

## Review

# Epidemiology, Classification and Management of Zygomatic Fractures Among Children

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### Abstract

The zygomatic bone, which includes the lateral and inferior orbital rims as well as the malar eminence, comprises the lateral part of the midface, giving it width and projection. Zygomatic arch fractures account for 10% to 15% of all facial fractures and are commonly caused by a direct blow to the face. Zygomatic fractures are most caused by blunt trauma. Paediatric zygomatic fractures are a rare complication in the continuum of craniofacial injuries that cosmetic and reconstructive surgeons deal with. The combination between etiology, force of damage, and stage of craniofacial development determines the location and distribution of facial fractures in children. The purpose of this research is to review the available information about the epidemiology, classification and management of zygomatic fractures in children. Although facial fractures especially zygomatic fractures in children are quite uncommon and rare, appropriate screening and diagnosis, as well as prompt treatment, are necessary to avoid consequences. Surgeons face tremendous hurdles when dealing with facial trauma associated with serious injuries, as there is a functional and aesthetic impact on the growing children, as well as a financial and emotional burden on the patient and family. The early management of zygomatic fractures in children, like any trauma, detects situations that require rapid treatment to avoid life-threatening consequences. Paediatric zygomatic fractures are quite uncommon due to the specific anatomic, physiologic, social, and environmental aspects that accompany craniofacial growth however the literature data is lacking and quite scarce, more epidemiological studies targeting age group of children are needed.

**Keywords:** zygomatic, fracture, children, facial, treatment

## Introduction

The zygomatic bone, which includes the lateral and inferior orbital rims as well as the malar eminence, comprises the lateral part of the midface, giving it width and projection. Zygomatic arch fractures account for 10% to 15% of all facial fractures and are commonly caused by a direct blow to the face. Nonoperative treatment is possible for isolated, nondisplaced zygomatic arch fractures, but surgical treatment with or without fixation is frequently required for displaced zygomatic arch fractures. Displaced fractures should be minimized and repaired within two weeks; failure to do so might cause functional and aesthetic issues (1). Because the underlying bone structure directly impacts the facial contour, the zygoma performs a critical function in maintaining facial contour. When this conspicuous bone fractures or dislocates, it affects ocular and mandibular functioning in addition to causing aesthetic problems. It is vulnerable to a variety of injuries due to its prominence; nevertheless, its bone design is remarkable in that it allows it to withstand tremendous impact without being broken (2).

Zygomatic fractures can be overlooked easily however, displaced fractures need urgent treatment. Untreated fractures can result in an aesthetic deformity such as cheek flatness or reduced mandibular movement due to the depressed zygoma intruding upon the mandible's coronoid process. Zygomatic fractures are most commonly caused by blunt trauma. On the affected side, 70–90% of patients will experience infraorbital or upper lip numbness. The maxillary central, lateral, and canine teeth may be affected. In comparison to the other side of the face, the affected side may appear flattened, however, this can be difficult to notice, especially when swelling is present. On the affected side, the patient may report an aesthetic flaw. The patient may experience epistaxis as a result of a ruptured maxillary sinus membrane or an irregular occlusion as a result of the fracture inhibiting normal mandibular movements (3).

Paediatric zygomatic fractures are a rare complication in the continuum of craniofacial injuries that cosmetic and reconstructive surgeons deal with. The combination between etiology, force of damage, and stage of craniofacial development determines the location and distribution of facial fractures in children. The development of zygomatic disruption in young children is substantially less common due to altered geometric proportions and specific anatomical features of the

paediatric facial skeleton (4). Different patterns of injury emerge when children with facial fractures are grouped into various age - groups based on developmental stages. Facial fractures seem to be more frequently observed in boys than girls and in children aged 0 to 18 years, the prevalence of fractures rises with age. Children between the ages of 0 to 5 years have the lowest rate of facial fractures due to adult supervision. Children in the age range of 6 to 11 years seemed to have the second greatest rate of facial fractures, with motor vehicle accidents, sports, and bike riding being the most common causes. However, facial fractures in children most typically occur between the ages of 12 and 18 years, when teenagers gain greater independence, begin to drive, and participate in contact sports (5).

Although the treatment of facial fractures in children is comparable to that of adults, it necessitates a specialized and in-depth study of the developmental challenges that this age group faces. Several of these variables combine to allow for the conservative management of a vast number of these injuries; yet surgical indications still exist. In these instances, the best course of action is to weigh the risks of affecting dentition or future skeletal growth against achieving sufficient stability and reduction for healing. The effective care of paediatric facial trauma seems possible provided the treating physician remains informed of critical anatomic, epidemiological, assessment, and management issues, despite its particular challenges (6). Zygomatic fractures among children are an area of concern however, very limited literature and research studies are available regarding the prevalence and management of zygomatic fractures among children. The purpose of this research is to review the available information about the epidemiology, classification and management of zygomatic fractures in children.

