ORIGINAL ARTICLE

Outcomes of paediatric mandibular trauma using acrylic cap splint followed by circum-mandibular wiring

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ABSTRACT

Background: The incidence of facial fractures in children is relatively low compared to adults, accounting for approximately 1% to 15% of all facial fractures, with mandibular fractures being the most common due to the prominence of the chin and falls being a frequent cause. This study was designed to evaluate the clinical and functional outcomes of paediatric mandibular fractures treated with acrylic cap splint followed by circum-mandibular wiring.

Material & Methods: A cross-sectional study was conducted at Jinnah Postgraduate Medical Centre, Karachi from Aprile 2025 to February 2026. Patients with either gender with age range of 2 to 12 years were included with mandibular symphysis, para symphysis and body fracture. These patients underwent fracture management through cap splint with circum mandibular wiring and postoperatively evaluated for occlusal stability, fracture union, mouth opening, pain level and gingival health status on follow up.

Results: Most of the paediatric patients with mandibular fracture (64.0%) reported were from urban population with mostly boys around 52.5% with mean age of 6.65 ± 2.66 years. Patients reported with Symphysis area of mandible fracture as most frequent (44.6%) type of fracture. Among them around 85% shows fracture union and occlusal stability postoperatively which shows a high level of treatment effectiveness.

Conclusion: For paediatric mandibular fracture using of acrylic cap splint with circum-mandibular wiring shows excellent post op clinical outcomes such as occlusal stability and fracture union.

Key Words: cap splint, mandibular fracture, mouth opening, occlusal stability

Authors' Declaration: The authors declared no conflict of interest and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed substantially to the planning of research, question designing, data collection, data analysis and write-up of the article.

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This article may be cited as: Kumar M, Alam J, Shah R, Mulk NU, Aman A, Shar MK, Javeria, Khan SA. Outcomes of paediatric mandibular trauma using acrylic cap splint followed by circum-mandibular wiring. Rehman J Health Sci. 2026;8(1). 63-69

Submitted: March 04, 2026 Revisions Submitted: May 22, 2026 Accepted: June 29, 2026

Introduction

Paediatric mandibular trauma is a significant concern in oral and maxillofacial surgery, given the unique anatomical and physiological characteristics of growing children.[1] The incidence of facial fractures in children is relatively low compared to adults, accounting for approximately 1% to 15% of all facial fractures,[2-3] with mandibular fractures being the most common due to the prominence of the chin and falls being a frequent cause. The management of such fractures in children requires special

consideration due to the presence of developing tooth buds, the elasticity of growing bones, and the potential for growth disturbances. Traditional treatment methods must be adapted to ensure stability while minimizing long-term complications.[4]

One effective approach for managing paediatric mandibular fractures is the use of an acrylic cap splint followed by circum-mandibular wiring (CMW).[2] This technique provides stabilization while avoiding direct bone manipulation, which is particularly beneficial in children with mixed dentition.[5] The acrylic cap splint acts as a rigid framework to maintain occlusion, while circum-mandibular wiring secures the splint in place, allowing for proper fracture healing. This method is especially advantageous in cases where internal fixation may interfere with tooth development or growth centers.[6] However, the outcomes of this technique, including functional recovery, occlusal stability, and complication rates, require further evaluation.

The incidence of paediatric facial fractures varies depending on age, with toddlers and school-aged children being more prone to mandibular injuries due to play-related accidents, sports, or motor vehicle collisions[7]. Mandibular fractures often involve the condyle, symphysis, or body, with condylar fractures being particularly common in younger children due to the thin neck of the condyle. [8] Unlike adults, children have a higher capacity for bone remodelling, making conservative approaches like acrylic splints and wiring a viable option. Nevertheless, improper management can lead to malocclusion, facial asymmetry, or temporomandibular joint dysfunction, emphasizing the need for reliable treatment protocols. [9]

A trial carried out by Abood et al reported that 90% of patients were treated with closed reduction using an open cap splint and two circumferential wires. [10] According to the findings, 40% of patients experienced discomfort, while 70% had fair oral hygiene. Additionally, 80% of the patients developed gingivitis, and 90% reported pain during the first week postoperatively. Given the limited research on long-term outcomes of this technique in children, this study contributes valuable insights into the optimal management of paediatric mandibular trauma. The findings may guide clinicians in selecting the most appropriate treatment to ensure favourable functional and aesthetic results while preserving growth potential. Understanding the success rates and potential complications of acrylic cap splints with circum-mandibular wiring has enhance clinical decision-making and improve patient care in paediatric maxillofacial trauma.

