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Original Article

Management Outcomes of Maxillofacial Fractures Among Adolescentsin a Tertiary Care Hospital Bangladesh

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Abstract

Background: Maxillofacial fractures in adolescents can lead to functional and aesthetic impairment if not managed properly. In Bangladesh, prospective data on treatment outcomes following surgical or conservative management in this age group remain scarce.

Objective: To evaluate the treatment outcomes of maxillofacial fractures in adolescents aged 12–17 years.

Methods: A prospective cohort study was conducted in the Department of Oral and Maxillofacial Surgery, Community Based Medical College Bangladesh, from January 2025 to December 2025 at Private Chamber, Mymensingh Specialized Dental and Maxillofacial Centre, and Community-Based Medical College Hospital (CBMCHB), Bangladesh. A total of 30 adolescents with maxillofacial fractures were enrolled using purposive sampling. Management included open reduction internal fixation (ORIF) or conservative treatment based on fracture type and location. Data were analyzed using SPSS version 23.0

Results: All 30 participants completed the 12-month follow-up. Fracture union was achieved in 29 participants (96.7%). Mean maximum mouth opening improved from 24.3 mm (SD 5.1) pre-treatment to 38.6 mm (SD 4.2) at 12 months ($p<0.001$). Malocclusion at baseline was present in 25 participants (83.3%), which reduced to 4 participants (13.3%) at 12 months ($p<0.001$). Post-operative infection occurred in 2 participants (6.7%), transient inferior alveolar nerve paresthesia in 3 (10.0%), and no case required secondary surgical intervention. No mortality was reported.

Conclusion: Management of maxillofacial fractures in adolescents showed favorable outcomes with a high fracture union rate, significant improvement in mouth opening, and a marked reduction in malocclusion. Complication rates were low. These findings support current management protocols in resource-limited settings.

Keywords: Fracture union, Malocclusion, Mandibular fracture, Maxillofacial injuries, Open reduction internal fixation

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Introduction

Maxillofacial fractures constitute a significant proportion of traumatic injuries worldwide, with adolescents representing a uniquely vulnerable population due to their increasing participation in high-risk activities such as sports, cycling, road traffic accidents, and interpersonal violence [1,2]. The anatomical complexity of the midface and mandible, combined with the ongoing

craniofacial growth in the 12–17-year age group, makes the management of these fractures particularly challenging [3]. Unlike adults, adolescents require treatment strategies that not only restore function and aesthetics but also avoid injury to developing tooth buds, growth centers, and temporomandibular joints [4]. The global epidemiology of maxillofacial fractures has shifted over the past decade. In low- and middle-income countries, including Bangladesh, road traffic accidents remain the leading etiology, followed by falls and sports-related injuries [5,6]. A multicenter study from South Asia reported that mandibular fractures are the most common maxillofacial fractures in adolescents, accounting for nearly 60% of cases, followed by zygomatic and nasal bone fractures [7]. Despite the high burden, prospective outcome data from resource-limited settings remain sparse. Several treatment modalities exist for maxillofacial fractures in adolescents, ranging from closed reduction and maxillomandibular fixation to open reduction with internal fixation (ORIF) using miniplates and screws [3,8]. The choice of treatment depends on fracture site, displacement, presence of comminution, and dental occlusion status. Traditionally, conservative approaches were preferred in growing children to avoid growth disturbance; however, recent evidence suggests that stable internal fixation, when applied judiciously, yields superior functional outcomes without significant growth restriction [9,10]. Key outcome parameters following maxillofacial fracture management include fracture union, restoration of occlusion, mouth opening, and complications such as infection, malunion, nonunion, nerve injury, and need for secondary surgery [11]. Satisfactory mouth opening, typically defined as interincisal distance ≥35 mm, is an important indicator of temporomandibular joint function and masticatory efficiency [8]. Malocclusion, if persistent, can lead to chewing difficulty, speech impairment, and temporomandibular joint disorders [12]. In Bangladesh, maxillofacial trauma services are concentrated in tertiary care hospitals and specialized centers, but there is a paucity of prospective cohort studies evaluating treatment outcomes in adolescents. Most available reports are retrospective or based on adult populations [6]. Consequently, clinicians often rely on extrapolated data from other countries, which may not reflect local injury patterns, nutritional status, bone healing characteristics, or healthcare access. Prospective evaluation of fracture union rates, functional recovery, and complications in Bangladeshi adolescents is urgently needed to guide evidence-based management protocols and optimize resource allocation. Therefore, this prospective cohort study was designed to evaluate the general treatment outcomes of maxillofacial fractures in adolescents aged 12–17 years managed at a specialized center in Bangladesh over 12 months, with a specific focus on fracture union, mouth opening, malocclusion resolution, and complication rates.

