



ROLE OF RESORBABLE PLATES IN PAEDIATRIC MAXILLOFACIAL TRAUMA

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ABSTRACT

Background: The pathology of paediatric maxillofacial trauma is different compared to adult counterparts as the craniofacial development and the developing dentition continues. The traditional fixation of titanium though not ineffective can disrupt growth and normally, it requires further elimination. The use of resorbable plate systems has become an avenue worth pursuing in the paediatric population.

Objective: To evaluate the clinical effectiveness and safety of resorbable plates in the management of paediatric maxillofacial fractures.

Methodology: This is a prospective observational study that will be undertaken between 1 st January 2024 and 1 st January 2025 at Bibi Aseefa Dental College SMBBMU Larkana. There were a total of 72 Paediatric patients (<16 years) with maxillofacial fractures that needed open reduction and internal fixation. The characteristics of fractures, the details of operations, clinical and radiological results, and the complications after the operations were evaluated. The statistical tests on the comparison of age groups were conducted using the relevant statistical tests and a p-value of <0.05 was deemed significant.

Results: Mandibular fractures were the most common injury pattern. Stable fixation and satisfactory radiological healing were achieved in over 90% of patients. Normal occlusion was restored in the majority of cases, and the need for intermaxillary fixation was limited. Postoperative complications were infrequent and mostly minor, with no clinically evident growth disturbances observed during follow-up.

Conclusion: Resorbable plate fixation provides reliable stability, favorable functional outcomes, and a low complication rate in paediatric maxillofacial trauma. Its use eliminates the need for secondary hardware removal and represents a safe and effective alternative to conventional metallic fixation in appropriately selected paediatric patients.

Keywords

Paediatric maxillofacial trauma; Resorbable plates; Facial fractures; Internal fixation; Children

INTRODUCTION

Children with maxillofacial trauma constitute a major percentage of emergency cases and have distinct physiological and structural factors. Paediatric facial skeleton is distinct and has high elasticity and continuous development, as well as immaturity of dentition, which affect the patterns of fracture and treatment. The management does not only seek to produce anatomical reduction and functional restoration but also tries to ensure that the long-term effects of the treatment on the development and growth of the face are minimized (1-3).

Maxillofacial trauma has been extensively treated with conventional open reduction and internal fixation with titanium plates. But in children, the metallic hardware can disrupt the development of the skeletal system, travel along bone remodelling, or necessitate a secondary surgical resection. These are the issues that have led to the exploration of alternative fixation procedures that offer sufficient stability but do not lead to permanent fixations and consequently long-term complications (4-6). To overcome these shortcomings resorbable plate and screw systems were invented. These systems are made of biodegradable polymers and ensure adequate rigidity during bone repair and they degrade over time thus removing the necessity of removing implants. They have been reported to gain more and more applications in paediatric craniofacial surgery, maxillofacial surgery, and have a positive outcome on fracture stability, healing, and safety (7-9).

Despite growing interest, clinical data on the routine use of resorbable plates in paediatric maxillofacial trauma remain limited, particularly in resource-constrained settings. This study was therefore conducted to evaluate the role of resorbable plate fixation in paediatric facial fractures by assessing operative characteristics, clinical and radiological outcomes, and postoperative complications in a cohort of paediatric patients.

METHODOLOGY

The study was undertaken as a prospective observational study to determine the effectiveness of resorbable plate system in the treatment of paediatric maxillofacial trauma. The period of investigation was January 2024 to January 2025 and the location of the study was Bibi Aseefa Dental college SMBBMU Larkana. The objective of the study was to evaluate the clinical outcome, radiological recovery and the number of complications after fixation using resorbable plates in children with facial fractures.

A total of 72 children were involved in the study under study through the use of consecutive sampling. Children younger than 16 years who reported with maxillofacial fractures that needed open reduction and internal fixation were regarded as eligible. Isolated dentoalveolar injuries treated conservatively, pathological fracture, polytrauma that necessitated extended intensive care and those who had had prior surgery to the face were excluded. Parents or legal guardians gave written informed consent before being included into the study.