Material and Methods

A descriptive cross-sectional study was conducted in the department of Oral and Maxillofacial Surgery, Jinnah Postgraduate Medical Centre, Karachi from April 2025 to February 2026. Ethical approval was obtained from the Institutional Review Board of JPMC (NO.F.2-81/2025-GENL/420/JPMC), and the study adhered to the principles of the Declaration of Helsinki. A total 139 patient were included through nonprobability consecutive sampling technique and sample size was calculated by using online openEpi sample size calculator at the power of 80% by assuming 95% confidence interval and an anticipated proportion of 90% of pain post operatively. [10] The included patients were either gender, age range of 2 to 12 years having symphysis, Para symphysis and body of mandible fracture and those patients which are classified as ASA-I and -II by the anaesthesia team before the procedure. Patients having long bone fracture, panfacial trauma and mandibular angle and condylar fracture were excluded. A written informed consent was obtained from the mother/father of all the included patients after explaining the procedure and purpose of this study by maintaining confidentiality of patient's information. All the reported patients underwent for diagnostic procedure through detailed history, clinical examination, and radiographically assessment. The history portion include the chief complaint, injury details, aetiology, and relevant medical or surgical history. A full general examination (head-to-toe) was conducted to rule out other serious injuries. Extraoral examinations were checked for swelling, deformities, limited mouth opening, or inability to close the mouth. The mandible was palpated for tenderness, mobility and OPG and PA view were used for confirmation of diagnosis. Impressions were taken, and casts poured. The mandibular cast was sectioned and repositioned using the upper cast as a guide. An open acrylic splint was fabricated using clear, heat-cured acrylic resin to monitor soft tissue pressure. Prophylactic antibiotics (ceftriaxone 500 mg for patients under 10 of age and 1000 mg for 10 to 12 years patients) were administered. A 26-gauge wire was used and passed percutaneously with a mandibular awl from the existing region, clamped near the alveolus on the lingual side, and then on the

buccal side upon exit. The awl and excess wire were cut to the desired length, and the splint was secured by twisting and tightening the wires. The mandibular fracture reduced anatomically and immobilized using an acrylic cap splint and circum-mandibular wiring after stablishing occlusion. A postoperative orthopantomogram confirmed proper positioning and weekly follow-ups were done for monitoring pain, occlusion stability, fracture union and mouth opening. Pain was assessed using VAS after 3 week. At the 3rd week follow-up, these patients were examined for occlusal stability through teeth alignments to make sure there was no sign of malocclusion such as open bite, cross bite or any early contacts. Radiographic and clinical assessment were done for the fracture union in form of painless jaw function, stability on manual palpation, assessing callus formation, continuity of trabecular bone confirmed bone union, and these responses were noted as yes and no on self-design performa. Simple foot scale/ ruler scale was used to assess maximum mouth opening by measuring the distance between upper and lower incisor on fracture side in case of Para symphysis and body of mandible fracture and noted in mm on performa at 3rd week postoperatively. Gingival health status was assessed using the gingival index (GI) described by Loe and Silness on the six Ramfjord teeth. The mean GI was used to determine the categorical gingival status according to Loe as follows: 0 healthy; 0.1–1 mild gingivitis; 1.1–2 moderate gingivitis; and 2.1–3 severe gingivitis.[11] At the 4th post operative week, splint and wires were removed under conscious sedation. All the data obtained from the patients were subjected to statistical analysis using SPSS V.26.0. Descriptive statistics, including means, standard deviations for age and mouth opening were calculated. Frequencies and percentages were calculated for gender (male / female), occlusal stability, fracture union and pain (Yes / No) of the participants. Qualitative variables were compared using the chi-square test and quantitative variables (mouth opening) were compared and p-values of less than 0.05 was considered as statistically significant.