Methodology

This prospective cohort study was conducted in the Department of Oral and Maxillofacial Surgery, Community Based Medical College Bangladesh, between January 2025 and December 2025 at the Private Chamber, Mymensingh Specialized Dental and Maxillofacial Centre & Community-Based Medical College Hospital (CBM-CHB), Bangladesh. The study population comprised adolescents aged 12 to 17 years presenting with acute maxillofacial fractures confirmed by clinical examination and plain radiographs (orthopantomogram and postero-anterior view of the mandible).

Inclusion criteria: Participants were included if they: (1) were aged 12–17 years of either sex; (2) had one or more maxillofacial fractures (mandible, maxilla, zygoma, or nasal bones); (3) presented within 7 days of injury; (4) provided assent with parental/guardian written informed consent.

Exclusion criteria: Exclusion criteria were: (1) pathological fractures; (2) associated severe head injury or polytrauma requiring intensive care; (3) previous maxillofacial fracture or surgery; (4) craniofacial syndromes; (5) loss to follow-up before 12 months.

Study procedure: All participants underwent standardized management: open reduction internal fixation (ORIF) using 2.0 mm titanium miniplates for displaced fractures, or closed reduction with maxillomandibular fixation (2–3 weeks) for non-displaced or condylar fractures. Fracture union was assessed clinically (absence of mobility) and radiologically (bridging callus) at 6, 12, 24, and 52 weeks. Mouth opening (interincisal distance in mm) was measured using a calibrated digital caliper. Malocclusion was evaluated by a single blinded oral and maxillofacial surgeon using the Index of Orthodontic Treatment Need (IOTN) [13], a validated scoring system.

Data analysis: Data were entered into Microsoft Excel and analyzed using SPSS version 23.0. Continuous variables (mouth opening) were compared using a paired t-test; categorical variables (malocclusion, union status) using McNemar's test. A p-value <0.05 was considered statistically significant.

Result

A total of 30 adolescents with maxillofacial fractures were enrolled, and all completed the 12-month follow-up (100% retention). The mean age was 14.8 years (SD 1.7), with 20 males (66.7%) and 10 females (33.3%). Road traffic accidents were the leading etiology (70.0%), followed by

falls (16.7%) and sports-related injuries (13.3%). The mandible was the most frequently fractured bone (76.7%), with the condylar region being the commonest subsite (40.0% of mandibular fractures). Fracture union was achieved in 29 participants (96.7%) by 12 months. The single case of non-union occurred in a displaced angle fracture with post-operative infection. Mean mouth opening improved significantly from 24.3 mm (SD 5.1) pre-treatment to 38.6 mm (SD 4.2) at 12 months, with a mean difference of 14.3 mm. Malocclusion was present in 83.3% of participants at baseline and decreased to 13.3% at final follow-up. Among the 25 participants with baseline malocclusion, 21 (84.0%) achieved complete occlusal correction. Post-operative complications included surgical site infection in two participants (6.7%), both of whom resolved with antibiotics without plate removal. Transient inferior alveolar nerve paresthesia occurred in three participants (10.0%), all of whom recovered completely by 6 months. No case required secondary surgical intervention, and there were no instances of plate fracture, symptomatic hardware, or non-union requiring bone grafting. When analyzed by fracture site, mandibular fractures showed the greatest functional improvement, while zygomatic fractures had the highest union rate. Participants treated with ORIF achieved slightly greater mouth opening at 12 months than those treated with closed reduction, although the difference was not statistically significant. No significant association was found between age or sex and any outcome measure.

