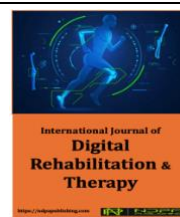




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Recovery of Hand Function with Comprehensive Rehabilitation for Distal Radius Fracture Fixed with Percutaneous Pinning

Aishwarya Pramod Shinde¹ and Sandeep Shinde*²

¹Krishna college of physiotherapy, Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India

²Krishna Vishwa Vidyapeeth, Karad, Maharashtra, India

Keywords

Muscle Atrophy
 Functional Mobility
 Rehabilitation Approach

ABSTRACT

Post operative stiffness is one of the common complications that occurs due to prolonged immobilization and sometimes because of delayed union of bone that may occur because of comorbidities such as diabetes mellitus. Comminated fractures are majorly seen in the traumatic injuries. In the present case report, there is closed comminated fracture of radius occurred to a patient when he experienced accidental trauma. This case report outlines the detailed assessment and physiotherapy management of 28year old male patient with right sided closed communicated fracture. Following the operative procedure by inserting k-wire (Kirschner)the patient was referred to physiotherapy department for post -operative management. After the implementation of structured exercise protocol for 12 weeks focusing on reducing pain, increasing muscle strength, improving range of motion, and mobility thereby enhancing the performance activity of daily living.



1. INTRODUCTION

Distal radius fractures (DRFs) are among the most prevalent upper extremity fractures. The distal radius has three separate articulating surfaces: the sigmoid notch, the lunate facet, and the scaphoid facet. The distal radius's carpal articulations are concave in relation to the carpus. As per the previous study, the elderly experience the highest rates, surpassed only by hip fractures. As the population ages, these numbers are expected to keep rising [1]. In young adults, These injuries typically occur as a result of high-energy traumas, while in older adults, they tend to arise from low-energy incidents like falls. In most cases, a fall on an outstretched hand from a standing height or lower. A distal radius fracture can be classified as a Colles, Smith, Barton, or Hutchinson fracture, depending on the specific nature of the injury. While analysing anatomy, the radio scaphoid articulation takes place on the distal radius's radial aspect, which also includes the radial styloid [2,3]. Ulnar styloid fractures, which have an incidence of 44–65%, are commonly observed with DRF [4]. The daily and professional lives of individuals may be greatly impacted by wrist stiffness following trauma or

surgery. Open reduction internal fixation has been the choice for instable DRF during all these years. Postoperative rehabilitation is a important key component for the postoperative stiffness [5].

Complications that occur postoperatively due to prolonged immobilization can worsen stiffness and heighten the risk of osteopenia [6]. Though, postoperative stiffness is a important concern after surgery, there aren't many research that address wrist stiffness that have been published in the literature [7]. Loss of range of motion of wrist joint post fracture is one of the complications that may occur [8]. Extrinsic stiffness refers to situations where the joint is initially preserved, whereas intrinsic stiffness encompasses all situations when there is a change in the morphology of the joint as a result of an articular fracture. Stiffness that occur in Post traumatic and post-operative cases of the wrist may have a significant impact on the working as well as daily life, [9] Wrist stiffness can be classified as intrinsic or extrinsic, according to Saffar et al., even though both types (mixed) are typically present [10].

For displaced and unstable fractures, surgical treatment of the distal radius is a good alternative. Although the majority of patentse show a positive

*Corresponding author

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* e-mail: drsandeepshinde24@gmail.com
 ORCID ID: 0000-0002-6466-3888

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response to the existing fixation methods, some still problems could arise. Both dorsal and volar plating can cause tendon irritation and rüptüre [11]. There's also a chance of infection, non-union, pain (DRFs) are the most prevalent type of fracture in adults, accounting for 17.5% of all fractures [12] Fractures from DR can happen at any age. Nonetheless, these injuries mostly follow a bimodal distribution according to sex and age Fractures of the distal forearm are less common in young and middle-aged adults compared to childhood and older age. However, when they do occur, the fracture patterns can be severe, leading to functional impairment or extended absence from work [13] The two distinct age categories that most prevalent are adults over 50 and children under 18 [14].

In the present case study, we have taken detailed assessment and structured physiotherapy management of a 28-year-old a male individual who suffered a distal radius fracture. Currently there is limited availability of data regarding a physiotherapy management in post of cases of distal radius fracture in young adults. Therefore, are aim being to assess the effect of comprehensive physiotherapy management to improve range of motion, post operative stiffness and functional mobility thereby to reduce any other post operative complications.