Results

In this descriptive cross-sectional study, clinical and functional outcomes were analysed for normality through the Kolmogorov-Smirnov and Shapiro-Wilk tests which shows not normally distributed as P<0.005. These paediatric patients with mean age of 6.65 ± 2.66 years having mandibular fractures which are managed through acrylic cap splints followed with circum-mandibular wiring. The baseline characteristics and treatment outcomes are shown in table-I. Most of these paediatric patients (64.0%) reported were from urban population with mostly boys around 52.5%. Patients reported with Symphysis area of mandible fracture were the most frequent (44.6%) type of fracture. Among them around 85% shows fracture union and occlusal stability postoperatively which shows a high level of treatment effectiveness. Regarding Gingival health status which was generally good (no gingivitis in 38.8%, moderate in 33.8%), with no severe gingival problems recorded, and pain resolution was excellent (no discomfort in 59.7%, mild in 32.4%).

The distribution of the aetiological factors that cause fractures in the study population is depicted in the bar chart. With 59.71% of cases, falls were the most frequent cause, meaning that falls accounted for more than half of the fractures. The second most common cause, accounting for 27.34% of fractures, was automobile accidents. By contrast, assault accounted for 5.76% of cases, sports-related injuries for 4.32%, and other causes for 2.88%, making other causes comparatively rare as shown in fig-I.

Binary Treatment outcomes such as occlusal stability and fracture union status was assessed for any significant with demographic data using chi square test by considering P-value <0.05 as significant association. Among 139 patients' occlusal stability was present in 118 cases (84.9%). The association with Gender (male: 62/73, female: 57/66, p=0.645) and address (urban: 77/89, rural: 41/50; p=0.475) was not significant. On the other hand, association with fracture aetiology showed borderline significance (fall: 77/83 [92.8%], RTA: 28/38, assault: 7/8, sport: 3/6, other: 3/4; p=0.080). Association with type of mandibular fracture was significant (symphysis: 55/62 [88.7%], para symphysis: 50/52 [96.2%], body: 13/25 [52.0%]; p<0.000).

Fracture union status shows the similar results as of 118(84.9%) patients had successful treatment as compared to 21 patients with non-union fractures on follow up. Similar pattern of association was also found when assessed with Gender (male: 61/73, female: 57/66; p=0.645) and address (urban: 77/89, rural: 41/50; p=0.475) which are statistically nonsignificant. Aetiology shows a borderline significant association (fall: 77/83 [92.8%], RTA: 28/38; p=0.080). A strong association were observed when compared with

the type of mandibular fracture type showed strong association (symphysis: 55/62 [88.7%], Para symphysis: 50/52 [96.2%], body: 13/25 [52.0%]; p<0.000) as shown in table-II.

Table-III shows the nonparametric analysis using Mann–Whitney U test. Mann–Whitney U resulted that mouth opening was not statistically significant with gender (p = 0.814), residential address (p = 0.257), occlusal stability (p = 0.843) and fracture union (p = 0.843). this shows that mouth opening was comparable with these variables. Likewise, visual analogue pain scale score was not significantly associated with gender (p = 0.804) or residential address (p = 0.681) but shows significant association when compared with occlusal stability and fracture union, suggesting that variations in occlusal stability and fracture healing status significantly influence patients' pain levels.

Table No. I. Demographic and Treatment Outcome of the Paediatric Mandibular Fractures

Variable		Frequency (%)
Gender	Male	73 (52.5%)
	Female	66 (47.5%)
Address	Urban	89 (64.0%)
	Rural	50 (36.0%)
Site Of Fracture	Symphysis	62 (44.6%
	Para Symphysis	52 (37.4%)
	Body Of Mandible	25(18.0%)
Occlusal stability	Yes	118 (84.9%)
	No	21 (15.1%)
	Total	139 (100.0%)
Fracture Union	Yes	118 (84.9%)
	No	21 (15.1%)
Pain status	No Pain	83 (59.7%)
	Mild Pain	45 (32.4%)
	Moderate Pain	11 (7.9%)
	Sever Pain	0 (0.0%)
	Worst Possible pain	0 (0.0%)
Gingival Health Status	No Gingivitis	54 (38.8%)
	Mild Gingivitis	38 (27.3%)
	Moderate Gingivitis	47 (33.8%)
	Sever Gingivitis	0 (0.0%)

