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Review Article

Physiotherapy Management in Distal End Radius Fractures - A Narrative Review

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ABSTRACT

Distal end radius fractures are one of the most common fractures in adults caused due to trauma. The clinical presentation of DRFs is diverse, ranging from subtle non-displaced cracks to severely comminuted fractures with significant articular involvement. Fall on an outstretched hand (FOOSH) is a major mechanism of injury in distal end radius fractures. A thorough physiotherapy assessment of distal end radius fractures (DRFs) comprising of subjective and objective assessment is paramount for guiding effective rehabilitation and ensuring optimal patient recovery. Treatment options for distal radius fractures include surgery fixation or conservative immobilization of the fracture in the cast. Regaining strength and mobility in the wrist and hand after an injury, whether it was treated with or without surgery, requires holistic rehabilitation.

Keywords: distal end radius fractures, physiotherapy, rehabilitation.

INTRODUCTION

Distal radius fractures (DRFs), which make up 17.5% of all fractures, are more common in adults. [1] While DRFs represent a significant portion of all fractures, their specific characteristics and impact vary across demographics. The increasing incidence of DRFs has been attributed to a number of factors, such as environmental factors, childhood obesity, lifestyle choices, and the prevalence of osteoporosis in the elderly population. The predilection for postmenopausal women is largely due to age-related bone density loss, particularly osteoporosis, which weakens bone structure and makes them more susceptible to fractures from even low-energy trauma, such as a simple fall.[2] Conversely, in younger individuals, especially males, DRFs are typically the result of high-energy mechanisms, such as sports injuries, motor vehicle accidents, or falls from significant heights. [2]

The anatomical location of the fracture, often at the cortico-cancellous junction, further explains its frequency. This region, being rich in cancellous bone, offers less structural rigidity than the more cortical shaft, making it a natural weak point susceptible to forces transmitted through the wrist during a fall on an outstretched hand. The abundant blood supply to this metaphyseal region, while contributing to faster healing, does not negate its inherent vulnerability to fracture under stress.[2]

The clinical presentation of DRFs is diverse, ranging from subtle non-displaced cracks to severely comminuted fractures with significant articular involvement. While Colle's fracture is a well-known archetype, characterized by dorsal displacement and often a "dinner fork" deformity, other patterns like Smith's fracture (volar displacement) or Barton's fracture (intra-articular rim fracture with displacement) also frequently occur, each demanding a specific understanding for proper management. The morphology of these fractures is greatly influenced by the age of the patient, the energy of the trauma, and the direction of the impacting force, leading to a spectrum of injury patterns that require careful assessment. The high incidence of DRFs, coupled with this morphological variability and the potential for long-term functional impairment, underscores the importance of continued research into their prevention, diagnosis, and optimal treatment strategies. [1, 2]

Classification:

Effective management regarding distal radius fractures (DRFs) necessitate a standardized approach to classification. Over time, several systems have emerged, each offering a distinct framework for categorizing these injuries based on different criteria such as anatomical involvement, mechanism of injury, or a comprehensive alphanumeric code. These classifications are vital tools for surgeons in guiding treatment selection, predicting outcomes, and facilitating research.

The Frykman classification system, developed by G. Frykman, methodically sorts fractures based on how much the joint surfaces are affected. [3] It specifically looks at whether the radiocarpal joint, the distal radioulnar joint (DRUJ), or both, have been fractured, as well as if there's an accompanying ulnar styloid fracture It escalates from simpler extra-articular patterns (Type I) to more complex intra-articular injuries involving both major wrist joints and an ulnar styloid fracture (Type VIII).

In contrast, the Fernandez classification system. [4] offers a biomechanical perspective by classifying DRFs based on the presumed mechanism of injury. This approach helps clinicians understand the forces that led to the fracture, which can significantly influence reconstructive strategies. Dr. Fernandez's system categorizes fractures into five main types, each reflecting a predominant injury pattern resulting from distinct energy transfer mechanisms.

