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Case Report

Post-operative rehabilitation of displaced-proximal radius fracture: a case study

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ABSTRACT

Proximal radial fractures typically occur after a fall on the outstretched hand. Elbow trauma is usually followed by post-traumatic elbow stiffness, which has been recognized as a major cause of functional impairment. A stiff elbow restricts patient's ability to position hand in space required, for desired use of the upper extremities during activity of daily living. The goal of rehabilitation, post-traumatic elbow stiffness is to restore functional arc of motion. The patient treatment should be designed depending on the severity, type and time course of the arthrofibrosis. Since, there is no universally recognized treatment algorithm, treatment must be personalized/customized and stipulated through a shared decision-making process with each patient. Fourty four-year female was diagnosed with post – operative elbow stiffness following a displaced proximal one-third of radius fracture (right side). The patient had decreased muscle strength and limited shoulder, elbow and wrist range of motion, hypersensitivity around the scar and wrist and elbow pain. Progressive multi-treatment rehabilitation approach was given to the patient. Physical therapy intervention improved range of motion, strength, decreased hypersensitivity and pain of the patient as well as aided in quick recovery from stiff elbow.

Keywords: Post-operative elbow stiffness, Elbow stiffness rehabilitation protocol, Displaced proximal one-third of radius fracture

INTRODUCTION

The most common mechanism of injury of proximal radius fractures is typically fall on the outstretched hand with pronated forearm. Depending upon the severity of fracture, likelihood of associated lesion increases such as ligamentous rupture or one or more additional elbow fracture(s). This increases the complication rate in patients from about 10% in patients with a non-displaced fracture, 50% in patients with a displaced fracture and up to 75% in patients with a comminuted fracture. According to the original Mason's classification, proximal radial fracture is classified as type I (non-displaced fracture), type II (fractured fragments are displaced more than 2 mm) and a type III (comminuted, non-constructible radial head fracture).[1]

The elbow joint is prone for development of post-traumatic stiffness because of thickening and contraction of capsular tissues, abnormalities of bone and soft tissue when exposed to trauma.[2] Post-traumatic elbow stiffness is a challenging and disabling condition causing substantial impairment of upper extremity function that interferes with daily activities and adversely impact quality of life of an individual. Elbow joint helps in movement of the hand in space by permitting the forearm to act as a lever in lifting, carrying and provides precision in both open and closed kinetic chain activity. Therefore, even a slight restriction of elbow range can significantly diminish the ability of the hand to reach its objectives.[3] Pain free elbow joint motion and adequate muscle strength is important for normal function. Morrey classified the post-traumatic elbow stiffness in two types: one is intrinsic such as intra-

articular adhesions, impinging osteophytes and articular incongruities and second is extrinsic such as impinging orthopedic implants, heterotopic ossification, and capsular contractures, or mixed.[4] Clinically, patient usually presents with loss of elbow extension and loss of forearm supination. There is direct association seen between elbow joint stiffness and trauma, poor rehabilitation and unnecessary prolonged immobilization. Patient involvement and compliance during rehabilitation is also considered as a factor for development of elbow stiffness.[5] Success in treatment also depends on early rehabilitation as first six months after injury present the critical rehabilitation period.

Outcome research specifically investigating the effect of multi approach rehabilitation protocols including strengthening exercises, stretching exercises, scar tissue mobilization, active and passive range of motion exercise, proprioception training, multiple angle isometrics, joint mobilization and muscle energy techniques following displaced proximal one-third of radius fracture treated surgically is limited. So, this case will help in providing a muti- approach rehabilitation protocol for such patients.

CASE REPORT

A female patient aged – 44 years, had a history of mechanical fall from two-wheeler scooter, onto an outstretched right hand. Patient was diagnosed with displaced proximal one-third of radius fracture of right side (Figure 1). Fracture was classified as type II fracture according to original Mason classification. Patient underwent for open reduction internal fixation (ORIF) with plating (volar approach) on the same day of injury, in a private hospital (Figure 2) and was then discharged. After the surgery patient was advised hand exercises and home physiotherapy. Patient continued the home exercise programme but she still experienced significant stiffness and pain in her right elbow, forearm, wrist, and hand. The patient symptoms increased in the morning but as the day progressed mild decrease in symptoms was observed by the patient however, the stiffness and soreness were consistent throughout the day. Patient experienced difficulties in using her right upper extremity for performing her activity of daily living due to her limited ROM and muscle weakness, and with these chief complaints the patient reported to physiotherapy OPD.