Table No II. The Associations of Demographic data with Treatment Outcomes in Paediatric Mandibular Fractures Patients

Variable		Occlusal Stability			*P*-Value
		Yes (n)	No(n)	Total (n)	
Gender	Male	62	12	73	0.645
	Female	57	9	66	
Address	Urban	77	12	89	0.475
	Rural	41	9	50	
Fracture Aetiology	Fall	77	6	83	0.08
	RTA	28	10	38	
	Assault	7	1	8	
	Sport	3	3	6	
	Other	3	1	4	
Type Of Mandibular Fracture	Symphysis Fracture	55	7	62	0.00*
	Para symphysis Fracture	50	2	52	
	Body Of Mandible Fracture	13	12	25	
Variable		Fracture Union			*P*-Value
		Yes (n)	No(n)	Total	
Gender	Male	61	12	73	0.645
	Female	57	9	66	
Address	Urban	77	12	89	0.475
	Rural	41	9	50	
Fracture Aetiology	Fall	77	6	83	0.08
	RTA	28	10	38	
	Assault	7	1	8	
	Sport	3	3	6	
	Other	3	1	4	
Type Of Mandibular Fracture	Symphysis Fracture	55	7	62	0.00*
	Para symphysis Fracture	50	2	52	
	Body Of Mandible Fracture	13	12	25	

Table No III. Mouth opening and pain score with gender, residential address, occlusal stability and fracture union using

Association	Mann-Whitney U	Wilcoxon W	Z value	p-value
Mouth opening with Gender	2354.500	5055.500	-.235	0.814
Mouth opening with Residential address	1972.500	5977.500	-1.134	0.257
Mouth opening with occlusal stability	1206.000	1437.000	-.199	0.843
Mouth opening with fracture union	1206.000	1437.000	-.199	0.843
Pain score with Gender	2321.000	5022.000	-.249	0.804
Pain score with Residential address	2118.000	3393.000	-.411	0.681
Pain score with occlusal stability	531.000	7434.000	-4.678	0.000
Pain score with fracture union	531.000	7434.000	-4.678	0.000