For a more comprehensive and highly detailed categorization, the AO Foundation's alphanumeric classification system (most recently revised in January 2018) stands as a globally recognized standard. [5] Developed by a worldwide network of surgeons focused on fracture management, this system offers a hierarchical structure that initially divides DRFs into three main groups: extra-articular, partially articular, and complete articular fractures. Further subdivisions are made based on factors such as the involvement of the ulna and the number and location of fracture fragments.

Mechanisms of Injury

Fall on an outstretched hand (FOOSH) is a major cause of distal end radius fractures. During a FOOSH injury, the kinetic energy of the fall is transmitted through the wrist, leading to compressive, shear, and rotational forces on the distal radius. The exact fracture pattern is influenced by several factors, including the wrist's position at impact (e.g., degree of dorsiflexion or pronation), the magnitude of the impact force, and the bone quality.

While FOOSH is primary, distal radius fractures can also result from other high-energy traumatic incidents. These include:

- **Direct Crush Injuries:** Sustained, high-magnitude compressive forces, often seen in industrial accidents or entrapments, can lead to complex comminuted fractures with significant soft tissue involvement.
- **High-Impact Trauma:** Such as those experienced in motor vehicle collisions, where direct impact to the wrist or transmitted forces from other body parts can cause severe fractures, frequently

associated with other musculoskeletal injuries.

- **Sports-Related Incidents:** High-impact sports, particularly those involving falls or direct contact (e.g., cycling, skateboarding, snowboarding, football), frequently lead to distal radius fractures. [6]
- **Workplace Accidents:** Beyond crush injuries, falls from heights or impacts with heavy objects in occupational settings are common causes. [6]

It is generally observed that the velocity and energy of the traumatic incident directly correlate with the complexity of the fracture. Higher velocity falls or greater impact forces tend to produce more comminuted, displaced, and intra-articular fractures, often with associated soft tissue damage.

A notable demographic distinction exists: younger patients typically sustain distal radius fractures from higher-energy mechanisms, such as sports injuries or significant falls. [7] This is often attributed to their higher activity levels and stronger bone density, requiring greater force to induce a fracture. Conversely, older patients, particularly those with underlying osteoporosis, are more susceptible to distal radius fractures from lower-energy falls, such as a simple fall from standing height. [7] In this demographic, even minor trauma can result in a fracture due to compromised bone strength. This age-related disparity in injury mechanism and bone quality significantly impacts fracture morphology and treatment considerations.

Assessment:

A thorough physiotherapy assessment of distal end radius fractures (DRFs) is paramount for guiding effective rehabilitation and ensuring optimal patient recovery. A comprehensive and individualized assessment is essential for developing a tailored rehabilitation plan that effectively addresses pain, improves range of motion (ROM), restores strength, enhances proprioception, and ensures robust functional recovery. The assessment is organized into a subjective history-taking and an objective physical assessment.

A] Subjective Assessment:

The subjective assessment commences with a detailed patient history, encompassing the precise mechanism of injury (e.g., fall on an outstretched hand, direct trauma, high-energy impact), previous wrist injuries, and relevant systemic conditions. The latter is crucial, as comorbidities like osteoporosis, diabetes, or rheumatoid arthritis can significantly influence bone healing, tissue integrity, and overall recovery trajectory. The therapist meticulously assesses pain characteristics, including intensity (often using a Numerical Pain Rating Scale or Visual Analog Scale), precise location, quality (e.g., sharp, dull, aching), and behavior (e.g., constant, intermittent, exacerbated by specific movements or activities, nocturnal pain).

A key part of the assessment involves understanding the injury's influence on a patient's everyday activities. This involves exploring difficulties with tasks such as gripping objects, lifting, carrying, dressing, personal hygiene, and occupational or recreational activities. The assessment also delves into the psychological impact of the injury, recognizing that chronic pain, functional limitations, and fear of re-injury can lead to anxiety, frustration, or depression. Finally, understanding the patient's expectations and rehabilitation goals is critical to foster engagement, set realistic targets, and tailor the treatment plan to their individual needs and desired outcomes.

