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Tailored Physiotherapy Rehabilitation of a Distal End Radius Fracture with Atypical Tendon Involvement: A Case Report

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ABSTRACT

Background: A distal radius fracture with accompanying ulnar styloid fracture, dorsal comminution, dorsal angulation, dorsal displacement, and radial shortening is referred to as a Colles fracture. To provide each patient with the best care possible, a multidisciplinary healthcare team is needed for patients with Colles fractures. The assessment, management, and treatment of Colles fractures are described in this report, along with the function of the interprofessional team in the patient's care. As there have been no articles highlighting the importance of the tendon injury other than the EPL tendon in distal radius fractures, we aim to do so in our case report.

Case Presentation: A 22-year-old female arrived at the DGH Physiotherapy OPD on January 18, 2024, complaining of pain, inability to move the fingers on her left hand, and having difficulties doing ADLs. After that, the patient was identified as having a fractured distal end of radius on the left side. Therefore, on November 16, 2023, the patient's distal end of the left side's radius fracture was carried out using K-wire fixation with local anesthesia.

Intervention: A structured physiotherapy rehabilitation program including cryotherapy, mobilization, stretching, strengthening, and scar management was implemented.

Results: Significant improvement was noted in pain reduction, range of motion, muscle strength, swelling, and functional performance.

Conclusion: After a tailored physical therapy session, the patient's general wellbeing and quality of life were significantly improved. Therefore, this case study will highlight the importance of physical therapy, its critical role in patients' recovery, and the various ways in which it has helped patients regain their ability to perform ADLs, minimize swelling, improve range of motion, and rebuild their muscle strength.

KEY WORDS: *Colles Fracture, Distal Radius Fracture, K-Wire Fixation, Physiotherapy Rehabilitation.*

INTRODUCTION

Distal radius fractures are the most common type of fractures in the upper extremities, in adults, accounting for 17.5% of all fractures. The most frequent cause of Colles fractures is trauma caused by vehicle accidents or sports-related injuries sustained by younger people. The most frequent cause of this in the older population is falls.[1] High-energy traumas have been defined as the fracture mechanism in younger patients, but low-energy trauma is the most prevalent cause of damage in the elderly.[2,3] An impact with a traumatic force that passes dorsally through

the wrist fractures the distal radius, moves it dorsally, and often causes dorsal comminution in an extended hand. This process results in the development of the well-known "dinner fork" deformity in the wrist, causing pain, edema, and a restriction in range of motion.[4]

These fractures can be treated with a variety of techniques, including plates, external fixators, Kirschner wires (K-wires), and elastic stable intramedullary nails (ESIN). For distal radius fractures, two popular procedures are ESIN and K-wires.[5] K wires are frequently applied to distal radius fractures that are dorsally displaced and can be effectively treated with this closed technique, this technique is speedier and less expensive.[6] Numerous issues that develop while treating these fractures can be roughly divided into three groups: immediate (nerve injury, compartment syndrome, and skin injury), late (mal union, delayed/non-union, infection, and stiffness of joints), and early (loss of reduction, tendon rupture, and infection). The main causes of tendon rupture are the repeated efforts made during K-wire fixation. Tendon ruptures can happen as soon as K-wire damage is detected, although they usually happen seven weeks after internal hardware insertion. Extensor pollicis longus tendon rupture is most frequently the result of discomfort from the volar plate's dorsal penetrating screws. Flexor pollicis longus injuries are often caused by hardware.[7]

As there have been no literatures stating the involvement or injury of any tendon other than the extensor pollicus longus tendon in the distal end radius fracture our study emphasizes on role of physiotherapy management in distal end radius fracture involving tendons of the fourth and fifth digits.

MATERIALS & METHODS

Research Setting: Physiotherapy OPD, Dhiraj General Hospital, Vadodara, Gujarat, India

Study Design: Single patient descriptive case report

Ethical Approval: Written informed consent was obtained from the patient prior to assessment and intervention.

Participant: A 22-year-old female with post-operative distal end radius fracture managed with K-wire fixation.

PROCEDURE: Detailed clinical examination including pain assessment, range of motion, muscle strength, girth measurement, and radiological evaluation was performed. A structured physiotherapy rehabilitation protocol was implemented over a period of 12 days.

1. CASE PRESENTATION

Patient information:

HOPI - A 22-year-old unmarried Female from Gujarat, Vadodara presented with right sided hand dominance and a student by occupation was experiencing pain and was unable to use her hand came to the Physiotherapy OPD, DGH. On asking the history the patient revealed that when she had been riding a scooter on 10th of November 2023, she met with an accident, falling on her left outstretched hand. She was unable to move her left hand from the wrist and was experiencing severe pain that started suddenly, persisted, and got worse over time. After that, she was rushed to a nearby hospital in Surat, where she was given medication to ease her discomfort and had tests done on her, including X-rays, CBC, and ESR which led to the diagnosis of a displaced distal end of radius fracture of the left side. Following that, on November 16, 2023, she underwent surgery for the same in the form of open reduction internal fixation - K-wire fixation. After 2 months, On January 18, 2024, the patient visited the Physiotherapy OPD, DGH with the aforementioned complaints.