Each patient was clinically assessed, their faces were evaluated, and their mouths were evaluated, as well as the condition of their neurons. Radiological evaluation was conducted as per relevant imaging modalities such as orthopantomogram and computed tomography scan as per the need to ascertain the fracture site, displacement and number of fracture segments. The fractures were categorized according to the anatomical location and displacement status.

General anesthesia surgery was carried out by highly qualified maxillofacial surgeons. The open reduction and internal fixation were performed on the basis of the resorbable plate and screw systems of the right size and thickness depending on the age of the patient, pattern of fracture, and the quality of the bone. Where possible an intraoral approach would be selected and only in the case of selected cases would an extraoral approach be employed to expose the patient to a broader audience. Surgery-related information like the length of surgery, quantity of plates and screws in operation, and mode of surgery were recorded.

Patients were followed up on the postoperative period to check on early complications such as infection, wound dehiscence, and plate exposure. The use of intermaxillary fixation was selective in the sense that it was used when considered necessary to aid in the maintenance of the occlusive

stability. The patients were followed at intervals to determine the stability of the fractures, occlusal outcome, mouth opening and radiological bone healing. The following complications were observed during follow-up: plate palpability, foreign body reaction, and reoperation.

Data were entered and analyzed using statistical software. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. Comparative analysis between age groups was performed using independent t-tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The study involved 72 paediatric patients with maxillofacial trauma treated with resorbable plates, which is slightly skewed towards those who were aged between 11 and 16. There was male dominance in both age equations and it is agreeable since boys were more exposed to the trauma activities. The age mean of the two groups was statistically significant because of the predetermined age stratification, whereas the gender distribution did not have any significant differences.

Table 1. Baseline Demographic Characteristics of Paediatric Patients Treated with Resorbable Plates (n = 72)

Variable	Overall (n=72)	≤ 10 years (n=34)	11–16 years (n=38)	p-value
Age (years), mean $\pm$ SD	10.9 $\pm$ 3.2	7.6 $\pm$ 1.8	13.8 $\pm$ 1.6	<0.001
Male, n (%)	46 (63.9)	20 (58.8)	26 (68.4)	0.40
Female, n (%)	26 (36.1)	14 (41.2)	12 (31.6)	—

The majority of younger children had falls as the most prevalent mechanism of injury, but road traffic accidents were found to be much more common in older children and adolescents. The most common injuries in the two age groups were mandibular fractures, which were then accompanied by midface and orbital fractures. Even though there was a higher prevalence of displaced fractures in older patients, the difference was not found to be significant.

Table 2. Injury Mechanism and Fracture Distribution in Paediatric Maxillofacial Trauma (n = 72)

Variable	Overall (n=72)	≤ 10 years (n=34)	11–16 years (n=38)	p-value
Mechanism of injury				
Fall, n (%)	32 (44.4)	20 (58.8)	12 (31.6)	0.02
Road traffic accident, n (%)	26 (36.1)	8 (23.5)	18 (47.4)	0.03
Sports-related injury, n (%)	14 (19.4)	6 (17.6)	8 (21.1)	0.71
Fracture site				
Mandible, n (%)	44 (61.1)	19 (55.9)	25 (65.8)	0.39
Midface fractures, n (%)	18 (25.0)	9 (26.5)	9 (23.7)	0.78
Orbital/zygoma fractures, n (%)	10 (13.9)	6 (17.6)	4 (10.5)	0.38
Displaced fractures, n (%)	48 (66.7)	20 (58.8)	28 (73.7)	0.18

The average length of stay in operation was much longer in the elderly age group as it represents more complexity of the fracture and fixation needs. The demand on mechanical requirements was greater among older children who needed more plates and screws. Surgical access through intraoral method was the most prevalent in both groups, and there was no statistically significant difference.