B] Objective Assessment

The objective assessment involves a series of structured physical examination techniques:

Observation/Inspection: This initial step involves a careful visual inspection of the affected wrist and forearm. The therapist looks for visible deformities (e.g., "dinner fork" deformity), presence and extent of swelling (edema), bruising (ecchymosis), and any skin changes (e.g., open wounds, scars from surgery, trophic changes, changes in skin colour or temperature). These findings can indicate the severity of the injury, ongoing inflammation, potential neurovascular compromise, or infection.

Palpation: Gentle yet systematic palpation is employed to localize areas of tenderness over the fracture site, surrounding carpal bones, ligaments, and soft tissues (e.g., muscles, tendons). The therapist also checks for any bony crepitus, which, if present, may indicate a displaced or unhealed fracture fragment, although this should be performed with extreme caution to avoid exacerbating pain or injury. Assessment for muscle guarding or spasm is also part of palpation.

Range of Motion (ROM) Assessment: Both active and passive ROM of the wrist and forearm are meticulously measured using a goniometer. By comparing these to the uninjured side to find restriction and establish rehabilitation goals accordingly. Assessing the end-feel during passive ROM is particularly important; a "hard" or "bony" end-feel may suggest heterotopic ossification or bony block, while a "leathery" or "capsular" end-feel might indicate capsular tightness. Wrist movements should also be assessed in relation to elbow and shoulder movements to rule out compensatory patterns.

Strength Testing: This component quantitatively assesses muscle strength. Grip strength is typically measured using a dynamometer (e.g., Jamar dynamometer), providing an objective measure of overall hand function. Individual wrist-specific movements (flexion, extension, pronation, supination, radial/ulnar deviation) are tested against resistance, often using a manual muscle testing scale (e.g., Oxford Scale) or a handheld dynamometer. This helps identify specific muscle weaknesses, tendon involvement (e.g., tendinopathy, rupture), or nerve deficits.

Neurological Evaluation: A neurological examination is crucial due to the distal radius's proximity to major nerves. [8] This assessment includes evaluating sensory changes (e.g., numbness, paraesthesia, hypersensitivity), specifically utilizing two-point discrimination to quantify fine touch sensation within the dermatomes of the median, ulnar, and radial nerves. Motor function of muscles innervated by these nerves is also tested. Special attention is given to signs of median nerve compression, such as carpal tunnel syndrome symptoms and thenar eminence atrophy, as these are common complications following DERFs, particularly after displacement or surgical fixation.

Outcome measures:

The International Classification of Functioning, Disability and Health (ICF) model classifies outcome measures under the Body Function/Structure category. Because it enables the comparison of a patient's status between interventions, choosing the right outcome measure is regarded as good clinical practice. [9] Additionally, it aids in the creation of care plans, boosts practice efficacy, enhances communication between the client and the physician, and helps to a more thorough assessment and analysis. [9]

According to a systematic review, functional outcome measures have been used in intervention studies for the rehabilitation of people with a DRF throughout the last ten years – of which grip strength, range of motion, and DASH are commonly used. The most popular ones were the DASH, Grip, and ROM. The use of patient-reported outcome measures in addition to performance-based measurements is growing in significance.

Patient-reported versus performance-based outcome measures:

Ten of the 15 most widely used outcome measures—DASH, PRWE, SF-12/36, Patient Satisfaction, Mayo-Wrist Score, EuroQol-5Dimension, Green and O'Brien Score, Canadian Occupational Performance Measure, and Michigan Hand Questionnaire—were exclusively patient-reported. ROM, Grip, Pinch, and Castaing Score were among the performance-based outcome indicators. Both performance-based and patient-reported measurement methods were included in the Gartland and Werley score. [10]

1] DASH:

It is a 30-item self-reported questionnaire grade on a 5-point Likert scale used to evaluate functional limitations and disability in people with disorders of the upper limbs. Higher scores indicate greater impairment. When compared to other functional outcome measures, the DASH exhibits great validity and high reliability (Cronbach's alpha > 0.9, ICC = 0.90–0.95). It is frequently used to track upper limb function and assess therapy results in clinical and research settings. [11]