2. CLINICAL FINDINGS AND DIAGNOSTIC ASSESSMENT:

The patient had signed a written consent form. The patient was co-operative and oriented to time, place and person. The patient's vitals were stable. Observation, Inspection and Palpation was done and the

patient was examined in sitting position. The patient was of moderate build. Grade 2 tenderness was present around the incision site of length of 1.5cm which was present on the dorsal aspect of the forearm at the midcarpal area. The patient reported pain of 7/10 on activity and 1/10 on rest. The pain (NPRS), range of motion, muscle strength and girth have been mentioned in (Table 1 to 3).

Table 1: Table shows Assessment of pain (NPRS Scale) throughout Different Time Span

		Pre Rehabilitation (18/01/2024)	Post Rehabilitation (24/01/2024)	Post Rehabilitation (30/01/2024)
Pain	**On Rest**	1/10	0/10	0/10
	On Movt.	7/10	4/10	1/10

Table 2: Table shows Assessment of Ranges throughout Different Time Span

JOINT	ACTION	Pre Rehabilitation (18/01/2024)		Post Rehabilitation (24/01/2024)		Post Rehabilitation (30/01/2024)	
		RIGHT SIDE (in degrees)	LEFT SIDE (in degrees)	RIGHT SIDE (in degrees)	LEFT SIDE (in degrees)	RIGHT SIDE (in degrees)	LEFT SIDE (in degrees)
Wrist Joint	Flexion	NA	NA	0 to 78	0 to 26	0 to 78	0 to 48
	Extension	NA	NA	0 to 79	0 to 45	0 to 79	0 to 62
	Radial Deviation	NA	NA	0 to 27	0 to 24	0 to 27	0 to 26
	Ulnar Deviation	NA	NA	0 to 32	0 to 16	0 to 32	0 to 29
Radio-Ulnar Joint	Supination	NA	NA	0 to 87	0 to 20	0 to 87	0 to 54
	Pronation	NA	NA	0 to 79	0 to 50	0 to 79	0 to 62
4th Metacarpophalangeal Joint	Flexion	0 to 83	0 to 67	0 to 83	0 to 73	0 to 83	0 to 78
	Extension	0 to 42	0 to 34	0 to 42	0 to 36	0 to 42	0 to 41
	Abduction	0 to 24	0 to 15	0 to 24	0 to 18	0 to 24	0 to 26
	Adduction	22 to 0	12 to 0	22 to 0	17 to 0	22 to 0	19 to 0
Proximal Interphalangeal Joint	Flexion	0 to 79	0 to 53	0 to 79	0 to 62	0 to 79	0 to 66
	Extension	79 to 0	53 to 0	79 to 0	62 to 0	79 to 0	66 to 0
Distal Interphalangeal Joint	Flexion	0 to 77	0 to 60	0 to 77	0 to 66	0 to 77	0 to 69
	Extension	77 to 0	60 to 0	77 to 0	66 to 0	77 to 0	69 to 0
5th Metacarpophalangeal Joint	Flexion	0 to 86	0 to 68	0 to 86	0 to 73	0 to 86	0 to 77
	Extension	0 to 46	0 to 38	0 to 46	0 to 38	0 to 46	0 to 44
	Abduction	0 to 27	0 to 18	0 to 27	0 to 20	0 to 27	0 to 26
	Adduction	23 to 0	16 to 0	23 to 0	18 to 0	23 to 0	22 to 0
Proximal Interphalangeal Joint	Flexion	0 to 83	0 to 60	0 to 83	0 to 66	0 to 83	0 to 73
	Extension	83 to 0	60 to 0	83 to 0	66 to 0	83 to 0	73 to 0
Distal Interphalangeal Joint	Flexion	0 to 79	0 to 65	0 to 79	0 to 69	0 to 79	0 to 75
	Extension	79 to 0	65 to 0	79 to 0	69 to 0	79 to 0	75 to 0

Table 3: Table shows Assessment of Strength throughout Different Time Span

JOINT	ACTION	Pre Rehabilitation (18/01/2024)		Post Rehabilitation (24/01/2024)		Post Rehabilitation (30/01/2024)	
		RIGHT SIDE (MRC Grading)	LEFT SIDE (MRC Grading)	RIGHT SIDE (MRC Grading)	LEFT SIDE (MRC Grading)	RIGHT SIDE (MRC Grading)	LEFT SIDE (MRC Grading)
Wrist Joint	Flexors	NA	NA	Grade 5	Grade 3	Grade 5	Grade 4
	Extensors	NA	NA	Grade 5	Grade 3	Grade 5	Grade 4

