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Research Paper

The Recovery of Elbow Range of Motion After Treatment of Supracondylar Fractures of Humerus in Children

Medical Science

KEYWORDS : elbow, range of motion, fracture, humerus, child

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ABSTRACT

We conducted a retrospective study for analyzing time required for regaining elbow range of motion after supracondylar humerus fracture and forearm fractures immobilized in above elbow cast without any physiotherapy. We found out that time of immobilization is directly related to time required for recovering range of motion; severity of injury is not related to time of recovery for range of motion; postoperative physiotherapy is not needed in children with uncomplicated elbow fractures.

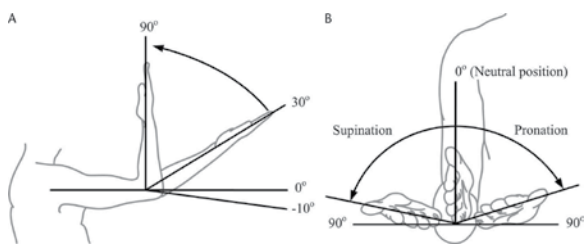
Introduction

Supracondylar fractures of distal humerus are the most common pediatric elbow fractures. Compared to adults stiffness after injury is relatively uncommon in children. The time required for restoration of elbow range of motion (ROM) and related factors have seldom been reported. Most commonly asked question after the treatment of elbow fracture is "When elbow function will become normal ?" To answer the question, we conducted a study to record the elbow ROM after the treatment of supracondylar humerus fractures. The purposes of this study was to report the time required for restoration of elbow ROM after the treatment of supracondylar condylar fractures of humerus in children, using distal forearm fractures as a control group, and to analyze the effect of casting on elbow without an elbow injury.

PATIENTS AND METHODS

From 2014 to 2016, children with distal humerus supracondylar fractures were included in this retrospective study.45 cases were included. Another group of 45 children with distal forearm fractures who were given long arm casting for around 28 days was used for comparision. All patients were treated by a senior orthopaedic surgeon. There were 15 cases in each subgroup of supracondylar fractures. The Gartland type 1 supracondylar fracture was treated with a long arm cast. The Gartland type 2 and 3 fractures were treated with closed reduction, internal fixation with smooth pins and long arm casts. The recommended casting time was 4 weeks. None of the cases in this series received open reduction. The elbow was immobilized in 90 degrees of flexion and forearm in neutral rotation. Passive elbow ROM including flexion, extension, forearm supination, and pronation was checked with a goniometer at the day of cast removal, 1 week after cast removal, and then every 2 weeks until the elbow ROM returned to 90% ROM (ROM-90) of the uninjured side. All the measurements were recorded by an orthopaedist. All the patients were encouraged to perform painless active ROM exercise after cast removal. None of them received passive or resisted ROM exercise .

The ROM required for functional activity of daily living (ROM-ADL) was defined as 30 degrees of extension, 130 degrees of flexion, and 50 degrees of forearm supination and pronation[6]. The time required to restore ROM-ADL and ROM-90 in each direction was recorded.



A.The measurement of elbow flexion–extension. B, The measurement of elbow supination– pronation.

RESULTS

The average casting time in the supracondylar fracture group was 32.5 days and distal forearm fracture group was 33.4 days. There was no statistical difference in casting time between fracture groups. There was no major complication .

From the trend line of Figure 5 (supracondylar fractures), the elbow total flexion angle reached a plateau of 135 degrees at 1 month after cast removal, whereas forearm total rotation ROM required half the time to reach 135 degrees

In the group of patients with elbow immobilization without elbow injury (distal forearm fracture group), the total elbow flexion– extension angle recovered faster and required less than 2 weeks to reach 135 degrees (fig 1,2) . The supination range was easier to recover than the pronation motion in supra- condylar fractures (fig 7,8)

Statistical analysis revealed that more time was required to restore flexion and extension motion in supracondylar group as compared with distal forearm fractures .From the paired t test it took longer for pronation to recover than supination in supracondylar fractures (fig 7,8).

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The number of days of casting was positively correlated with the number of days of ROM-90 elbow extension recovery in patients with supracondylar (P = 0.021) fractures. The ROM-90 flexion recovery days in supracondylar fractures was also positively correlated with days of casting (P = 0.021) (fig 9). Otherwise, the days of casting were not correlated with other directions recovery days.

