

FUNCTIONAL RECOVERY OF DISTAL RADIUS FRACTURE: AN INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS

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Abstract: Distal radius fracture (DRF) is the most common upper limb fracture, which reduces independence in daily living activities. This study explored the functional recovery of distal radius fracture six months post-injury. We conducted a qualitative study using an interpretive phenomenological analysis (IPA). Eleven adults aged 18 and 59 with DRF participated in face-to-face, semi-structured, in-depth interviews recorded digitally. In addition, transcribed recordings were analysed thematically. Four themes emerged from the analysis: (i) I could or could not do, (ii) How I live my life, (iii) what I feel like, and (iv) Something is wrong with my hand. Following over six months of injury, all participants experienced physical limitations where most participants reported reduced daily activities performance. Consequently, some participants developed adaptive strategies to enhance their daily activities' ability. DRF also affected their psychological aspects. Overall, DRF affects individuals' functioning in daily living activities, work and leisure for over six months post-injury. This study highlights that occupational therapists need to maintain or strengthen functional recovery and support individuals with DRF even for over six months post-injury.

Keywords: Knowledge, attitude, practice, chemical safety.

Introduction

A Distal Radius Fracture (DRF) is one of the most common types of fractures or traumatic conditions of the upper limb (Rupp *et al.*, 2019; Palola *et al.*, 2021) and is commonly due to falls on an outstretched hand or wrist (MacIntyre & Dewan, 2016; Shahabpour *et al.*, 2021). DRF or wrist fractures affect the person's physical function, mental health and ability to work (Singaram & Naidoo, 2019). In addition, DRF not only causes immediate pain (Rakulini & Attanayake, 2019) but also affects an individual's social and emotional processes and thus affecting the overall health-related quality of life (HRQoL) (Tomaszewski *et al.*, 2015).

DRF's incidence has increased globally and is estimated to be over one-sixth of fracture

cases treated in emergency units (MacIntyre & Dewan, 2016). In Malaysia, almost one per cent of the cases admitted to the Emergency Department were reported to have DRF, which Malay people dominated with a mean age of 54 years old (Chao *et al.*, 2021). In addition, males reported the highest incidence of DRF at 20 to 29 years old, whereas females at 60 to 69 years old (Chao *et al.*, 2021).

Watson *et al.* (2018) reported that individuals with wrist fractures experienced significant social role changes and increased daily life dependency. Individuals with wrist fractures described that eating and working activities involving lifting and grasping were challenging (Doerrer *et al.*, 2021). Most studies focused on body structures and functions

such as range of motion (ROM), strength and pain or structures like radiographic findings (Tomaszewski *et al.*, 2015; Dilek *et al.*, 2018; Mulders *et al.*, 2018) rather than the individual's ability to perform daily activities such as self-care, recreational, productivity and social activities, household activities, and engagement in meaningful activities and roles (Mauck & Swigler, 2018; van Leerdam *et al.*, 2019; Ikpen, 2021; Stern *et al.*, 2021).

Most studies suggested the optimum recovery time of DRF within six months post-injury (Ydreborg *et al.*, 2015; Takeuchi *et al.*, 2016; Vergara *et al.*, 2016). During the first three months post-injury, individuals with DRF experienced high pain levels and severe disability due to closed reduction, operative treatment, and stiffness due to immobilisation (Bobos *et al.*, 2018). Pain then lessened, and patients reported minor disability between three and six months post-injury (Ydreborg *et al.*, 2015; Vergara *et al.*, 2016;). However, six months post-injury, most individuals with DRF still experienced difficulty carrying ten pounds of weight, pushing up from a chair, and resuming other daily activities (MacDermid *et al.*, 2003).

However, most studies on DRF recovery quantitatively measure injury outcomes and their treatment and did not capture the individuals' subjective experiences during the recovery process. Thus, the individuals' experience regarding functional recovery, especially after six months after DRF and its impacts on their daily lives, remains understudied in the literature. Furthermore, none of the published studies was conducted in Malaysia, with different cultural backgrounds and lifestyles. Thus, our research question was, what are the functional recovery experiences of individuals with DRF?