2] PRWE:

Patient-Rated Wrist Evaluation (PRWE) Scale is a self-reported questionnaire used to evaluate functional disability and discomfort in people with wrist and hand disorders. With scores ranging from 0 (no disability) to 100 (severe disability), it comprises 15 items that are further subdivided into two subscales: function (10 questions, further divided into specialized and normal tasks) and pain (5 items). When compared to other upper limb function assessments such as DASH, the PRWE has great validity and excellent reliability (Intraclass Correlation Coefficient, ICC = 0.90–0.97). It is frequently used to monitor pain and healing in situations such distal radius fractures, wrist arthritis, ligament injuries, and post-surgical rehabilitation. [12]

3] Mayo-Wrist scale:

A clinician-reported instrument used to evaluate wrist function, discomfort, range of motion, and grip strength following surgery or injury. With a total score of 100, it is composed of four components: pain (25 points), function (25 points), range of motion (25 points), and grip strength (25 points). Higher scores correlate to greater wrist function. With a strong correlation with other wrist outcome measures such as the PRWE and DASH, the MWS has demonstrated good validity and moderate to high reliability (ICC = 0.75–0.89). It is frequently used to assess healing and treatment efficacy in post-fracture examinations, ligament injuries, and wrist arthroplasty. [13]

4] Green and O'Brien Score:

One clinical method for evaluating the functional outcome of distal radius fractures is the Green and O'Brien Score. Each of its four parts—pain, range of motion, grip strength, and functional status—contributes to a final score that runs from 0 to 100. Improved wrist function is indicated by a higher score. In cases of distal radius fractures and other wrist injuries, the score is frequently used to assess the effectiveness of treatment and recovery. The Green and O'Brien Score has shown good reliability, with high test-retest reliability (ICC = 0.90) and inter-rater reliability (ICC ranging from 0.84 to 0.94). Additionally, it has strong validity because it correlates favourably with other validated outcome measures for wrist function, including PRWE and the Mayo Wrist Score. [14]

5] Canadian Occupational Performance Measure (COPM):

A client-centred assessment tool called the Canadian Occupational Performance Measure (COPM) is used to gauge a person's perceived performance and satisfaction in day-to-day tasks. Patients can use it to grade their performance, determine which vocations are most essential to them, and gauge how satisfied they are with their current skills. Comparing it to other outcome measures such as the Functional Independence Measure (FIM), it has shown strong concurrent validity and high reliability (test-retest reliability = 0.79–

0.95). The COPM is especially helpful for tracking how a patient's performance varies over time. [15]

6] Michigan Hand Questionnaire (MHQ):
In order to evaluate hand function, discomfort, and health-related quality of life in people with hand problems, the Michigan Hand Questionnaire (MHQ) is a thorough, self-reported instrument. It covers the following six areas: function, daily living activities, work performance, pain, aesthetics, and patient satisfaction. With great test-retest reliability (ICC = 0.89–0.96) and high internal consistency (Cronbach's alpha = 0.94–0.97), the MHQ has demonstrated exceptional reliability. It is frequently used in research and clinical practice to assess hand function and inform treatment choices. [16]

7] Gartland & Werley Score:
A point-based outcome measure for assessing hand and wrist function is the Gartland & Werley Score. Range of motion, residual deformities, nerve problems, and subjective and objective factors pertaining to wrist and hand function are all included in the original scale's "demerit" grading system. The score is derived from a set of items divided into four categories: complications, subjective evaluation, objective evaluation, and residual deformity. The sum of the results for the four domains determines the final test score. A final total score of 21 or higher indicates "poor" hand function, which is linked to a "healed" Colles's fracture. [17]

Rehabilitation:
Treatment options for distal radius fractures include surgery fixation or conservative immobilization of the fracture in the cast. Regaining strength and mobility in the wrist and hand after an injury, whether it was treated with or without surgery, requires rehabilitation.