Table 3. Operative Characteristics of Resorbable Plate Fixation (n = 72)

Variable	Overall (n=72)	≤10 years (n=34)	11–16 years (n=38)	p-value
Duration of surgery (minutes), mean ± SD	78.6 ± 14.3	72.4 ± 12.1	84.1 ± 13.8	0.001
Plates used per patient, mean ± SD	1.6 ± 0.6	1.4 ± 0.5	1.8 ± 0.6	0.004
Screws used, mean ± SD	6.3 ± 1.9	5.7 ± 1.6	6.8 ± 2.0	0.02
Intraoral approach, n (%)	52 (72.2)	26 (76.5)	26 (68.4)	0.44
Extraoral approach, n (%)	20 (27.8)	8 (23.5)	12 (31.6)	0.44

The fixation success and satisfactory radiological bone healing was observed in over 90 per cent of patients which showed the efficacy of resorbable plates in paediatric trauma. The restored normal occlusion at the final follow-up was observed in most cases. The need of intermaxillary fixation was temporal and similar across age groups.

Table 4. Clinical and Radiological Outcomes Following Resorbable Plate Fixation (n = 72)

Outcome	Overall (n=72)	≤10 years (n=34)	11–16 years (n=38)	p-value
Stable fixation achieved, n (%)	69 (95.8)	33 (97.1)	36 (94.7)	0.63
Satisfactory radiologic healing, n (%)	68 (94.4)	32 (94.1)	36 (94.7)	0.91
Normal occlusion at final follow-up, n (%)	66 (91.7)	32 (94.1)	34 (89.5)	0.47
Temporary intermaxillary fixation required, n (%)	14 (19.4)	5 (14.7)	9 (23.7)	0.33

Most postoperative complications were minor, and therefore, the safety profile of resorbable plate systems in children is favorable. The most frequent complication was plate palpability which was self-limiting most of the time. Severe negative events, including plate exposure, foreign body reaction, and the necessity to conduct reoperation were infrequent.

Table 5. Postoperative Complications Associated with Resorbable Plates (n = 72)

Complication	Overall (n=72)	≤10 years (n=34)	11–16 years (n=38)	p-value
Surgical site infection, n (%)	4 (5.6)	2 (5.9)	2 (5.3)	0.92
Plate palpability, n (%)	6 (8.3)	2 (5.9)	4 (10.5)	0.47
Plate exposure, n (%)	2 (2.8)	1 (2.9)	1 (2.6)	0.94
Foreign body reaction, n (%)	1 (1.4)	0 (0.0)	1 (2.6)	0.34
Re-operation required, n (%)	1 (1.4)	0 (0.0)	1 (2.6)	0.34