Materials and Methods

Study Design and Setting

This study explored the functional recovery experiences following DRF and its impacts on daily activities according to the International Classification of Functioning, Disability and

Health (ICF) (World Health Organization, 2001). The ICF emphasised that a person's functional level was dynamically dependent on their health, personal, and environmental factors (World Health Organization, 2001). Then, the IPA was used to examine individuals' management of the DRF experiences (Smith *et al.*, 2013). The researchers explored the significance of individuals' experiences and tried to understand what was happening to them (Smith *et al.*, 2013). Data were obtained through face-to-face semi-structured in-depth interviews. Participant recruitment occurred at the occupational therapy units in the southern peninsular of Malaysia.

Sample

Using purposive sampling, participants had established a patient-therapist relationship with the second author before this study's commencement. They were individuals with DRF based on the following inclusion criteria: (i) either male or female aged between 18 to 59 years old; (ii) had DRF more than 6 months; (iii) had undergone either conservative or surgical management; (iv) pre-morbidly independent in activities of daily living (ADL); and (v) had consented to be interviewed. Participants were excluded if they had: (i) additional traumatic injuries or multiple fractures; (ii) pathological fractures due to specific diseases or disorders; and (iii) cognitive impairment that interferes with the ability to communicate effectively.

Data Collection Procedure

Potential participants were screened, and their medical records were reviewed to assess their eligibility. Eligible participants were approached to participate in this study via phone or face-to-face when they came for treatment at the occupational therapy unit. Participants were provided information about the study and gave their written informed consent before the interview.

The interview guide was developed based on the research objective and previous literature (Bamford & Walker, 2010; Watson *et al.*, 2018),

allowing participants flexibility to lead the discussion. Besides, the interview questions were also developed based on the components in the ICF. A pilot study was conducted to test the interview guide before the data collection process by the second author assisting the first author. All interviews were conducted by the second author in private rooms in the occupational therapy units in the southern peninsular of Malaysia without the presence of non-participants. Then, the interviews were digitally recorded and transcribed verbatim. The second author was a female with Bachelor's Degree in Occupational Therapy student.

The interviewers used neutral, prompt or clarification questions and encouragement to understand DRF's functional recovery experiences and their impact on daily activities. In addition, participants were given opportunities to provide additional information that did not arise during the interview process at the end of the interview. The interviews took approximately 45 to 60 minutes to complete. Full and rich data was reached after eleven participants were interviewed.

Following each interview, the interviewer completed a debrief form for summarising participants' non-verbal and verbal communication and any notable features of the interview. Participants were invited to give feedback on the debrief form's accuracy to increase the data analysis' trustworthiness. Two participants provided feedback on the findings. Interviews were recorded using a digital recorder and transcribed verbatim, and the debriefed information was used in the data analysis. There was no repetition of the interview conducted. The study obtained approval from the Ethics Review Committee of Universiti Teknologi MARA (UiTM) (600-IRMI (5/1/6)) and the Ministry of Health's Medical Research and Ethics Committee (MREC) (NMRR ID: NMRR-18-3703-44130).

Data Analysis

Data were thematically analysed using IPA (Smith *et al.*, 2013) manually by the first

and second authors. The analysis focused on examining and interpreting the underlying ideas and concepts to develop an insider's view of the experience under investigation. Four steps were employed in the analysis. First, each interview transcript was read several times, followed by initial noting any significant features within the transcripts and notes about emerging themes from the data were also recorded. Secondly, a table was developed to map and cluster the themes from each interview. Thirdly, themes were compared between interviews to investigate similarities and differences, leading to ten clustered themes by the first and last author. Then the themes and statements were collated into the table. Finally, the first and second authors read through each of the themed tables of interviews separately, track the development of superordinate and subordinate themes, and then discuss the theme. All authors finally reviewed and agreed with the themes.

Results

No participant refused to participate in the study. The demographic data of participants were summarised in Table 1. Four superordinate themes emerged as in Table 2: (1) "I could and could not do"; (2) "How I live my life"; (3) "I feel like"; and (4) "Something is wrong with my body". The first two pre-set themes emerged according to the research objective, and two new themes emerged from the analysis. Participants' direct quotes were selected from the transcripts to illustrate data summaries regarding participants' functional recovery experiences following DRF.

