

## Functional Outcome Assessment Using Quick Disability of the Shoulder, Arm and Hand (Quick DASH) Score in Children treated with ORIF for Clavicle Fractures

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### Abstract

**Aim:** Functional Outcomes of Clavicular Fractures Fixation in Adolescent Children

**Methods:** A retrospective study was conducted in the Department of Orthopaedics, SB Medical College & Hospital, Hazaribagh, Jharkhand, India. 50 patients treated with ORIF for closed, isolated and neurovascularly intact clavicular fractures were identified. Case notes were reviewed, and radiographic evidence analysed, paying special attention to the rate of healing, radiographic union, functional outcomes and complications.

**Results:** 50 children treated with ORIF for clavicle fractures were identified. Mean age was 14.2 years (range 13.5-15.8), and all 45 cases were males. 45 children had mid-shaft fractures and 5 had a lateral-end fracture. The mean shortening at time of injury was 15.5mm on the AP film (range 12-22mm) with mean vertical displacement 18.5mm (range 16-24mm). Out of 50 patients, 44 were able to return to unrestrained sport at 12 months. The 3 patients with lateral-end fractures had to have the hook plate removed at six months, 3 patients had plate removal nine months due to plate prominence. The mean Quick DASH score at 12 months follow-up was 3.34 (range: 0 - 15.8). The worst Quick DASH score was seen in the patient with the lateral-end fracture, who suffered with mild to moderate pain post-operatively and had limited ability to return to unrestrained sporting activity.

**Conclusion:** Good functional and radiographic outcomes can be obtained with internal fixation of clavicle fractures in children. Subjective satisfaction rates post-operatively tend to be high.

**Keywords:** Quick DASH score, clavicle fractures, ORIF.

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### Introduction

Fractures of the shaft of the clavicle are common in both adults and children[1]. Many fractures heal with non-operative

treatment without adverse sequelae, but there exists a subset of patients who may benefit from operative intervention[2-4]. In particular, controversy exists about optimal

treatment of a midshaft clavicle fracture in the presence of significant displacement, comminution or shortening of the fracture in adolescents[2-5]. Recent studies in the adult literature have indicated that improved functional outcomes are achieved after open reduction and internal fixation of the clavicle[2,3,5]. McKee et al examined 111 patients with midshaft clavicle fractures randomised to either traditional non-operative treatment or open reduction and internal fixation with a plate[5]. That study found superiority of operative fixation, with superior surgeon-based (Constant shoulder score) and patient-based (Disabilities of the Arm, Shoulder and Hand (DASH) score) outcome measures at every time-point in the study. Patients who underwent operative fixation had an earlier return to normal function[5]. Additionally, a multicenter randomised controlled trial performed in Canada also suggested that operative fixation of displaced clavicle shaft fractures resulted in improved Constant and DASH scores among adults compared with non-operative treatment[3]. However, the recent data on operative treatment of clavicular fractures in adults show lower rates of malunion and non-union, shorter time to radiographic union, and improved patient satisfaction rates, with less postoperative complication and improved objective measures of shoulder strength and function[6-10]. In the paediatric population, very little data exists in the literature on operative management of clavicle fractures. It is assumed that children have higher remodeling potential thus better outcomes following non-operative management of clavicle fractures. However, post-mortem data shows that the clavicle extends from the medial physal plate and achieves most of its length by age 14, thus exhibiting limited remodeling potential thereafter[11,12]. There is still much debate and controversy regarding the operative versus non-operative management of clavicle fractures in children, and in particular in the adolescent

population. In the absence of randomised controlled trials (RCTs), the highest level of evidence currently published relating to this topic is a retrospective cohort study of 42 adolescents 17 patients treated operatively and 25 patients treated non-operatively[13]. The authors conclude that open reduction and internal fixation (ORIF) in the 12- 18 age groups led to reduced time to radiographic union and return to activities. While they reported no non-unions, there were five cases of symptomatic malunion in the non-operative group, four of which were later treated with osteotomy and internal fixation.

There are only a few studies in the literature evaluating operative management for children with clavicle fractures, and particularly given the encouraging data obtained from the adult population, we decided to do a retrospective study regarding the outcomes in children who have undergone ORIF for closed clavicle fractures.

### Materials and methods

A retrospective study was conducted in the Department of Orthopaedics, SB Medical College & Hospital, Hazaribagh, Jharkhand, India for 1 year.

### Methodology

50 patients treated with ORIF for closed, isolated and neurovascularly intact clavicular fractures were identified. Case notes were reviewed, and radiographic evidence analysed, paying special attention to the rate of healing, radiographic union, functional outcomes and complications. Mean shortening and vertical displacement were measured on pre-operative antero-posterior (AP) films. The type of clavicle fracture and the operative fixation used were identified. All children were scored at 12-month follow-up using the Quick Disability of the Shoulder, Arm and Hand (Quick DASH) score, an 11-item questionnaire used to objectively measure shoulder function[14]. All patients had

been operated on within seven days of injury using an infraclavicular approach. Care was taken to preserve supraclavicular cutaneous nerves with meticulous soft tissue dissection. All post-operative complications and further operations were noted.

## Results

50 children treated with ORIF for clavicle fractures were identified. Mean age was 14.2 years (range 13.5 – 15.8), and all 45 cases were males. 45 children had mid-shaft fractures and 5 had a lateral-end fracture.

