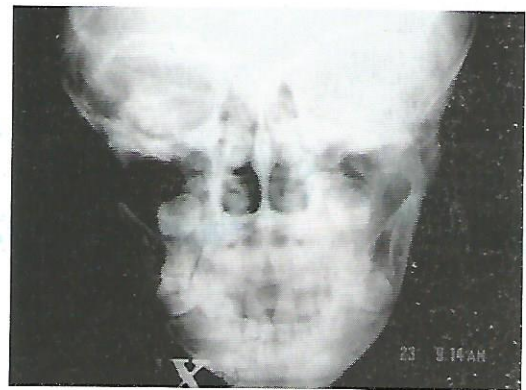


Fig. 4: Medial bowing of left condyle



Fig. 5: Body with bilateral condylar fracture



Fig. 6: Medial bowing of bilateral condyles



Fig. 7: Parasympyseal fracture on OPG x-ray



Fig. 8: Parasympyseal fracture on photograph



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Fig. 9: Dento alveolar fracture of maxilla



Fig. 10: Dento alveolar fracture of maxilla



Fig. 11: Dento-alveolar fracture of mandible



Fig. 12: Dento alveolar fracture of mandible

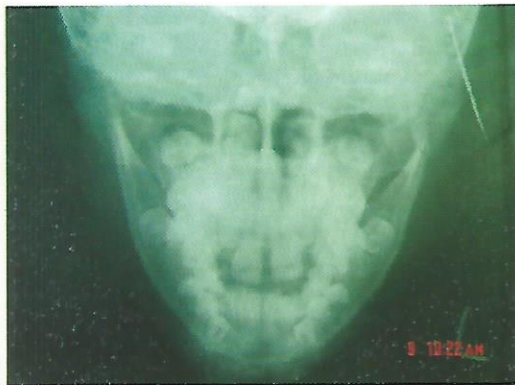


Fig. 13: Condylar fracture of mandible



Fig. 14: Dento alveolar fracture of maxilla

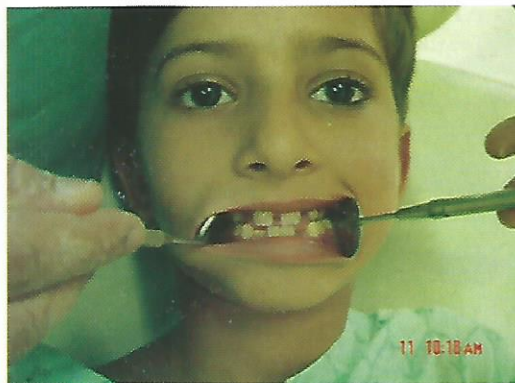


Fig. 15: Condylar fracture and malocclusion

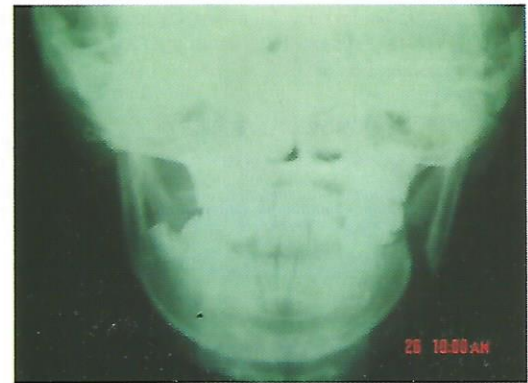


Fig. 16: Unfavorable fracture angle mandibular



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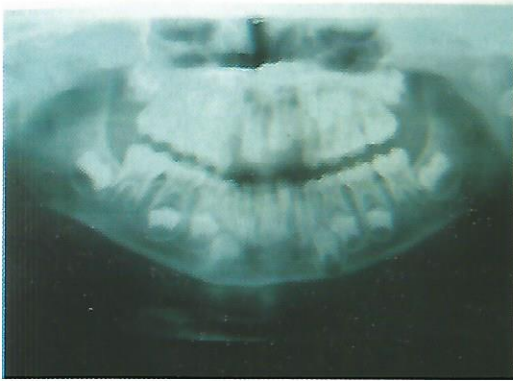


Fig. 25: Bilateral condylar bone fracture patient



Fig. 26: Patient with Le Fort III fracture



Fig. 27: Patient with rt. zygomatic & alveolar #



Fig. 28: Reverse bite with Le Fort III fracture



Fig. 29: PNS Patient with rt. zygomatic bone #



Fig. 30: Mandible with parasymphiseal fracture



Fig. 31: X-Rays with parasymphiseal fracture



Fig. 32: TMJ ankylosis and facial asymmetry after mismanaged mandibular fracture