Physical examination

The patient was evaluated 2 month 25 days following ORIF. She presented with a 1 cm increase in swelling around the surgical scar, increased skin temperature, hypersensitivity and tenderness when palpated over the proximal radius and incision site. Scar tissue thickening was noted. She had decreased elbow, wrist, shoulder and first carpal – metacarpal joint ranges. Patient also had paraesthesia around the web space. Her score on the disabilities of arm, shoulder, hand (DASH) was 60/100. Patient had noncapsular pattern of restriction as elbow extension was more limited than elbow flexion and forearm supination was restricted then pronation. Decreased muscle strength of elbow and wrist joint muscles was also observed when compared with uninvolved side. The restricted motion was mainly due to the surgery, immobilization and poor patient involvement in exercise rather than due to an actual degenerative process in the elbow. Patient pain on a 10-point NPRS scale was 7/10.

Figure 1: Pre-operative X-ray of displaced proximal 1/3 of radius fracture of right side.

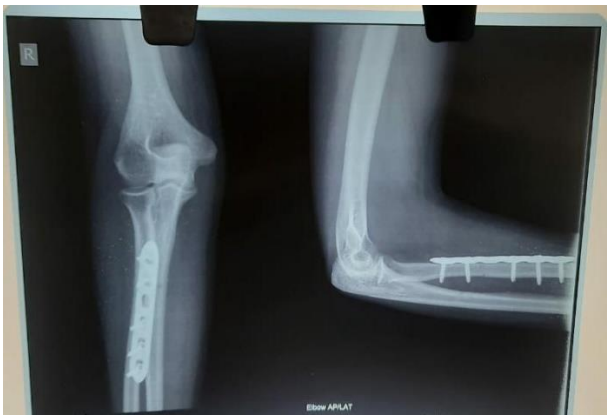

Figure 2: Shows post-operative X-ray of open reduction and internal fixation.

Therapeutic intervention

Goal of the treatment was designed according to international classification of functioning disability and health (ICF). Outcome measures used were manual muscle testing (MMT), range of motion (ROM), numeric pain rating scale (NPRS), disability of the arm, shoulder and hand (DASH score). A rehabilitation program of 20 days (6 days pr week).

Tables 1-4 along with home exercise programme was given to the patient with progression according to patient's status. Patient was kept motivated during whole rehabilitation program by frequent appreciation and giving new target to achieve.

Outcome measures

There was a marked difference in the range of motion index measured pre-post rehabilitation at elbow joint (Figure 3), and wrist joint (Figure 4). Increase in muscle strength was found when pre- post rehabilitation manual muscle testing for elbow joint (Table 5) and wrist joint muscles (Table 6) was done.

When pre- post rehabilitation NPRS and DASH scores were compared, then there was increase in DASH score from 60 to 90 (Figure 5) and decrease in NPRS score from 7 to 1 (Figure 6).

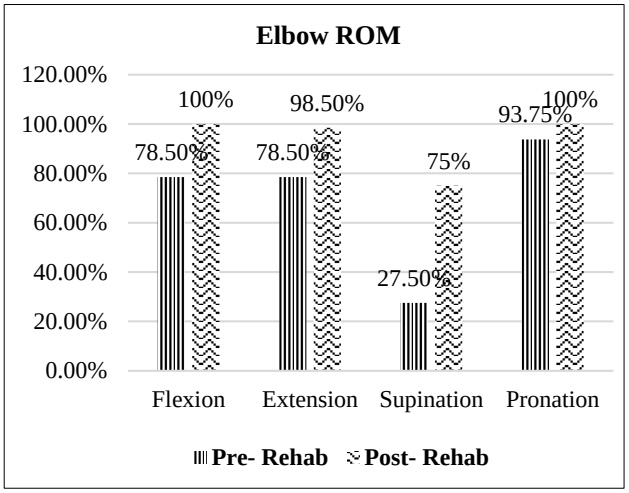

Figure 3: Percentage increase in elbow range of motion, post rehabilitation after 3 weeks.

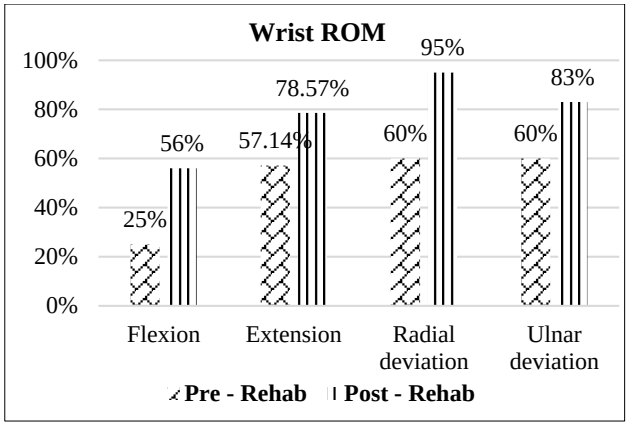

Figure 4: Percentage increase in wrist range of motion, post rehabilitation after 3 weeks.