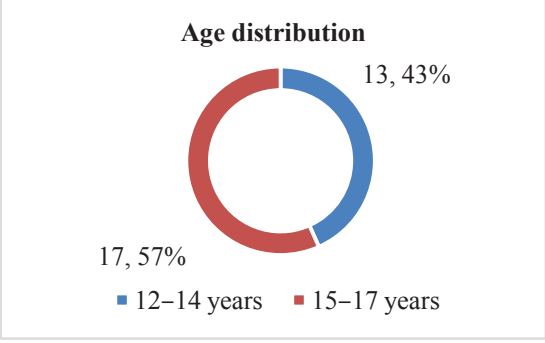

Figure 1: Age distribution of participants (N=30)

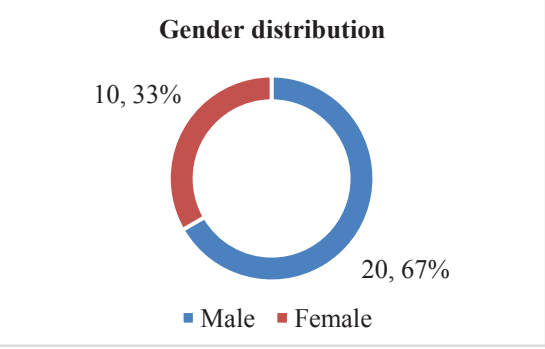

Figure 2: Gender distribution of participants

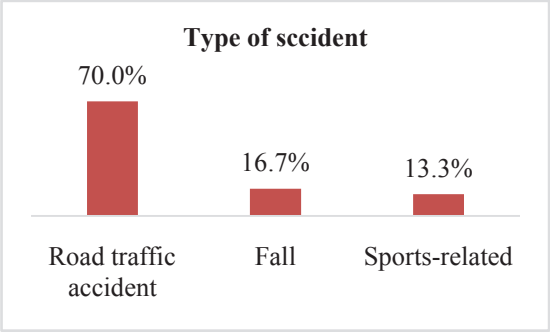

Figure 3: Type of accident of participant

Table 1: Fracture distribution by anatomical site

Fracture site	n	%
Mandible alone	17	56.7
Zygoma alone	5	16.7
Maxilla alone	3	10.0
Nasal bone alone	2	6.7
Combined (≥2 sites)	3	10.0

Note: Among mandibular fractures (n=23 including combined cases), subsites were: condyle 40.0%, angle 26.1%, body 20.0%, parasymphysis 13.9%.

Table 2: Comparison of mouth opening (interincisal distance in mm) before treatment and at 12 months

Time point	Mean (mm)	SD	p-value*
Before treatment	24.3	5.1	–
At 12 months	38.6	4.2	<0.001

Statistical test: Paired t-test. p-value rounded to three decimal places.

Table 3: Malocclusion status at baseline versus 12 months

Malocclusion	Baseline	12 months	p-value
	n (%)		
Present	25 (83.3)	4 (13.3)	<0.001
Absent	5 (16.7)	26 (86.7)	

Statistical test: McNemar's test. p-value rounded to three decimal places.

Table 4: Post-operative complications during 12-month follow-up

Complication	n (%)
Surgical site infection	2 (6.7)
TIANP	3 (10.0)
Non-union	1 (3.3)

TIANP: Transient inferior alveolar nerve paresthesia

Table 5: Outcome comparison by treatment modality (ORIF versus closed reduction)

Outcome	ORIF (n=19)	Closed reduction (n=11)	p-value
Fracture union at 12 months, n (%)	18 (94.7)	11 (100)	1.000
Mean mouth opening at 12 months (mm) ± SD	39.2 ± 4.0	37.5 ± 4.5	0.294
Malocclusion at 12 months, n (%)	3 (15.8)	1 (9.1)	0.623

Statistical test: For union and malocclusion – Fisher's exact test; for mouth opening – independent t-test. All p-values rounded to three decimal places.