## Methodology

This study is based on a comprehensive literature search conducted on April 18, 2022, in the Medline and Cochrane databases, utilizing the medical topic headings (MeSH) and a combination of all available related terms, according to the database. To prevent missing any possible research, a manual search for publications was conducted through Google Scholar, using the reference lists of the previously listed papers as a starting point. We looked for valuable information in papers that discussed the information about the epidemiology, classification and management of zygomatic fractures in children.

There were no restrictions on date, language, participant age, or type of publication.

## Discussion

Although facial fractures especially zygomatic fractures in children are quite uncommon and rare, appropriate screening and diagnosis, as well as prompt treatment, are necessary to avoid consequences. When compared to adults, children's maxillofacial trauma is normally treated conservatively, and non-surgical treatments should be employed wherever possible to avoid growth and development disruptions. Facial asymmetry, epistaxis, airway obstruction, cerebral traumas, enophthalmos, and paraesthesia in the infraorbital nerve distribution, and orbital floor deformities are the most common complications associated with zygomatic complex fractures (7). Surgeons face tremendous hurdles when dealing with facial trauma associated with serious injuries, as there is a functional and aesthetic impact on the growing children, as well as a financial and emotional burden on the patient and family. The diagnosis and treatment of damage differ between paediatric and adult patients due to anatomical and developmental variations. The prevalence of facial fractures account for around 5% to 15% among children. Paediatric facial fractures are least common in infants and increase in frequency is observed as children get older. The prevalence of facial fractures among children under the age of 5 years is just 1% while in children over the age of 16 the frequency range is 1% to 14.7% (8).

## Epidemiology

There are few studies in literature that have reported the prevalence or epidemiological data regarding zygomatic fractures among children. Results of a 9-year-old retrospective study conducted in Italy recruiting participants from age of 2-years to 86 years published in 2012 revealed that there were 86% zygomatic fractures, and 14% zygomatic arch fractures. 7% of the patients were under the age of 9, 70% were between the ages of 10 to 39 years (9). Results of an analytical study conducted in North China published in 2020 among age range of 0-8 years of children showed that 335 participants in the study had a total of 597 fractures. There were 38.5% patients who had isolated fractures and 61.5% patients who had multiple fractures. The most common fracture location was the mandible 69.3%, followed by the zygoma 12.9%, maxilla 7.7%, naso-orbito ethmoid 4.2%, Le Fort type 3.9% and orbit 2% (10). Results of an Indian retrospective study conducted among children of age 12 years and younger in 2020

showed that among 99 individuals, a total of 112 facial bone fractures were observed. Mandibular fractures were the most common, accounting for 82.8% of the cases, whereas nasal bone fractures accounted for 22.2% followed by fractures of the maxilla 4%, zygomatic 2%, and orbital bones 2% (11). Results of another retrospective study conducted in Chile in 2014 revealed that zygomatic fractures accounted for 0.6% of total facial fractures among children of age group of 1 month to 15- years (12).

Another study conducted among Sudanese children in 2016 depicted that mandible fractures accounted for 77% of all fractures, followed by combination fractures 32.7% and zygomatic-complex fractures 13.5% (13). Findings of Egyptian study conducted among age group of 0-18 years in 2019 showed that of all fractures nasal fractures accounted for 10.16% , orbital blow out fractures accounted for 6.78%, while zygomatic fractures accounted for 15.25% among study population (14). Results of a Yemini retrospective study published in 2021 revealed that 87 fractures in total were reported. 63.4% of the patients in the research had isolated fractures, whereas 36.6% had multiple fractures. Mandibular fractures were the most common type of fracture 55.2%, followed by nasal fractures 18.4%, zygoma 14.9%, maxilla 8.0%, and orbit 3.4% (15). A 10-year retrospective review study in 2018 in Saudi Arabia reported a prevalence of 2.6% for zygomatic fractures among children aged 0-10 years (16). Another retrospective study conducted in Madinah in 2018 reported a frequency of 7.05% for zygomatic bone fractures among pediatric population studied (17). Findings of another retrospective study in Riyadh in 2018 showed that the zygomatic area was found to be responsible for 23% of the fractures. Zygomatic complex fractures were the most commonly reported fractures at 94.8%, followed by isolated zygomatic arch fractures which accounted for 5.2%. The severity of the injuries was reflected in the fact that more than half of the zygomatic fractures 51.3% were bilateral in distribution among the age range of 3-year to 69-year old population (18).