	Radial Deviators	NA	NA	Grade 5	Grade 3	Grade 5	Grade 4
	Ulnar Deviators	NA	NA	Grade 5	Grade 3	Grade 5	Grade 4
Radio-Ulnar Joint	Supinators	NA	NA	Grade 5	Grade 3	Grade 5	Grade 4
	Pronators	NA	NA	Grade 5	Grade 3	Grade 5	Grade 4
4th Metacarpophalangeal Joint	Flexors	Grade 5	Grade 2+	Grade 5	Grade 3	Grade 5	Grade 4
	Extensors	Grade 5	Grade 2+	Grade 5	Grade 3	Grade 5	Grade 4
	Abductors	Grade 5	Grade 2+	Grade 5	Grade 3	Grade 5	Grade 4
	Adductors	Grade 5	Grade 2+	Grade 5	Grade 3	Grade 5	Grade 4
Proximal Interphalangeal Joint	Flexors	Grade 5	Grade 3	Grade 5	Grade 3+	Grade 5	Grade 4+
	Extensors	Grade 5	Grade 3	Grade 5	Grade 3+	Grade 5	Grade 4+
Distal Interphalangeal Joint	Flexors	Grade 5	Grade 3	Grade 5	Grade 3+	Grade 5	Grade 4+
	Extensors	Grade 5	Grade 3	Grade 5	Grade 3+	Grade 5	Grade 4+
5th Metacarpophalangeal Joint	Flexors	Grade 5	Grade 2+	Grade 5	Grade 3	Grade 5	Grade 4
	Extensors	Grade 5	Grade 2+	Grade 5	Grade 3	Grade 5	Grade 4
	Abductors	Grade 5	Grade 2+	Grade 5	Grade 3	Grade 5	Grade 4
	Adductors	Grade 5	Grade 2+	Grade 5	Grade 3	Grade 5	Grade 4
Proximal Interphalangeal Joint	Flexors	Grade 5	Grade 3	Grade 5	Grade 3+	Grade 5	Grade 4+
	Extensors	Grade 5	Grade 3	Grade 5	Grade 3+	Grade 5	Grade 4+
Distal Interphalangeal Joint	Flexors	Grade 5	Grade 3	Grade 5	Grade 3+	Grade 5	Grade 4+
	Extensors	Grade 5	Grade 3	Grade 5	Grade 3+	Grade 5	Grade 4+

Table 4: Table shows Assessment of Girth throughout Different Time Span

		Pre Rehabilitation (18/01/2024)	**Post Rehabilitation (24/01/2024)**	**Post Rehabilitation (30/01/2024)**
Girth	**Right Side**	NA	38.4 cm	38.4 cm
	Left Side	NA	39 cm	38.5 cm

TIMELINE: The patient reported history of injury which occurred due to a fall on 10th of November 2023, the patient was diagnosed with a distal end of radius fracture of the left side. On 16th of November 2023 the patient got operated for the same in the form of open reduction internal fixation – K wire fixation. Two Months later on 18th January 2024 the patient-initiated physiotherapy rehabilitation. The last session of physiotherapy intervention was on 30th January 2024 given by us after which the patient was recommended to undergo regular follow up at the Physiotherapy OPD and a home exercise program was explained to her.

DIAGNOSTIC ASSESSMENT:

Anteroposterior and lateral views of the left wrist joint immediately following fracture are shown in Fig. 1, indicating the presence of a distal radius fracture. In contrast, Fig. 2, the post-surgical x-ray, shows the k wire fixation performed for the distal radius fracture of the left wrist joint.

Fig 1.

Fig 2.

Fig 1: Anteroposterior and Lateral X-ray of Left Wrist Joint Immediately after Fracture
Fig 2: K Wire Insertion on the Left Wrist Joint

FIG 3.

FIG 4.

Figure 3: Wrist Extension Range of Motion taken on Day 6 - Left Side
Figure 4: Girth Measurement taken on Day 6 - Left Sid

3. THERAPEUTIC INTERVENTION:

Table 5: Representation of Physiotherapy Management Protocol

INTERVENTION	DOSAGE	RATIONALE
Cryotherapy	10-15 minutes	To reduce pain, inflammation and swelling
Active range of motion exercise	10 repetitions of 2 sets each	To maintain range of motion of shoulder and elbow joint
Active assisted range of motion Exercise	10 repetitions of 2 sets each	To maintain range of motion of wrist, radio-ulnar joint and digits
Scar mobilization	8-10 minutes	Breaks Adhesion
Hold relax technique	10 repetitions of 2 sets each	To increase range of motion of wrist, radio-ulnar joint and digits
Contract relax technique	10 repetitions of 2 sets each	To increase strength of muscles of the wrist, radio-ulnar joint and the digits
End range stretching exercise	10 repetitions of 2 sets each with 7 secs hold	To increase range of motion of wrist, radio-ulnar joint and digits
Diaphragmatic Breathing Exercises.	10 times /day and between exercise intervals	Promote Relaxation To mobilize shoulder girdle and improves lung compliance and vital capacity.
Resistance Exercises	10 repetitions of 2 sets each	Maintains tone, contractility, strength of muscles