Table 1: Participants' descriptions

Pseudonym	Age	Gender	Marital Status	Injured Hand	Time Since Injury (Months)	Medical Management
Mr. A	39	Male	Married	Non-dominant	22	Conservative
Miss B	24	Female	Single	Dominant	6	Conservative
Miss C	21	Female	Single	Dominant	13	Conservative
Mrs. D	37	Female	Married	Dominant	9	Surgical
Mr. E	36	Male	Married	Dominant	10	Surgical
Mrs. F	40	Female	Married	Dominant	12	Surgical
Mr. G	34	Male	Single	Non-dominant	6	Surgical
Mr. H	45	Male	Married	Non-dominant	8	Conservative
Miss I	32	Female	Single	Dominant	7	Surgical
Miss J	26	Female	Single	Dominant	12	Surgical
Mrs. K	42	Male	Married	Dominant	14	Conservative

Table 2: Total active motion of participants

Superordinate Themes	Subordinate Themes
I could do and could not do	ADL & IADL Work Rest and sleep Leisure and play Social participation
How I live my life	Avoidance of activities Modification of activities Getting helps from others
I feel like	Sense of gratefulness Sad and frustration
Something is wrong with my hand	Limited range of motion (ROM) Weakness Pain Stiffness

Superordinate Theme 1: “I could and could not do”

All participants described interruptions in their daily activities, including self-care, work, leisure, and social participation. This superordinate theme describes the daily activities that were able and not able to be executed by participants. Five superordinate themes emerged under this theme: (i) activities of daily living (ADL) and instrumental activities of daily living (IADL);

(ii) work, (iii) rest and sleep, (iv) leisure and play, and (v) social participation.

Subordinate Theme 1: ADL and IADL

Most participants expressed difficulty in ADL, as they reported difficulty reaching behind their backs during bathing due to a limited ROM at the affected hand’s forearm.

Mrs. F: “I can use my right hand (during bathing), but I cannot reach

my back body. I need to move my body forward to reach back body, but I still cannot fully turn my hand due to pain in my right wrist."

Six participants expressed problems with hygiene care using the affected hand, including combing hair, cutting nails, and putting on makeup. Buttoning and zipping activities in dressing were also affected due to their physical limitations. For example, female participants who wore a scarf reported that putting on a brooch was challenging post-injury.

Mrs. K: *"If I want to wear a brooch on the left side of the body, it is quite difficult because I need to pull my shirt forward to wear the brooch."*

All participants expressed difficulties with IADL. All female participants said they had difficulties with laundry tasks, including handwashing clothes, taking clothes from the washing machine and hanging wet clothes. Home establishment and maintenance were tasks that were challenging for all participants. They mentioned that lifting heavy objects was their main problem daily maintaining their personal and household chores. However, light tasks are still possible, including sweeping the floor, wiping windows, or throwing away light trash.

Miss B: *"What I can do for now is just clean up, like sweeping and wiping. I only can do that. Sometimes I try to lift heavy stuff, but I am not strong enough to lift it, and the pain is killing me too."*

All participants reported affected driving performance. As a result, some discontinued driving and relied on others for transportation. However, others could drive alone but with difficulties while driving or riding the motorcycle.

Mr. E: *"Driving is not a problem because my dominant hand is right. But sometimes, when I need to make a U-turn, I need to use my left hand to support the steering while turning it. It is painful sometimes, though I can do it."*

Subordinate Theme 2: Work

DRF affected the participants' working performance, except for this one participant.

Mr. E: *"My work did not involve any heavy and manual tasks, so it (DRF) did not disturb my performance at work."*

Some participants reported changes in work duties due to job demands misfits. As a result, they also needed to perform their work differently, and their job scope was adjusted accordingly.

Mr. A: *"I am a supervisor. I used to work a lot. I run a forklift and arrange stuff. As for now, I do the records, sit down for recording and supervise my co-workers."*

Three participants quit and did a temporary part-time job before returning to their previous work. However, their work tasks' ability remained limited due to the condition.

Miss I: *"I resigned due to the injury. However, I did a part-time job for one or two weeks as a promoter in a supermarket. I have to write, serve the customers and arrange light stuff."*

Subordinate Theme 3: Rest and Sleep

Most participants reported no sleep disturbance. However, one respondent claimed her sleep was disturbed due to the pain of the injured hand, although her injury lasted for over half a year.