1] Early Protective phase:
Preserving the fracture site and avoiding additional harm are the main goals of the early stage. A cast or splint is usually used to immobilize the fracture during this period. Duration of this phase is 3 to 4 weeks depending on fracture fragment stability. According to the detailed clinical practice guidelines set forth by the Academy of Orthopaedic Physical Therapy and the Academy of Hand and Upper Extremity Physical Therapy, Mehta et al. (2024) underscore the significance of early immobilization (whether following surgery or during conservative treatment) and the vital need for managing pain and reducing swelling through elevation and compression. [18] Controlling pain, minimizing swelling, and preserving healing are the objectives. To avoid stiffness, range of motion (ROM) exercises for nearby joints (such as the fingers, elbow, and shoulder) may be started. To preserve general muscular strength without putting undue strain on the fracture site, weight-bearing is avoided and isometric workouts for the shoulder and forearm may be added.

2] Mobilization Phase:
After the fracture site has stabilized and healing has started, usually after 3 weeks, the cast or splint is taken off, and attention turns to regaining mobility and avoiding stiffness. As evidenced by studies on accelerated rehabilitation protocols, such as that by Brehmer and Husband (2014) for distal radius fractures treated with volar plating, active and passive range-of-motion exercises for the hand, wrist, and forearm are progressively introduced. [19] To regain flexibility, active and passive range-of-motion activities for the hand, wrist, and forearm are progressively added. In order to improve wrist mobility at this point, holds are included, with an emphasis on flexion, extension, pronation, and supination. To prevent strain on the mending bones, hand and forearm strengthening activities can begin with mild resistance. During this stage, controlling swelling and managing pain are still essential.

3] Strengthening Phase:
Restoring functional strength and enhancing grip strength become more important as the fracture heals. Resisted wrist flexion/extension, radial/ulnar deviation, and grip strengthening exercises with therapeutic putty or resistance bands are among the progressive wrist, forearm, and hand strengthening exercises that are introduced. The importance of this progressive loading to achieve optimal outcomes is implicitly supported by systematic reviews, such as that by Handoll and Watts (2007), which examine the efficacy of various rehabilitation interventions for distal radial fractures. [20]
To avoid re-injury, patients are urged to do functional tasks such lifting light things, utilizing the hand for everyday duties. During this stage, the patient strives to fully resume everyday activities, including mild sports and manual labour. Enhancing coordination and endurance will be part of the rehabilitation approach to make sure the wrist can support growing weights and functional tasks.
Numerous variables, including the fracture pattern, related injuries, and patient characteristics can affect the success of distal radius fracture management. Although the therapist has no control over any of these elements, therapist has to focus on pain, weakness, stiffness, edema, and the challenge of helping the patient to get back to their regular routines.
According to a systematic review by Meijer et al. (2023), rehabilitation following distal radius fractures currently lacks standardized exercise protocols, and patient adherence to home programs remains a significant challenge. However, the review highlights promising opportunities to improve outcomes by integrating smart technology (e.g., mobile applications). These digital tools can offer valuable home-based support, facilitate patient monitoring, and significantly enhance both self-efficacy and adherence. The authors emphasize that, regardless of the initial treatment approach, early and progressive active range of motion and strengthening exercises are vital for optimal functional recovery, in addition to all-encompassing techniques including managing edema and regularly evaluating pain, range of motion, and grip strength. [21]

Complications:
There are a variety of complications that can occur after DRF. Recovery from distal radius fractures can be greatly impacted by complications such carpal tunnel syndrome, complex regional pain syndrome, tendon adhesions, and ulnar nerve compression. Preventing long-term functional deficits requires effective management techniques, such as early detection, conservative treatment like physical therapy, and, in certain situations, surgical procedures. Recent studies, such as one conducted by Seigerman D, Lutsky K, Fletcher D, et al. (2019), emphasize how crucial it is to treat these issues using a multidisciplinary strategy in order to maximize results and restore function. [22]

CONCLUSION
Distal end radius fractures require timely subjective and objective physiotherapy assessment. A holistic rehabilitation during the immobilization and post immobilization phase assist in recovery of optimal function and return to work.

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