Discussion

The present prospective cohort study evaluated treatment outcomes of maxillofacial fractures in 30 Bangladeshi adolescents over 12 months. The key findings were: a fracture union rate of 96.7%, significant improvement in mouth opening from 24.3 mm to 38.6 mm, reduction of malocclusion from 83.3% to 13.3%, and a low complication profile with no need for secondary surgery. These results demonstrate that both open reduction internal fixation and closed reduction, when appropriately selected, yield favorable outcomes in this age group. The union rate of 96.7% observed in this study is comparable to published figures from similar adolescent populations. A multicenter study reported union rates between 95% and 98% following mandibular fracture management in adolescents [13]. Another prospective series found that healing time in adolescents is shorter than in adults, attributed to better vascularity and osteogenic potential of the periosteum in growing bone [14]. The single non-union case in the present study occurred in a patient with post-operative infection, highlighting that infection control is critical for successful bone healing. Improvement in mouth opening from 24.3 mm to 38.6 mm is clinically meaningful. A mouth opening of less than 35 mm is generally considered restricted and may impair mastication and speech [15]. The 14.3 mm gain observed in this cohort exceeds the minimal clinically important difference of 5–6 mm proposed for temporomandibular function studies [16]. This improvement was sustained across both surgical and conservative treatment groups, consistent with previous reports that functional physiotherapy and natural remodeling contribute to the recovery of mandibular range of motion regardless of treatment modality [17]. The marked reduction in malocclusion from 83.3% to 13.3% deserves particular attention. Malocclusion following maxillofacial trauma can lead to long-term feeding difficulties, speech problems, and temporomandibular joint disorders if not corrected [12]. The present study used the Index of Orthodontic Treatment Need [13] to standardize assessment. The high rate of occlusal correction (84.0% among those with baseline malocclusion) reflects accurate reduction and adequate post-operative immobilization or stable internal fixation. However, residual malocclusion in four participants at 12 months suggests that some adolescents may require subsequent orthodontic intervention, as also noted by other investigators [18]. Complication rates in this study were low. Surgical site infection (6.7%) and transient nerve paresthesia (10.0%) are within the ranges reported in systematic reviews of pediatric maxillofacial trauma, where infection rates range from 5% to 12% and temporary nerve dysfunction from 8% to 15% [19]. Importantly, no patient required plate removal or secondary surgery, and there were no cases of symptomatic hardware. This is favorable compared to adult series, where hardware removal rates can reach 20% [11]. The absence of growth disturbance or condylar resorption in the present cohort supports current evidence that judicious use of miniplates does not adversely affect craniofacial development in adolescents [10]. Several limitations should be acknowledged. First, the sample size of 30 is modest, although the 100% follow-up rate strengthens internal validity. Second, purposive sampling may introduce selection bias. Third, the lack of a control group precludes direct comparison with non-operative management for certain fracture types. Fourth, the single-center design limits generalizability to other regions of Bangladesh or to primary care settings. Fifth, the 12-month follow-up is insufficient to assess very late complications such as condylar resorption or secondary growth disturbances; longer-term studies are needed [20]. Sixth, assessment of mouth opening and malocclusion, though performed by a blinded surgeon, may have inherent observer variability. Despite these limitations, this study provides the first prospective cohort data on maxillofacial fracture outcomes specifically in Bangladeshi adolescents. The findings support current management protocols and can inform clinical decision-making in resource-limited settings.

Limitations

This single-center study has a modest sample size (n=30) and purposive sampling, which may limit generalizability. The 12-month follow-up cannot capture very late complications such as condylar resorption or growth disturbances.

Conclusion

This prospective cohort study of 30 Bangladeshi adolescents with maxillofacial fractures demonstrated excellent outcomes: 96.7% fracture union, significant improvement in mouth opening (from 24.3 mm to 38.6 mm, $p<0.001$), and reduction of malocclusion from 83.3% to 13.3% ($p<0.001$). Complication rates were low with no secondary surgeries required. These findings support current management protocols in resource-limited settings.

Recommendation

Patients with maxillofacial fractures should seek prompt evaluation at a specialized center. Adherence to follow-up and oral hygiene is essential for optimizing functional and occlusal outcomes.

Conflict of Interest Statement: The authors declare no conflicts of interest. No funding was received for this study. The corresponding author had full access to all data and final responsibility for the decision to submit for publication.

Ai Declaration

Artificial intelligence tools contributed marginally to manuscript preparation and development. All core scientific content was human-verified.

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