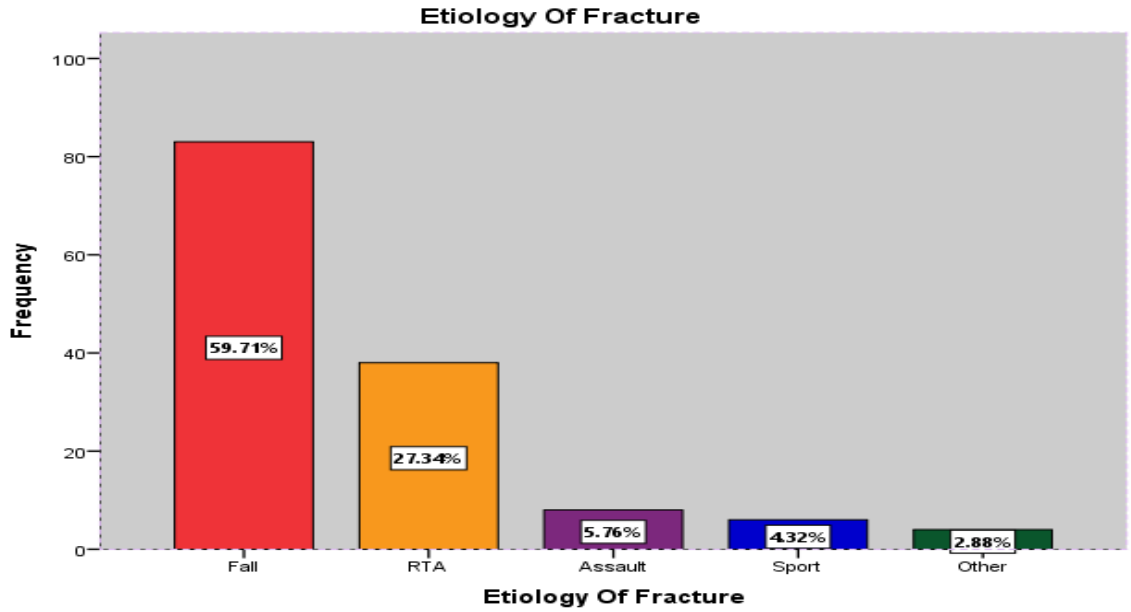

Fig No I. Figure Shows the aetiology of Fracture Among the paediatric Population

Discussion

In the recent literature success rate of conservative treatment has been effective over open reduction and internal fixation.[12] In line to the literature our study reported that conservative management by using cap splint with circum-mandibular wiring gives excellent treatment outcomes for the management of paediatric mandibular fracture as reported 85% fracture union and occlusal stability.

Tandon et al. reported 92% fracture union employing similar conservative management by using cap splint techniques among 50 paediatric mandibular fracture cases [13] which is in line with our findings and support to preservation of jaw growth centres and developing tooth buds from any injury. In another study, Swayampakula et al. reported comparable 88% achieving union and occlusal stability among their 120 paediatric mandibular fractures cases[14] which support the idea of cap splints' superiority as compare to rigid fixation and decreases growth disturbance events. These findings validate our high success rates, particularly for symphysis/Para symphysis fractures (93% combined success), consistent with biomechanical advantages at these sites.[15]

A retrospective study carried out in Sweden reported that gender and residential address had no predictive value across 580 mandibular fractures [16] which also support our findings as these correlations are also not statically significant in our study. These findings established cap splints are best initial treatment option for symphysis and para symphysis fractures of mandible and indicates body of mandibular fractures has high failure rate and need additional supplemental stabilization methods.[17] Patients with history of fall shows high (92.8%) success rate than RTA/sports injuries and correlation is of borderline significance (p=0.08), which is consistent with Tandon et al. study. [13]

However, our identification of body of mandible fractures as significant risk factors (52% success vs. 93% others, p<0.001) partially contradicts some reports favouring uniform conservative success. Rai et al. found no site-based differences across 80 cases (87% overall), [17]

potentially due to their inclusion of older children with mixed dentition. Similarly, a 2025 meta-analysis by Bansal et al. noted equivalent outcomes across sites with cap splints (OR=1.1, 95%CI 0.8-1.5), [18] though their paediatric subgroup was limited (n=156 total).

On assessing the gingival health status which shows no signs of sever gingivitis as demonstrating no gingivitis in among 54(39%), mild gingivitis in 38(27.3%) and moderate gingivitis among 47(33.8%) of study participants. These are also supported by a systematic review published by Kumari et al.[19], who had analysed 312 mandibular fractures treated with cap splint and shows mild/moderate gingivitis in only 22% as compare to 48% with ORIF (OR=0.31, 95%CI 0.18-0.52), attributing success to acrylic splints' plaque-resistant surfaces and unobstructed oral hygiene access.[20] Similarly, Bansal et al. descriptive study of 156 conservatively managed fractures found 91% acceptable gingival indices (≤1), [18] confirming cap splints' superiority over wiring alone for periodontal preservation during 4-6 weeks immobilization.

Mouth opening exhibited non-normal distribution (KS=0.194, $p<0.001$) with floor effects from high success rates (84.9%), indicating reliable functional restoration. This pattern matches the 2023 conservative management series by Hajibandeh et al. reporting 94% of cap splint patients achieving normal interincisal opening (>90% pre-injury) by 6 weeks without site-based trismus differences. [21]

The management of mandibular fractures in children is challenging because of developing tooth buds, growing state of the mandible and insufficient permanent dentition for immobilization.[18] To minimize the trauma to such vital factors use of cap splint and circum mandibular wiring is an excellent conservative treatment option with good results in managing mandibular fractures. This technique has limitation for providing stability in posterior mandibular fracture hence care should be taken on follow ups to provide additional support if needed in such cases. Current study also supports the literature to implement this conservative treatment option for managing paediatric mandibular fractures.

Conclusion

For paediatric mandibular fracture using of acrylic cap splint with circum-mandibular wiring shows excellent post op clinical outcomes such as occlusal stability and fracture union. In spite of promising results this conservative treatment option gives poor occlusal stability and fracture union in posterior mandibular fractures.

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