Miss J: *"I had pain a few times last week. I dreamt that I was in pain, and unfortunately, when I woke up, I was really in pain." It (pain) feels like shooting pain. Most of the time, the pain would present at night and sometimes while I was sitting alone without doing any activity (at night).."*

Subordinate Theme 4: Leisure and Play

Most participants could not return to their leisure and play. They experienced limited leisure activities and were inactive for an extended period post-injury.

Mr. H: *"I like sports. But because of this injury, what else can I do? (His voice is getting louder). So, for now, I stopped playing badminton."*

However, one participant still participated in leisure activities during the recovery process of DRF.

Mr. E: *"Even though I was not well (first three months), I still travel... (he then continued) I had an accident in July 2018, but six months later, I started to play football again in January 2019"*.

Subordinate Theme 5: Social participation

All participants expressed engagement in social activity, including meeting friends and family members. However, most rely on others for transportation rather than driving independently.

Mr. A: *"They (friends) had to pick me up (chuckle). Because I had a strong reason (I had DRF), they had no choice. Such a little spoiled, isn't it (chuckle again)."*

Superordinate Theme 2: "How I live my life"

Individuals adopted coping strategies to perform their daily activities. These strategies were either avoiding or modifying the activities or getting help from others.

Subordinate Theme 1: Avoidance of activities

All participants avoided rigorous activities even after six months post-injury as it would affect their performance due to physical limitations.

Miss C: *"Currently, I do not play badminton because I will use my right hand to play it. I stopped playing badminton because of the weakness here (while pointing her right wrist). I do not think I can do well when I play it (badminton)."*

Subordinate Theme 2: Modification of activities

Participants' modification of activities includes using the unaffected hand, modifying the objects, pacing the activity, and alternating hands to do

most activities independently. For example, they used their unaffected hand while carrying items.

Miss B: *"... If previously I used my right hand to perform those tasks, as for now, I had to switch to my left hand to accomplish the tasks. For instance, carrying my tote bag with this hand (pointing to her left hand)"*

Most participants also used modifying items' weight. For example, one participant encountered difficulty while cooking. She asked her husband to transfer cooking oil into a smaller bottle for ease of use. Additionally, most participants had to pace the activity, consuming more time.

Mrs. F: *"Sometimes I use my fractured hand, but it is not as good as before. I could not move it (hand) faster. So, it took a long time for me to complete even a simple activity like combing my hair. "*

Few participants performed daily activities by using their hands alternately.

Mr. G: *"I can wipe a big living hall window, but slightly slower than before. I used my left and right hand alternately. If my fractured hand is in pain or numb, I will use another hand to continue the task until it is finished."*

Subordinate theme 3: Getting help from others

However, most participants get others' help only after trying their best.

Mr. A: *"Well, I do not like to get help from others. But what else can I do? So I had to ask for help from my colleagues to do certain things, for example, getting or placing heavy tool overhead."*

Superordinate Theme 3: "I feel like"

Participants described how DRF psychologically affected their life in positive and negative ways. However, despite being sad and frustrated, they were also grateful.

Subordinate theme 1: Sense of gratefulness

Few participants expressed gratefulness for their unserious injury.

Mr. E: *“I could say that I am grateful for what has happened to me now. Looking at my motorbike after the accident, I could not believe I still survived.”*

Subordinate theme 2: Sad and frustration

Most participants expressed sadness and frustration due to physical limitations and the inability to perform certain daily activities.

Miss B: *“When I looked at my right hand, I felt sad and frustrated. All activities were affected after the fracture; I regret this and am not strong enough to bear it alone.”*

Superordinate Theme 4: “Something is wrong with my hand”

All participants reported that the limiting factors that contributed to difficulty performing daily activities after injury were physical limitations. All participants have various physical limitations, resulting in the incapacity to perform daily activities independently.

Subordinate theme 1: Limited ROM

All participants experienced limited ROM at the forearm and wrist on their affected hands. Hence, they encountered difficulty performing daily activities.

Mrs. D: *“If I want to cook or take a bath, it is difficult to turn my hand because the movement (of the right wrist) is restricted.”*

Subordinate 2: Weakness

Most participants experienced weakness in the affected hand; hence, they used adaptive strategies to perform daily activities.