2. MATERIALS AND METHODS

syndromes, posttraumatic arthritis, and nerve damage. Having a treatment plan in place to lessen the issue and being aware of the many complications is crucial [11] Distal radius fractures

2.1. Case Report

A 28-year-old man arrived at our Krishna Hospital complaining of pain in his left wrist, which had experienced there for a month. patient had alleged history of road traffic accident on 23/05/2024 at around 10 am near karad, since then he experienced complain of discomfort and inflammation which was acute in onset, continuous in nature, sharp shooting and non-radiating. The patient had no history of head injury or chest trauma. to assess intensity of pain Visual Analogue Scale (VAS) were taken. Pain was gradual in onset and nonprogressive, it was on and off. It was moderate in intensity, and additionally there was complain of swelling over left wrist It was aggravated by the movement, holding the object, picking up the object. He was operated on 30/05/2024 for the closed reduction of a distal radius fracture Pre-Cutaneous K Wire Fixation. After that limb was immobilised for 1 month with the plaster cast. On 01/06/2024 the plaster cast was removed, Patient complains of pain and wrist stiffness, swelling and patient was referred to physiotherapy. He visited physiotherapy department on 01/06/2024. Figures1,2 shows AP/OBL and AP/LAT x-rays of the patient with k-wire fixation.

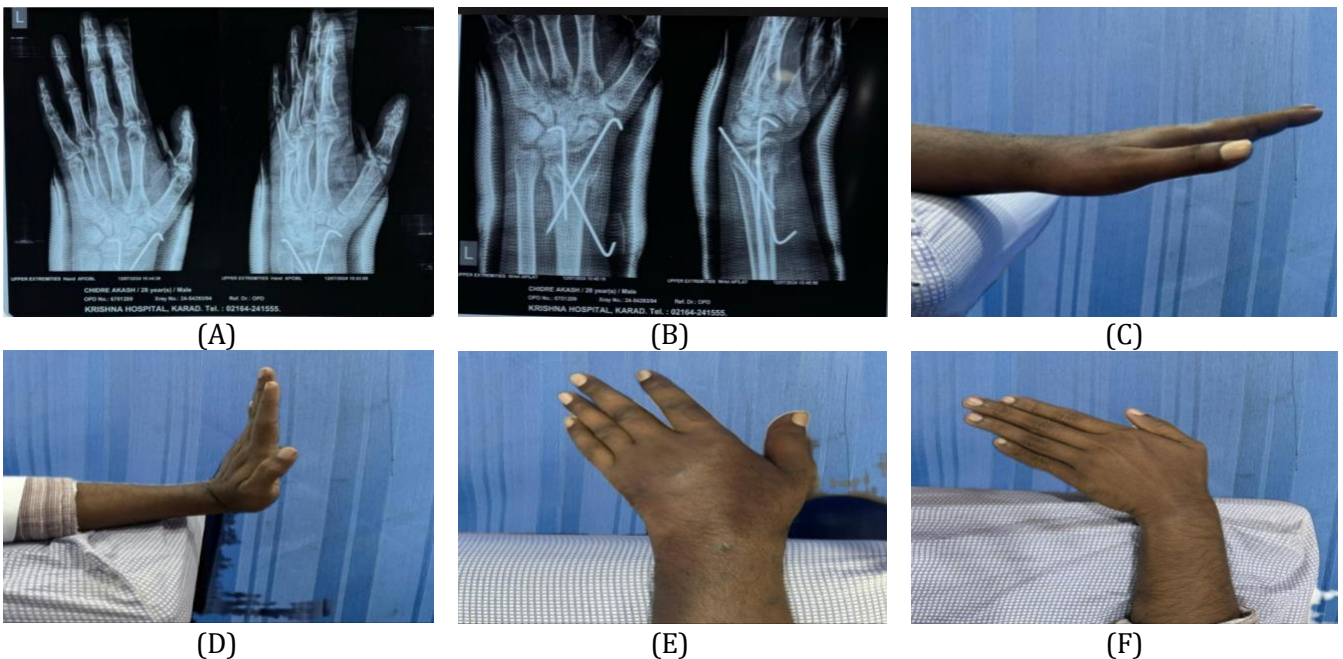


Figure 1. ADistal radius fracture of left wrist (pre-operative) AP/OBL view A ; Distal radius fracture of left wrist (pre-operative) AP/LAT view B ; Pre-operative wrist flexion C ; Post-operative wrist flexion D ; Pre-operative wrist radial deviation E ; Post-operative wrist radial deviation F