The subclassification and type of treatment of individual fractures did not show statistically significant impact on the recovery of ROM-90 and ROM-ADL, but the case number in each sub-

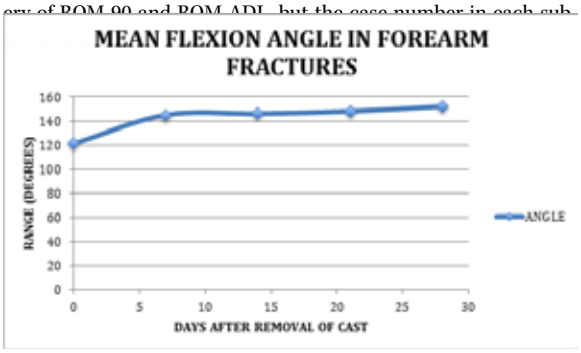

Figure 1: Mean flexion angle after cast removal.

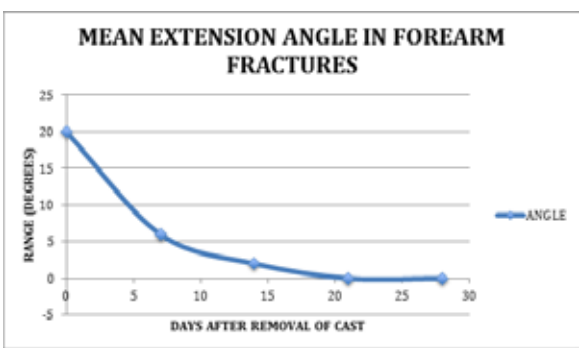

Figure 2: Mean Extension angle after removal of cast

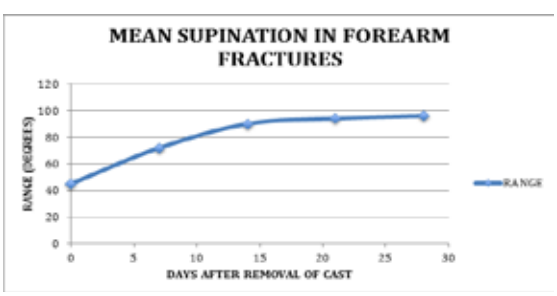

Figure 3 : Mean range of supination in forearm fractures

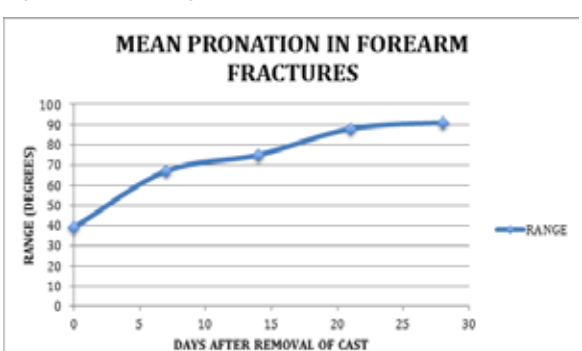

Figure 4: Mean range of pronation in forearm fractures

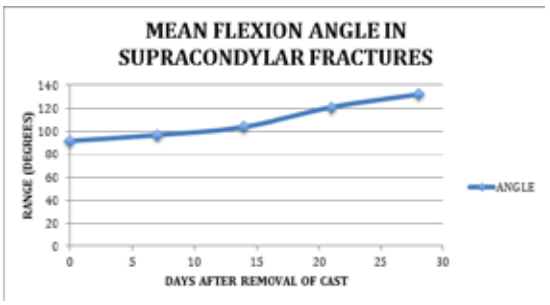

Figure 5: Mean flexion range in supracondylar fractures

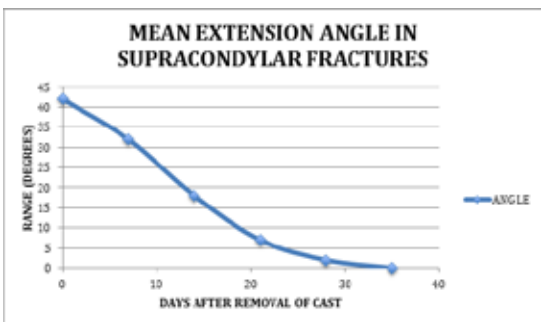

Figure 6: Mean extension angle in supracondylar fractures

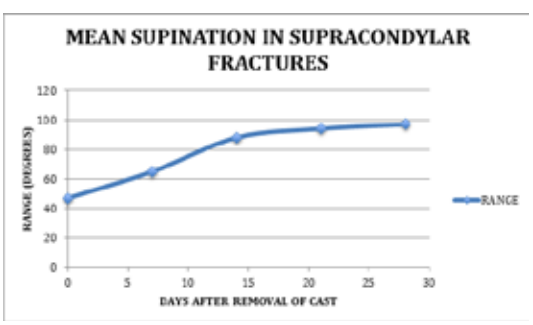

Figure 7: Mean range of supination in supracondylar fractures.