**Table 1: Demographic profile**

Mean age	14.2 years
Mid-shaft fractures	45
Lateral-end fracture	5
Male	45
Female	5

The mean shortening at time of injury was 15.5mm on the AP film (range 12-22mm) with mean vertical displacement 18.5mm (range 16-24mm). The mid-shaft fractures were fixed using Acumed® clavicle plates and the lateral-end fracture was fixed with a hook plate. Radiographic healing was achieved in all cases by three months. Post-operatively, there were no wound infections and only two patients reported sensitive scars. None of the patients had any loss of sensation in the distribution of supraclavicular nerves. In total, 30 patients had implant removal post-operatively, 8 cases who had scar sensitivity, 8 patients because of plate prominence and 4 hook plate for lateral end fracture. There were no instances of residual incisional numbness.

The hook plate did enable union but was associated with mild pain, sensitivity, inability to perform contact sports and was subsequently removed at six months post-operatively. Out of 50 patients, 44 were able to return to unrestrained sport at 12 months. The 3 patients with lateral-end fractures had to have the hook plate removed at six months, 3 patients had plate removal nine months due to plate prominence. The mean QuickDASH score at 12 months follow-up was 3.34 (range: 0 - 15.8). The worst QuickDASH score was seen in the patient with the lateral-end fracture, who suffered with mild to moderate pain post-operatively and had limited ability to return to unrestrained sporting activity.

**Table 2: Mean Quick DASH score**

Mean Quick DASH score	3.34
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## Discussion

The clavicle is the most common site for fractures to be sustained in the paediatric population, and historically these fractures have always been managed non-operatively, despite the amount of radiographic displacement at the time of injury. Recently, evidence in the adult population showing improved subjective and objective long-term outcomes in the

function of the shoulder with operative fixation has led many to question whether an operative approach will also be beneficial in children[10]. This may be the case particularly in the adolescent population.

Indeed, in our paediatric sample, fixation allowed radiographic union in all cases at three months follow-up, and at 12 months, 88% patients were able to return to unrestricted sporting activity. Patients also

had good objective function, with mean QuickDASH score of 3.34. When the lateral-end fracture with hook plate fixation is excluded, this score improves even further to 2.36.

Kubiak and S longo were one of the first to report on the outcomes from operative management of various types of paediatric clavicular fractures (eight mid-shaft, two medial, five lateral)[15]. They examined 15 children over a 21-year period who had fixation of the clavicle at their institution. All children had recovered full range of movement by 88 days of mean follow-up. They recommended operative management for the following indications: compound fractures, neuro-vascular injury, severe shortening of the shoulder girdle and impingement of soft tissue with or without potential for skin perforation.

Mehlman et al. examined a larger sample size of 24 who had primary ORIF and elective hardware removal at a later date[12]. They found that 87% of children were able to return to unrestricted sports activities, but the remainder did not have parental permission. Subjective satisfaction with the outcome of fixation was achieved in all cases. There were no infective complications or cases of non-union. However, two patients reported scar sensitivity and one patient suffered from transient ulnar nerve neuropraxia. They concluded that operative treatment of clavicular fractures in children is safe and effective and argue that since most of the length of the clavicle is achieved early in life, clavicular fractures in children should be treated similarly to those in adults.

In Namdari's retrospective study on 14 children treated with ORIF for clavicular fractures, the authors also found union and good functional outcomes to be universally achieved post-fixation[16]. All subjects performed well on the QuickDASH and simple shoulder test (SST) scores at follow-up. However surgical fixation did result in two cases of residual incisional numbness

and four patients required hardware removal. Given the risks of surgical site numbness and revision surgery they recommended operative management only for patients who are at risk of complications from non-operative treatment. Considering the fact that five of our patients also required subsequent plate removal and two suffered from sensitive scar sites, we also feel that caution must be exercised before deciding to embark upon an operative route of management.

Prinz et al. looked at displaced midclavicular fractures in children and followed up 59 children with 60 fractures[17]. Ten had operations, all of whom were over ten years old. They found all but one of the under-10s managed non-operatively did well apart from a patient who developed a painful psuedarthrosis. However, whilst functional outcome in the older children was as good as the younger children in- dependent of treatment method, the global and cosmetic satisfaction scores were lower. The authors also reported that older children with non-operative treatment suffered from more pain and were dissatisfied with the long immobilisation.

Labronici et al reported ten patients between the ages of five to eleven years (mean of 7.3 years) were observed. Nine patients were treated conservatively and one surgically. They reported the treatment indication for distal fractures of the clavicle in children should be based on the patient's age and the displacement of the fragments[18]. This present study tracked the medium-term progress of clavicular fixation in a paediatric sample, however it is not without limitations. The sample size was relatively small, and the study is retrospective in nature. Additionally, the presence of a baseline matched control group managed non-operatively would be required to better compare the long-term outcomes achieved from both modalities. Furthermore, whilst the Quick DASH score is well validated in the adult population, its

internal validity in the paediatric population can only be gleaned from data obtained from those older than 18 years. Further studies in the form of randomised control trials are required to evaluate the outcomes of operative vs non-operative management in paediatric clavicle fractures, and to help define the specific indications and conditions under which operative management may be recommended.

### Conclusion

Good functional and radiographic outcomes can be obtained with internal fixation of clavicle fractures in children. Subjective satisfaction rates post-operatively tend to be high.

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