2.2. Therapeutic Intervention

Table 1. Therapeutic intervention exercise program

PHASE	DURATION / WEEK	MODALITIES / EXERCISE	DOSAGES / REPITATION / SETS
Phase 1	10 days- week 3	Cryotherapy	10 min
		Active isolated ROM exercise for finger joint	10 reps of 3 sets
		1) Extension	
		2) Flexion	
		3) Adduction	
		4) abduction	
		Tendon gliding exercises	10 reps of 3 sets
		Free exercises of elbow	10 reps of 3 sets
		1)Flexion	
		2)Extension	
Phase 2	Week (4-6)	Free exercise of shoulder	10 reps of 3 sets
		1)Flexion	
		2)Extension	
		Thumb opposition	10 reps of 3 sets
		Phase 1 exercises	
		Cryotherapy	10 min
		Stretches	10 reps of 3 sets
		1) Flexors	
		2) Extensors	
		Wrist mover	10 reps of 3 sets
Phase 3	Week (7-9)	Dynamic splinting	
		(Pre-Program)	15 reps 3 sets
		Progressive resistance exercises	
		Resistance exercises with free weight	
		Resistance band	15 reps 3 sets
Phase 4	Week (10-12)	1) Flexion	
		2) Extension	
		3) Radial deviation	
		4) Ulnar deviation	
		Return to daily activity	
Phase 4	Week (10-12)	1) Advanced strengthening	
		For wrist: progressive resistant exercise	
		2) Endurance exercises: It includes repetitive or sustained use of affected side.	
Phase 4	Week (10-12)	3) Activity-specific training:	
		Motivate the patient to perform daily activities using affected side.	

2.3. Therapeutic Intervention

The therapeutic intervention and treatment goals were determined based on the patient's needs and state of recovery.

Table 2. The therapeutic intervention and treatment goals

Joint	Movement	Pre-treatment ROM	Post-treatment ROM
Wrist	Flexion	21 ⁰	67 ⁰
	Extension	2 ⁰	59 ⁰
	Ulnar deviation	9 ⁰	31 ⁰
	Radial deviation	7 ⁰	23 ⁰
Therapeutic intervention		Dosage	
Active isolated ROM exercises for finger joints	Flexion	10 reps of 3 sets	
	Extension	10 reps of 3 sets	
	Abduction	10 reps of 3 sets	
	Adduction	10 reps of 3 sets	
Thumb opposition		10 reps of 3 sets	
Flexor tendon gliding exercises		10 reps of 3 sets	
Wrist mover		10 reps of 3 sets	
Stretching	Wrist flexor stretch	10 sec hold 3 reps	
	Wrist extensor stretch	10 sec hold 3 reps	
Strengthening exercises	Resistance exercises with free weight	15 reps of 2 sets	
	Resistance band	10 reps with yellow TheraBand	

2.4. Follow-Up and Outcome Measures

A review of outcome metrics following nine weeks of treatment. The patient subsequently

demonstrated improvement, as evidenced by Table 1-2, which displays the outcome measure scores before and after treatment.

Table 3. Range of motion right wrist

Joint	Movement	Pre-treatment ROM	Post-treatment ROM
Wrist	Flexion	21 ⁰	67 ⁰
	Extension	2 ⁰	59 ⁰
	Ulnar deviation	9 ⁰	31 ⁰
	Radial deviation	7 ⁰	23 ⁰

Table 4. Manual muscle test of lower limb

Joint	Muscles	Pre -treatment MMT grade	Post -treatment MMT grade
Wrist	Flexors	3/5	4/5
	Extensors	3/5	4/5
	Radial deviator	3/5	4/5
	Ulnar deviator	3/5	4/5

2.5. MMT: Manual Muscle Testing

0: No contraction; 1: Flickering of contraction; 2: Full range of motion in gravity-eliminated position; 3: Full range of motion

against gravity position; 4: Full range of motion against minimal resistance; 5: Full range of motion against maximal resistance

Table 5. Visual Analogue Scale

VAS (at rest)	Pre test	Post test
	5	1
VAS (on activity)	Pre test	Post test
	8	2

3. RESULTS

Following nine weeks of physiotherapy, the patient's wrist range of motion returned to normal,

there was no pain (VAS on activity) or discomfort when doing wrist activities, and there was no soreness across the dorsal portion of the wrist. Pre and post pain assessment is done. For the purpose

of the VAS assessment, patients were asked to grade wrist the discomfort they encountered during the activity daily tasks. scores on the visual analogue scale (VAS) that were noted during the most recent follow-up appointment. A conventional goniometer was used to measure the wrist ROM values of wrist.