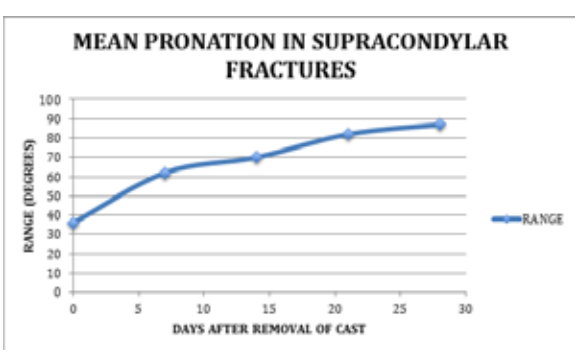

Figure 8: Mean range of pronation in supracondylar fractures

DAYS NEEDED TO ACHIVE FUNCTIONAL RANGE	FLEXION ANGLE		EXTENTION ANGLE		SUPINATION		PRONATION	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
FUNCTIONAL RANGE TARGET(DEGREES)	130		30		50		50	
DISTAL FOREARM (DAYS TO ACHIEVE)	3.8	0.7	0	-	2.1	1.2	2.8	1.1

SUPRACONDYLAR FRACTURES (DAYS TO ACHIEVE)	28.2	13.7	9.1	7.4	2	0.8	3.4	1.6

Table 1: Average days needed for recovery of functional range of motion in forearm and supracondylar fractures

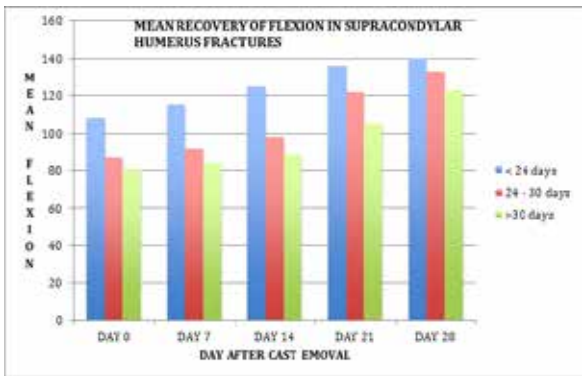

Figure 9: Mean recovery of flexion in supracondylar humerus fractures depending on timing of removal of cast

DISCUSSION

Trauma constitutes the most frequent cause of elbow contracture,[1-6] and immobilization during the bone healing stage can also contribute to the functional loss. Most of the published discussion on ROM recovery after elbow fractures focuses on the etiology and treatment of stiffness[7-14].

Since the children in the distal forearm group (elbow immobilization without elbow fracture) had better initial elbow flexion–extension(figs 1,2) and the ROM recovered faster than the other elbow fracture groups (Figs. 5, 6), the posttreatment transient elbow stiffness does not seem to be due to only elbow immobilization, but a combined effect of original injury, related treatment, and immobilization.

In our study, forearm supination recovered faster than pronation in both groups. This might be explained by the fact that the supinators are stronger than pronators.[15]

King and Faber[6] reported that the residual loss of extension is more common than flexion after elbow trauma.But in our study, all cases regained their ROM-90 at final follow-up.

It has been reported that the severity of elbow trauma affects the functional outcome in adults[5,6] but our study did not detect any difference of ROM recovery between fracture severity types in children.

In Letts' textbook, McIntyre[16] stated that early mobilization at 3 weeks usually would minimize elbow stiffness.

Morrey and King and Faber[5,6] reported that posttraumatic elbow stiffness is related to prolonged immobilization and the severity of injury. We did not find a significant relationship between ROM recovery and fracture severity, which was defined by fracture subtypes.

We did find that the ROM recovery time was positively correlated with immobilization time, indicating that the duration of immobilization should be shortened as much as possible to facilitate functional recovery after elbow injury.(fig 9)

Keppler P et al stated that postoperative physiotherapy is unnecessary in children with supracondylar humerus fractures.[17] So, it is widely accepted that postoperative physiotherapy is unnecessary in children with supracondylar humerus fractures.[18] In our study cases regained their ROM-90 without physiotherapy,hence postoperative physiotherapy is not needed in children with uncomplicated elbow fractures.

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