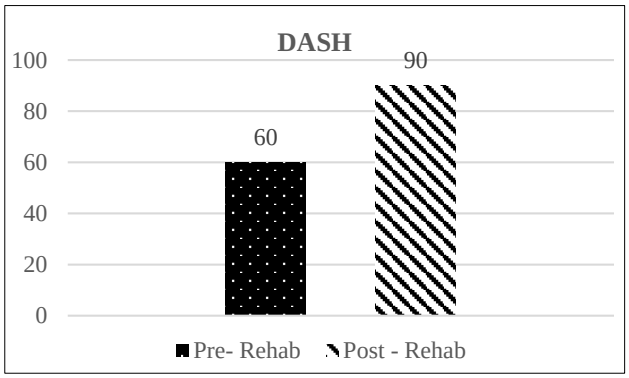

Figure 5: DASH score pre-post rehabilitation, after 3 weeks.

Table 1: Treatment protocol day 1-2.

1-2 days	Exercise	Repetition
ROM	Range of motion exercise of elbow, wrist and shoulder	10 repetitions each
Strengthening	End range isometric exercise; elbow flexion and extension, supination and pronation; wrist flexion, extension, radial and ulnar deviation	10 repetitions with 10 sec holds
	Ball pressing	10 repetition 5 sec hold
For scar tissue and post operative stiffness	Scar tissue mobilization – kneading with vaseline; joint distraction – humeroulnar, humeroradial	10 min
	Bicep and brachioradialis self-stretching	10 repetition, 10 sec hold
For paresthesia	Tapping to improve the sensation around web space	20-25 tap
Home exercise	Hot water fomentation, normal range of motion exercise for shoulder, elbow, wrist and lock and key exercise	2 set 10 repetitions

Table 2: Treatment protocol day 2-5.

2-5 days	Exercise	Repetition
ROM	Mobilization - proximal radioulnar joint (ventral glide of radial head), distal radioulnar joint (dorsal glide of distal radius), humeroradial joint (dorsal glide, ventral glide), humeroulnar (medial and lateral glide) and carpal metacarpal joint	Maitland grade- 2 30-60 sec, 3 set
	Weighted ex. elbow extension, flexion and supination and wrist flexion and extension	5 sec holds, 10 repetition

Continued.

2-5 days	Exercise	Repetition
Strengthening	Resistance exercise - elbow flexor and extensor, shoulder flexor, extensor abductors, internal and external rotator, wrist flexors, extensor, radial and ulnar deviation. (½ kg weight cuff)	10 repetitions
	Hand grip exerciser (5 kg)	5 sec holds, 10 repetition
	Multiple angle isometric – elbow supination and extension, wrist flexion and extension with blue TheraBand at initial, mid and end range	5 sec hold 5 repetition each range
For stiffness	Paraffin wax - brushing method was used, area covered right wrist and elbow, 8-10 coats of wax were applied to the area with a paintbrush using even and rapid strokes	15 minutes
	Scar tissue mobilization– kneading with vaseline	10 min
	Bicep and brachioradialis self-stretching	10 repetition, 10 sec hold
For paresthesia	Tapping to improve the sensation around web space	20-25 tap
Home exercise	Hot water fomentation, resisted exercise (½ kg weight cuff) for shoulder, elbow, wrist and lock and key exercise	10 repetitions

Table 3: Treatment protocol day 5-10.

5-10 days	Exercise	Repetition
ROM	Previous treatment cont.	
	Mobilization	Maitland grade- 3, 4, 30-60 sec, 3 set
	End range weighted ex.	10 sec holds, 10 repetition
	Movement with mobilization for elbow extension and forearm supination	Mulligan- 5 set of 1 min
	Muscle energy technique for pronators (autogenic inhibition)	5-7 sec hold for 8-10 repetition followed by a gentle passive stretch
	Forearm exerciser for supinator	10 repetition, 10 sec hold
Stiffness	Previous treatment cont., paraffin wax, scar tissue mobilization, bicep and brachioradialis self-stretching	Same
Proprioception control	Chair push exercise for co-activation of upper extremity	10 sec hold 10 repetition
Strengthening	Previous treatment cont.	
	Resistance exercise (½ kg weight cuff)	25 repetitions
	Multiple angle isometric (blue TheraBand)	10 sec hold 10 repetition each range
	Hand grip exercise (10 kg)	10 sec holds, 10 repetition
Home exercises-	Previous exercise cont.	25 repetitions
	Glass holding practice, towel twisting exercise for supinator, dough exercises, tapping to improve the sensation around web space	10 sec holds, 10 repetition

Table 4: Treatment protocol day 10-20.