4. DISCUSSION

There was no recognized the conventional method for managing distal treatment radius fractures. We observed the patient's extensive physiotherapy rehabilitation program in this case study [6]. The early physiotherapy program focuses on preventing finger, elbow, and shoulder stiffness and lowering oedema. And expands the forearm, wrist, and finger range of motion. In this case, there was a noticeable improvement over the course of nine weeks of rehabilitation [7]. Focus of study was on regaining joint Range the range of motion that was diminished as a result of the prolonged immobilization [16]. Subluxations and joint contractures, which arise in this case due to muscle irritation from cables or pins piercing them, must be prevented with careful physical treatment. While functional loading and ambulation are necessary for the ossification of the regenerating bone, stretching and preserving range of motion (ROM) are essential for preventing contractures, dislocations, and subluxations, highlighting the significance of physical therapy [16].

After nine weeks of postoperative treatment, patients who followed an independent home exercise routine and tracked their progress with a training diary demonstrated significantly greater improvements in wrist functionality (including PRWE scores, grip strength, range of motion in extension and flexion, as well as ulnar and radial abduction). [15] An increasing number of patients with distal radius fractures are being managed using day-case surgery when it is available since it is known to be effective and secure [17]. Many of the young male patients suffered distal radius fractures as a result of high-energy and low-energy traumas, respectively [17]. In order to achieve union and rectify the fractured distal radius, closed reduction per cutaneous K wire fixation was performed on the patient. An increase in distal radius fracture surgeries could lead to a higher rate of post-operative infected non-union distal radius fracture [18]. We also provided active isolated range of motion exercises for finger joints, thumb opposition exercises, flexor tendon gliding exercises, isometric exercises, range of motion exercises, and muscle strengthening exercises.

This emphasizes the comprehensive advantages of treating immobilization-related secondary deficits. We emphasized how early therapy significantly improves upper limb function. Acute and chronic Discomfort is a frequently experienced side effect of these functional limitations that can significantly lower the patient's general well-being. The increasing prevalence of a number of related comorbidities further taints the complex clinical picture following DRF [19]. Another frequent consequence of DRFs is Adhesive contracture, a condition characterized by tissue scarring and stiffness that limits joint motion.[20] A full functional recovery after DRF surgery depends on early rehabilitation therapy. It includes using prompt interventions to prevent problems like stiffness and joint adhesion. Strategies for managing pain use techniques such as cryotherapy [20]. In our study we have provided active isolated range of motion exercises for finger joints, thumb opposition exercises, flexor tendon gliding exercises, isometric exercises, Flexibility exercises and muscle-building activities, thumb opposition exercises and Outcomes have been noted with the appropriate physio therapy treatment.

Limitation

Additional research can be conducted on a bigger population ; however this study focuses on a single person. During intervention, both personal and environmental factors should be taken into account. Instead of using VAS, ROM, or MMT, other kinds of outcome measures should be employed. Consideration should be given to complications such active insufficiency.

5. Conclusion

In this study, post-operative Physiotherapy has greatly enhanced outcomes for the a male patient of who underwent closed reduction treatment for a distal radius fracture internal fixation. Over The progression of nine weeks of rehabilitation, with the aid of the physiotherapy protocol, there are notable gains in function, including pain reduction, range of motion, and muscular strength improvements that ultimately enable a safe return to regular activities.

Conflict of Interest

The authors declare that there are no conflicts of interest related to publication of this case study

Ethics Committee

Patient inform consent form was obtained before initiation of the study

Author Contributions

Conception and design of the study: APS, SS; Data collection: APS, SS; Data analysis and interpretation: APS; Drafting the article and/or its

critical revision; APS; Final approval of the version to be published: SS. All authors have read and agreed to the final version of the manuscript.

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