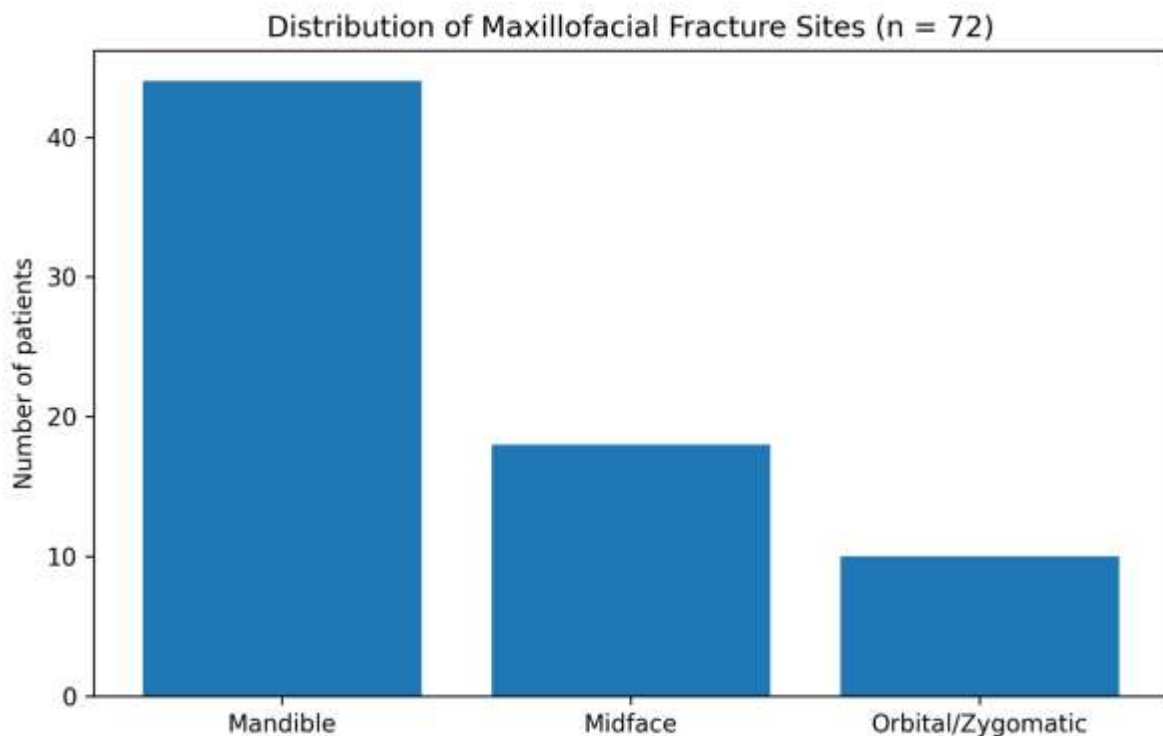


Figure 1: Distribution of maxillofacial fracture sites among paediatric patients managed with resorbable plates (n = 72).

DISCUSSION

The specifics of paediatric maxillofacial trauma complicate the treatment because of face development, dental formation, and the necessity to reduce morbidity in the long run. Resorbable plate fixation in the current study showed great stability of fractures, an acceptable radiological healing and a good result with the occlusion, and thus this method of fixation can be effective in children. Such results support the increasing popularity of resorbable systems in children in which permanent devices can disrupt development or require additional removal (10-12).

The age composition and injury trends seen in this study are in line with current clinical trends whereby the majority of the patients were men and the mandibular fracture site was the most affected. The age-related patterns were falls were more common in younger children and road traffic accidents were common in older children and adolescents. The large percentage of mandibular involvement underscores the biomechanical frailty of the mandible in paediatric trauma and that it often requires surgical fixation (13-15).

The results of operative outcomes in this cohort were promising, with older children taking more time to fixate and consuming more fixation hardware, presumably because fractures were more complex and loads higher. Nevertheless, resorbable plates had sufficient stability in all age groups, in spite of these differences. The use of intra-oral type of surgery also contributes to the benefit of resorbable systems in reducing the morbidity of surgery and scarring of the soft-tissues in the paediatric population (16-18).

The clinical and radiological results proved to be very satisfactory whereby over 90 percent of patients attained stable fixation and normal occlusion in the end period of follow-up. The fact that intermaxillary fixation is only necessary to a small degree implies that resorbable plates have adequate rigidity to support functional recovery but does not require long-term immobilization. The results are of particular usefulness in children, in which early resumption of normal functioning is linked with the need to fulfill nutrition, speech development, and psychosocial well being (19, 20).

The rate of complication in this study was minimal and majority of the complications were mild and self-limiting. Plate palpability was the most common, and serious complications occurring in such situations as infection, plate exposure, foreign body reaction, or reoperation were uncommon.

Notably, the follow-up showed no clinically evident growth abnormalities, which justifies resorbable plates as safe in the paediatric facial skeleton. Nevertheless, it needs a longer follow-up to determine growth-related outcomes conclusively.

CONCLUSION

Resorbable plate fixation is a safe and effective modality for the management of paediatric maxillofacial fractures, providing reliable fracture stability, high rates of bone healing, and favorable functional outcomes with a low complication profile. Its ability to eliminate the need for secondary hardware removal and reduce the risk of growth interference makes it particularly well suited for the paediatric population. Resorbable plates should be considered a valuable first-line option in appropriately selected cases of paediatric maxillofacial trauma.

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