## Classification

Classification of fractures helps in better understanding of the fracture. Zygomatic fractures are commonly classified as; Type 1 zygomatic arch fractures which are the isolated zygomatic arch fractures. Types 2 and 3 are referred as zygomaticomaxillary complex fractures. Type 2 fractures are described by the mechanical force applied in one direction, while type 3 fractures are

distinguished by the application of force in two directions. Type 4 zygomatic arch fractures are comminuted zygomatic arch fractures. Each of these fractures include further subclassifications (19).

The classification of zygomatic arch fractures includes five subtypes. Nondisplaced fractures are referred to as type I, they can have any form of non-displaced fracture, and the zygomatic arch's anatomical shape is preserved. Greenstick fracture with or without coronoid impingement is type II. This is a common fracture in youngsters, though it can also happen in adults, with or without coronoid impingement. Single displaced fracture with or without coronoid impingement is type III, isolated zygomatic arch fracture with visible displacement along the fracture line, with or without coronoid impingement. Multiple displaced fractures with or without coronoid impingement are classified as type IV. Comminuted fracture with or without coronoid impingement is classified as type V (20).

The classification system helps clinicians determine whether a fracture is stable following reduction and whether it must be fixed. The severity of traumatic impact of zygomaticomaxillary complex fractures has also been used to classify zygomaticomaxillary complex fractures into low-, medium-, and high-energy patterns, as shown on computed tomography scan; low-energy type is associated with non-displaced or minimally displaced en bloc fractures, medium-energy type is displaced fractures both with and without fragmentation, while the high-energy type is linked with fractures due to massive displacement, comminution, or fragmentation. They can further be classified based on their anatomical location as isolated zygomatic arch fracture which is type A1, while detachment at the frontozygomatic suture and infra-orbital rim are types A2 and A3, respectively. Type B is a full monofragment with separation at all five articulation sites, whereas type C is multifragmented (21).

### **Management**

Scarring, growth disruption, facial asymmetry, and iatrogenic damage are all hazards that surgeons face when treating juvenile facial fractures. As a result, most craniofacial departments have a higher threshold for operating on such patients, with the majority of patients approximately 70% being managed conservatively; nonetheless, operational management increases with age and fracture severity. Circum-zygomatic closure reduction is a conservative approach to typical surgical care that reduces the risk of perioperative complications

while allowing patients to tolerate and comply with the procedure (22).

The early management of zygomatic fractures in children, like any trauma, detects situations that require rapid treatment to avoid life-threatening consequences. These include maintaining an adequate airway, controlling or preventing haemorrhage, avoiding aspiration, and detecting concomitant injuries. To avoid the disruptions in dentition and growth associated with more intrusive techniques, a traditional, non-surgical approach has always been recommended. Nondisplaced or only minimally displaced fractures that are not significant enough to cause functional or severe aesthetic abnormalities are generally candidates for nonoperative observation. However, due to the high prevalence of comminuted or displaced fractures in the paediatric patient population as a result of high-impact traumas, open reduction and internal fixation are frequently required to avoid future growth disruptions (4).

To achieve correct anatomical reduction of the highly misplaced and comminuted zygoma, recognized craniofacial procedures must be used to ensure extensive exposure and mobilization of the entire zygoma. Open reduction in children can be achieved in a variety of ways, depending on the location of the fracture. The frontozygomatic suture, infraorbital rim or orbital floor, and zygomatic buttress can all be accessed through lateral upper eyelid, lower lid sub ciliary or transconjunctival, and upper buccal sulcus incisions, respectively. The sphenozygomatic suture is reduced initially, before the other fracture lines, allowing for more precise restoration and better cosmetic results (23). Limited literature and research studies are available regarding epidemiology and management of zygomatic fractures in children especially in recent times, in future more population-based studies are needed to be conducted to generate evidence-based results among children with respect to prevalence and treatment strategies of zygomatic fractures among children.

### **Conclusion**

Paediatric zygomatic fractures are quite uncommon due to the specific anatomic, physiologic, social, and environmental aspects that accompany craniofacial growth however the literature data is lacking and quite scarce. To establish appropriate treatment and management options as well as prevent potential hazards and consequences that may impede optimal function and aesthetic results in children who sustain zygomatic

fractures, large-scale population-based, prospective, longitudinal studies are needed.

## Disclosure

### Statement

The authors declare no conflict of interest.

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### Ethical consideration

Non-applicable.

### Data availability

Data that support the findings of this study are embedded within the manuscript.

### Authors' contribution

All authors contributed equally to the drafting, writing, sourcing, article screening and final proofreading of the manuscript.

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