Mr. A: *“The truth is, I am not strong enough to lift or carry heavy stuff. Even to pull the doorknob, I still have a problem with it.”*

Subordinate theme 3: Pain

Most participants experienced pain in the affected hand, especially when performing certain activities. Consequently, they might avoid performing these activities.

Miss B: *“I really could not lift heavy stuff. Even though it is only two to three plates, I struggled to do it. I felt so much pain in my hand until here (pointing to her shoulder). It was painful, but I had to do it.”*

Subordinate theme 4: Stiffness

Five participants complained of stiffness on their affected hands, with one having sleep disturbance at night.

Mrs. F: *“I got a sleep problem because of my stiff hand. For now, I cannot sleep in a side-lying position. The stiff hand in pain if I sleep that way. I would have trouble sleeping at least three times a week.”*

Discussion

The study aimed to describe the functional recovery of individuals six months after the DRF. This study’s findings elucidate that individuals with DRF encountered many difficulties performing daily activities, even six months post-injury. This study found that reaching the back of the body was the most common self-care problem due to the lack of optimal wrist position for hand placement while performing activities (Beringer *et al.*, 2020). Although independent, difficulty in personal hygiene and dressing was also experienced. A previous study also reported these restrictions (Watson *et al.*, 2018). Furthermore, even at twelve months, 78% of individuals with DRF reported difficulties in ADL (Nielsen & Dekkers, 2013; Abdul Halim *et al.*, 2021).

Most participants had difficulties in domestic activities. For example, lifting or carrying heavy objects was the most challenging activity either while shopping, preparing meals, or managing

the household due to increased wariness in specific tasks to avoid injuring themselves again (Sloney *et al.*, 2014). Similarly, the most reported difficulties were meal preparation and household chores (Nielsen & Dekkers, 2013; Porter, 2013; Vergara *et al.*, 2016). In addition, driving performance was also affected following DRF (Jones *et al.*, 2017; Watson *et al.*, 2018). However, some participants can still drive independently but with difficulties due to pain. Thus, proper evaluations by health professionals are essential for a safe return to driving.

Individuals' roles undergo social changes after a hand injury, especially workers. Return to work may involve returning to the pre-injury employer or an alternate employer, job and occupation or alternate full-time work capacities or duties, or returning to lighter duties (Peters, 2016). This study highlights that individuals with DRF experienced difficulties after returning to work and were assigned light duties, including working with computers and other office tasks. In addition, manual and laborious tasks, such as lifting and carrying heavy stuff, impede their ability to perform previous responsibilities. This finding supports that upper extremity injuries reduced job satisfaction and productivity, loss of financial resources, unemployment, and social status forfeiture (Peters, 2016).

This study revealed that DRF affects individuals' ability to participate in leisure and play as wrist injury significantly impacts the individuals' ability to perform recreational activities (Naughton & Algar, 2019). Recreational activities such as crafts, sports, and playing musical instruments were the most frequently reported impossible activities following the injury.

Coping and adaptive strategies used by individuals with DRF were highlighted and supported previously (Teunis & Ring, 2015). Most participants avoided recreational activities, lifting, carrying, and doing domestic activities, but not self-care tasks. Self-care is an essential task that makes up a routine for an individual's life (American Occupational Therapy Association, 2020). This study found

that activity modification was the most reported adaptive strategy after DRF. Maintaining the ability to undertake daily activities independently was essential.

Similarly, this study's findings highlight that DRF psychologically affected individuals in varying ways, including low emotional state and loss of confidence to perform specific tasks or activities (Sloney *et al.*, 2014). In addition, most participants experience sadness and frustration rather than a sense of gratefulness. In contrast, one study reported that most participants reacted calmly and achieved acceptance at the early DRF stage (Watson *et al.*, 2018).