OUTCOME MEASURES:

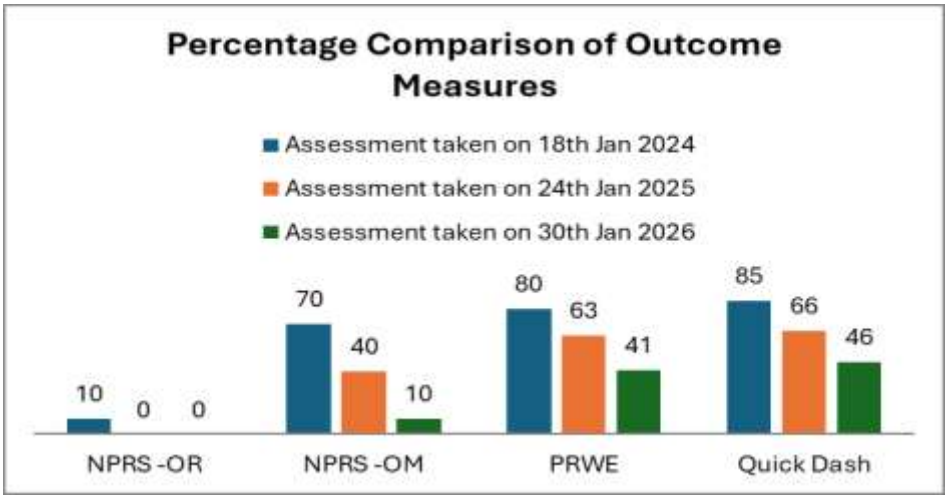

Figure 5: Showing the Comparison of Outcome Measures

RESULTS: Post-rehabilitation assessment demonstrated marked improvement in pain levels, wrist and finger range of motion, muscle strength, and reduction in swelling. Functional ability in activities of daily living improved significantly by the end of the intervention period.

DISCUSSION

K wire fixation is a commonly used surgical procedure for displaced distal end radius fractures. This study suggests that, in order to reduce risk, concealed fixation is preferable to exposed type of K wire fixation. It has also been shown that extensor pollicis longus tendon is often injured or impacted in this type of fractures.[8] Given that the extensor tendon sheath begins at the wrist and terminates at the finger, it can be challenging to diagnose its involvement in distal radius fracture. In contrast, our report finding suggested the involvement of the fourth and fifth MCPs, that is the extensor digitorum tendon and extensor digiti minimi tendon with the fourth digit being more affected than the fifth one. Apart from this, another observation was that the swelling considerably reduced when PT was administered, which also helped to improve finger movement along with other range of motion exercises. As we observed, the patient's discomfort persisted from the start of the physical therapy regimen, and in a short amount of time, pain was decreased by the management of the physical therapy along with increase in the muscle strength which shows the beneficial effect of physiotherapeutic exercises on the same.[9] As we found no case report or other higher studies specifying the involvement of extensor digitorum tendon and extensor digiti minimi tendon injury in Colles fracture, presence of K wire fixation may injure the tendon and the tendon sheath therefore affecting the movement of the tendon and its overall function. Furthermore, a physiotherapist should be cautious, whenever treating such cases where k wire fixation was carried out, proper assessment of the 4th and the 5th digit should be taken into consideration along with the assessment of the other digits.

CONCLUSION

Following the K wire fixation surgery, physical therapy management have improved the outcomes measures like pain, over time, the functional activities have been improved by the methodical and carefully designed approach. increased range of motion, increased muscular function, and a greater degree of pain and swelling reduction all added to the individual's improved state of health.

Abbreviations:

ADL's - Activities of Daily Living
CBC - Complete Blood Count
DGH - Dhiraj General Hospital

ESIN - Elastic Stable Intramedullary Nails
ESR - Erythrocyte Sedimentation Rate
MCP - Metacarpophalangeal Joint
NPRS - Numerical Pain Rating Scale.
OM - On Movement
OR - On Rest
PRWE - Patient Related Wrist Evaluation
PT - Physiotherapy

Declaration By Authors:

Informed Consent: The patient was informed about the study and informed consent was acquired.
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Conflict Of Interest: The authors declare that there are no conflicts of interests.

Authors' Contributions:

The first and the second author were responsible for assessing and managing the patient, the third author was responsible for giving the concept and guiding and also the fourth author for guiding throughout the case report.

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