10- 20 days	Exercise	Repetition
ROM	Previous treatment cont.	
	Mobilization (added first carpal metacarpal joint)	Grade-4 previous, addition grade-3
	End range weighted ex.	10 sec hold, 20 repetition
	MET for pronators	
	Supinator wrist exerciser	20 repetition, 10 sec hold
Strengthening	Previous treatment cont.	
	Multiple angle isometric (sliver)	10 sec hold 20 repetition each range
	PNF patterns upper extremity (D1, D2) (1 kg Dumble)	
	Weight holding exercise (1 kg)	10 min
	Isometric exercise for thumb abductors and extensors	10 sec holds, 15 repetition
Stiffness	Paraffin wax bath	Morning, evening

Continued.

10- 20 days	Exercise	Repetition
Proprioception control	Chair push exercise for co-activation of upper extremity	10 sec holds, 20 repetition
	Weight shifting on ball	10 sec hold and shift, 10 repetition
Home exercises-	Previous exercise cont. with inc. repetition.	
	Resisted exercise (1 kg weight cuff) for shoulder, elbow, wrist	20 repetitions

Table 5: Manual muscle testing score of elbow joint muscles, post rehabilitation after 3 weeks.

Elbow	Pre-rehab M.M.T	Post-rehab M.M.T
Flexion	4-	4+
Extension	3-	4-
Supination	2+	4-
Pronation	4-	4

Table 6: Manual muscle testing score of wrist joint muscles, post rehabilitation after 3 weeks.

Wrist	Pre-rehab M.M.T	Post-rehab M.M.T
Flexion	2+	4-
Extension	3-	4-
Radial deviation	3-	4-
Ulnar deviation	3-	4-

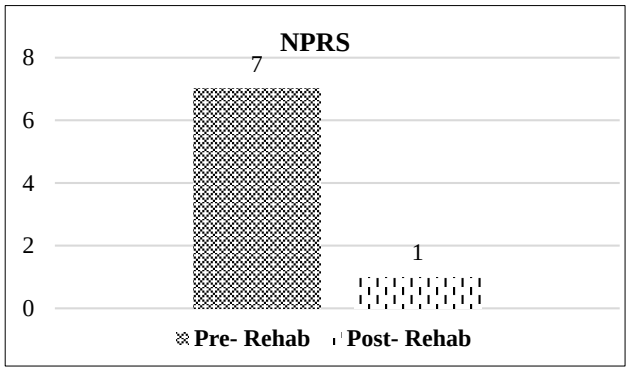

Figure 6: NPRS score pre- post rehabilitation, after 3 weeks.

DISCUSSION

This case study reports favourable outcome specifically for patient following displaced proximal one-third of radius fracture treated surgically with ORIF using physical therapy management including the use of multi-treatment approach protocol. Patient presented with good prognosis within 3 weeks of rehabilitation. Chief complaints of the patient including pain, stiffness and decreased range of motion were mainly due to immobility and lack of appropriate rehabilitation post- operatively. Various study found that rehabilitation helps in preventing excess stress on healing tissues, occurring due to immobilization.[6-10] A quite similar result were found in a study, which reported that stiffness impacts activity of daily living thereby, early range of motion exercises, active exercises, mobilization, mobilization with movement should be started at the appointed time to prevent joint stiffness.[3,11,12] In this case report, muscle energy technique (MET) combined with other treatment protocols was found to be an effective technique for improving forearm supination which is similar to study finding which concluded that MET can be used to treat elbow stiffness post elbow fracture and provide marked gain in range of motion.[13-15] Wrist joint rehabilitation following post–traumatic elbow stiffness also plays an important role in improving functional activities and quality of life of an individual which is usually ignored by the physiotherapists. Future research should consider the added benefit for multi-treatment rehabilitation approach for full restoration of elbow as well as wrist range of motion.

CONCLUSION

This reported case presented successful management of a 44 -year-old female following displaced proximal one-third of radius fracture. After elbow trauma, it's not only the elbow joint but also the wrist joint which also shows restriction due to immobility. The joint stiffness is also accompanied by weakness of muscles of hand, arm and forearm. Proper and appropriate protocol post-operative is important for rehab of the patient so that ADL's and instrument assisted activities of daily living (IADL's) can be successfully accomplished. Multi-treatment approach is an effective way to enhance rehabilitation and help in early recovery in patients with post operative elbow stiffness.

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