All participants experienced long-term physical limitations six months post-injury. Most reported factors that restricted their daily activities' abilities were limited ROM, hand weakness, pain, and stiffness. Rakulini and Attanayake (2019) stated that loss of function and immediate pain happened due to DRF. Those impairments, including weakness, might be due to mal-alignment, soft tissue injuries, and DRF complications. This study highlights that limited ROM at the wrist and forearm was the primary impairment reported, followed by pain, weakness, and stiffness on the affected hand as secondary impairments similar to previous studies (Dilek *et al.*, 2018; Mulders *et al.*, 2018; Tomaszewski *et al.*, 2015). However, these impairments were not previously reported as common among individuals with DRF for more than six months (Cherubino *et al.*, 2010).

Each individual's functional recovery with DRF varies. Individuals with DRF experienced pain and disability, although one-year post-injury (MacDermid *et al.*, 2003; Moore & Leonardi-Bee, 2008), without achieving optimal recovery in daily activities. The injury might continue to affect the individuals' lives, although functionally independent (Bialocerkowski & Grimmer, 2004). DRF that involved the dominant hand might substantially impair functional ability (Beaulé *et al.*, 2000), as individuals with non-dominant hand injury showed better functional recovery. Injury adaptation is more accessible when the dominant hand can be used

except for the bilateral hand's tasks (Bamford & Walker, 2010).

Previously, a scoping review found few activities explored during recovery from DRF, including ADL, IADL, leisure, and productivity (Abdul Halim *et al.*, 2021). Our study added further information regarding the functional recovery experiences of individuals in Malaysia with DRF that explored all stated activities with the addition of restrictions in other activities, including rest, sleep, and social participation. These findings help therapists better understand their clients to provide appropriate treatment and support during recovery. Hence, the functional ability of individuals with DRF must be evaluated during recovery. In addition, there are several patient-rated or performance-based outcome measures, such as Patient-Rated Wrist Evaluation (PRWE), Disability of Hand, Arm, and Shoulder (DASH), Canadian Occupational Performance Measure (COPM), and Performance Quality Rating Scale.

This study's limitation is that the complexity of DRF was not considered, limiting the study's findings' transferability. Individuals with simple fractures have better functional performance than those with complex fractures. Few studies reported that complex DRF involving intra-articular or wrist displacement is associated with poor functional outcomes (Goldfarb *et al.*, 2006; Ali *et al.*, 2021). As this is a qualitative study, it does not capture individuals' functional abilities from time to time. A future longitudinal study is recommended to identify the DRF functional recovery pattern.

Conclusion

In conclusion, this study was conducted on one site in Malaysia and highlighted that individuals' overall function and occupational performance were affected for more than six months following DRF. This research showed the challenges people experienced and their coping and adaptive strategies to perform daily activities. DRF also affects the psychological aspects of individuals. Most DRF individuals

experienced sadness and frustration. Physical limitations such as pain, stiffness, weakness, and limited ROM were the limiting factors that affected the individuals' ability to perform daily activities.

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References

- Abdul Halim, M. A., Kounosuke, T., Ahmad Roslan, N. F., & Che Daud, A. Z. (2021). Functional recovery of Distal Radius Fracture (DRF): A scoping review. *Malaysian Journal of Medicine and Health Sciences*, 17(SUPP3), 320-333.
- Ali, M., Rosales, R. S., & Atroshi, I. (2021). Distal Radius Malunions. *Evidence-based Orthopedics*, 853-859.
- American Occupational Therapy Association. (2020). Occupational therapy practice framework: Domain and process. *American Journal of Occupational Therapy*, 74, 1-87.
- Bamford, R., & Walker, D. M. (2010). A qualitative investigation into the rehabilitation experience of patients following wrist fracture. *Hand Therapy*, 15(3), 54-61. <https://doi.org/10.1258/ht.2010.010013>
- Beaulé, P. E., Dervin, G. F., Giachino, A. A., Rody, K., Grabowski, J., & Fazekas, A. (2000). Self-reported disability following distal radius fractures: The influence of hand dominance. *Journal of Hand Surgery*, 25(3), 476-482. [https://doi.org/10.1016/S0363-5023\(00\)70027-X](https://doi.org/10.1016/S0363-5023(00)70027-X)
- Beringer, C. R., Mansouri, M., Fisher, L. E., Collinger, J. L., Munin, M. C., Boninger,

- M. L., & Gaunt, R. A. (2020). The effect of wrist posture on extrinsic finger muscle activity during single joint movements. *Scientific Reports*, *10*(1), 1-11.
- Bialocerkowski, A. E., & Grimmer, K. A. (2004). Compensatory mechanism use during the first 6 months following distal radius fracture. *International Journal of Therapy and Rehabilitation*, *11*(10), 467-475. <https://doi.org/10.12968/ijtr.2004.11.10.17191>
- Bobos, P., Lalone, E. A., Grewal, R., & Macdermid, J. C. (2018). Recovery, age, and gender effects on hand dexterity after a distal radius fracture. A 1-year prospective cohort study. *Journal of Hand Therapy*, *31*(4), 465-471.
- Chao, W., Azman, M., Rosdi, S., Tuan-Mustafa, T., Tan, Y., Abdullah, S., & Aizuddin, A. (2021). Epidemiology and factors affecting functional outcome of distal radial fracture in an Urban Tertiary Medical Centre in Malaysia. *Malaysian Orthopaedic Journal*, *15*(3), 84.
- Cherubino, P., Bini, A., & Marcolli, D. (2010). Management of distal radius fractures: Treatment protocol and functional results. *Injury*, *41*(11), 1120-1126. <https://doi.org/10.1016/j.injury.2010.09.016>
- Dilek, B., Ayhan, C., Yagci, G., & Yakut, Y. (2018). Effectiveness of the graded motor imagery to improve hand function in patients with distal radius fracture: A randomized controlled trial. *Journal of Hand Therapy*, *31*(1), 2-9. e1.
- Doerr, S. B., Walter, J. R., Priganc, V., Winston, K., Barth, R. W., & Moss, D. P. (2021). The impact of shoulder pathology on individuals with distal radius fracture. *Journal of Hand Therapy*.
- Goldfarb, C. A., Rudzki, J. R., Catalano, L. W., Hughes, M., & Borrelli, J. (2006). Fifteen-year outcome of displaced intra-articular fractures of the distal radius. *Journal of Hand Surgery*, *31*(4), 633-639. <https://doi.org/10.1016/j.jhsa.2006.01.008>
- Ikpen, O. M. I. (2021). The role and importance of social support during recovery following distal radius fracture.
- Jones, C. M., Ramsey, R. W., Ilyas, A., Abboudi, J., Kirkpatrick, W., Kalina, T., & Leinberry, C. (2017). Safe return to driving after volar plating of distal radius fractures. *Journal of Hand Surgery*, *42*(9), 700-704. <https://doi.org/10.1016/j.jhsa.2017.05.030>
- MacDermid, J. C., Roth, J. H., & Richards, R. S. (2003). Pain and disability reported in the year following a distal radius fracture: A cohort study. *BMC Musculoskeletal Disorders*, *4*, 24. <https://doi.org/10.1186/1471-2474-4-24>
- MacIntyre, N. J., & Dewan, N. (2016). Epidemiology of distal radius fractures and factors predicting risk and prognosis. *Journal of Hand Therapy*, *29*(2), 136-145. <https://doi.org/10.1016/j.jht.2016.03.003>
- Mauck, B. M., & Swigler, C. W. (2018). Evidence-based review of distal radius fractures. *Orthopedic Clinics*, *49*(2), 211-222.
- Moore, C. M., & Leonardi-Bee, J. (2008). The prevalence of pain and disability one year post fracture of the distal radius in a UK population: A cross sectional survey. *BMC Musculoskeletal Disorders*, *9*, 129. <https://doi.org/10.1186/1471-2474-9-129>
- Mulders, M. A., Detering, R., Rikli, D. A., Rosenwasser, M. P., Goslings, J. C., & Schep, N. W. (2018). Association between radiological and patient-reported outcome in adults with a displaced distal radius fracture: A systematic review and meta-analysis. *The Journal of Hand Surgery*, *43*(8), 710-719. e715.
- Naughton, N., & Algar, L. (2019). Linking commonly used hand therapy outcome measures to individual areas of the International Classification of Functioning: A systematic review. *Journal of Hand Therapy*, *32*(2), 243-261.

- Nielsen, T. L., & Dekkers, M. K. (2013). Progress and prediction of occupational performance in women with distal radius fractures: A one-year follow-up. *Scandinavian Journal of Occupational Therapy*, 20(2), 143-151.
- Palola, V., Ponkilainen, V., Huttunen, T., Launonen, A., & Mattila, V. M. (2021). Incidence for volar locking plate removal following distal radius fracture surgery. *Archives of Orthopaedic and Trauma Surgery*, 141(8), 1297-1302.
- Peters, S. E. (2016). *Factors influencing return-to-work following upper extremity surgery*. (PhD thesis). The University of Queensland, Australia, [https://espace.library ...](https://espace.library...)].
- Porter, S. (2013). Occupational performance and grip function following distal radius fracture: A longitudinal study over a six-month period. *Hand Therapy*, 18(4), 118-128.
- Rakulini, R., & Attanayake, A. S. (2019). Analysis the Improvements of the quality of life in Ayurvedic treatment for the wrist fracture. *21*(1), 1-15.
- Rupp, M., Cambon-Binder, A., Alt, V., & Feron, J.-M. (2019). Is percutaneous pinning an outdated technique for distal radius fractures? *Injury*, 50, S30-S35.
- Shahabpour, M., Abid, W., Van Overstraeten, L., & De Maeseneer, M. (2021). Wrist trauma: More than bones. *Journal of the Belgian Society of Radiology*, 105(1).
- Singaram, S., & Naidoo, M. (2019). The physical, psychological and social impact of long bone fractures on adults: A review. *African Journal of Primary Health Care and Family Medicine*, 11(1), 1-9.
- Sleney, J., Christie, N., Earthy, S., Lyons, R. A., Kendrick, D., & Towner, E. (2014). Improving recovery - Learning from patients' experiences after injury: A qualitative study. *Injury*, 45(1), 312-319. <https://doi.org/10.1016/j.injury.2012.12.025>
- Smith, J. A., Flowers, P., & Osborn, M. (2013). Interpretative phenomenological analysis and the psychology of health and illness. *Material Discourses of Health and Illness*, 77-100.
- Stern, B. Z., Njelesani, J., & Howe, T.-H. (2021). Transitioning from hurting to healing: Self-management after distal radius fracture. *Disability and Rehabilitation*, 1-10.
- Takeuchi, N., Hotokezaka, S., Okada, T., Yuge, H., Mae, T., & Iwamoto, Y. (2016). Recovery of wrist function after volar locking plate fixation for distal radius fractures. *The Journal of Hand Surgery (Asian-Pacific Volume)*, 21(02), 199-206.
- Teunis, T., & Ring, D. (2015). Recovery from distal radius fracture. *Journal of Hand Surgery*, 40(1), 190.
- Tomaszewski, K. A., Henry, B. M., Paradowski, J., Kłosiński, M., Walocha, E., Golec, J., Kucharska, E., & Dudkiewicz, Z. (2015). Cross cultural adaptation of the English version of the IOF-QLQ to polish, to assess the health-related quality-of-life of patients after a distal radius fracture. *Health and Quality of Life Outcomes*, 13, 158. <https://doi.org/10.1186/s12955-015-0354-x>
- van Leerdam, R. H., Huizinga, F., Termaat, F., Kleinveld, S., Rhemrev, S. J., Krijnen, P., & Schipper, I. B. (2019). Patient-reported outcomes after a distal radius fracture in adults: A 3-4 years follow-up. *Acta Orthopaedica*, 90(2), 129-134.
- Vergara, I., Vrotsou, K., Orive, M., Garcia-Gutierrez, S., Gonzalez, N., Las Hayas, C., & Quintana, J. M. (2016). Wrist fractures and their impact in daily living functionality on elderly people: A prospective cohort study. *BMC Geriatrics*, 16(1), 1-8.
- Watson, N. J., Martin, S. A., & Keating, J. L. (2018). The impact of wrist fracture, surgical repair and immobilization on patients: a qualitative study. *Clinical Rehabilitation*, 32(6), 841-851. <https://doi.org/10.1177/0269215518754614>

World Health Organization. (2001). International classification of functioning. *Disability and Health (ICF)*, 28, 66.

Ydreborg, K., Engstrand, C., Steinvall, I., & Larsson, E.-L. (2015). Hand function,

experienced pain, and disability after distal radius fracture. *The American Journal of Occupational Therapy*, 69(1), 6901290030p6901290031-6901290030p6901290037.