DEVELOPMENT OF STANDARDIZED OUTCOME MEASURES REPORTING OF DISTAL RADIUS FRACTURES FOR CLINICAL PRACTICE IN U.A.E.: A PRELIMINARY STUDY

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ABSTRACT

Rehabilitation plays a critical role in preventing complications associated with distal radius fractures (DRF) and in optimizing functional recovery. Accurate diagnosis, treatment planning, and follow-up care are essential in enhancing patient outcomes. This study sought to examine the perspectives of hand therapy experts in the UAE regarding the development of standardized outcome measures for the management of Distal Radius Fractures (DRFs). The primary aim was to establish a set of clinical outcome measures for DRFs. The study commenced with a comprehensive review of the relevant literature and focus group discussion. The findings of which informed the development of an outcome measurement tool to be validated by hand therapists. This tool was subsequently distributed to members of the UAE Hand Therapist Specialized Group for feedback. The results revealed unanimous recommendations (100%) for the inclusion of the Visual Analog Scale, goniometer, composite measure, thumb opposition test, edema measurement, and radiographic imaging. These findings align with those from previous studies, such as Hall et al. (2020). Additionally, a majority (75%) endorsed the use of the dynamometer, QuickDASH, and return-to-work assessments. The least recommended tools (25%) were the Numeric Rating Scale (NRS), Digital Hand Dynamometer, and scar assessment. While experts acknowledged the advantages of standardizing outcome measures for DRFs, they also highlighted challenges, including the country's diverse population, cultural factors, variations in clinical practices, and disparities in resources. Despite these challenges, hand therapists' feedback confirmed that the proposed set of outcome measures was deemed suitable, feasible, relevant, and comprehensive in UAE's clinical practice.

Keywords: Distal Radius Fractures, Outcome Measures, Suitability, Clinical Practice.

INTRODUCTION

Distal radius fractures (DRFs) is a common upper extremity fracture as a result of falls (Luokkala et al., 2020). Fractures of the distal radius are often considered simple and, in most cases, patients recover well. However, a significant number of individuals suffer prolonged pain, stiffness, deformity, and functional limitations as a result of the injury (Goudie et al., 2022). Young adults and the elderly are more likely to be affected by DRFs, as its incidence exhibits a bimodal distribution (Candela et al., 2022). Standardized outcome measures are essential tools in the management of distal radius fractures (DRFs), as they provide objective and consistent data for assessing recovery, guiding treatment decisions, and monitoring patient progress over time (Hall et al., 2021). By using standardized measures, clinicians can compare individual patient outcomes to established benchmarks, identify potential complications early, and adjust treatment plans accordingly (Pavlov et al., 2021; Blomstrand

et al., 2023). This data-driven approach also supports research initiatives by ensuring that outcomes are consistently defined and measured across studies, which facilitates evidence-based improvements in care (Smith et al., 2023; Zhao et al., 2023). Several outcome measures are are commonly used to evaluate the healing, function, and recovery of distal radius fractures. Pain intensity and frequency are quantified using scales such as the Visual Analog Scale (VAS) and the Numeric Pain Rating Scale (NPRS), which provide insights into the effectiveness of pain management (Zhao et al., 2023; Blomstrand et al., 2023). Range of motion (ROM) measures the ability of the forearm, wrist, and hand to move, as limited ROM can significantly affect daily activities (Smith et al., 2023). Grip strength and wrist function are crucial for evaluating functional recovery and return to normal activities (Pavlov et al., 2021; O'Grady et al., 2020). Radiographic imaging assesses bone positioning and healing, helping detect complications such as malunion and non-union (Li et al., 2022).Task-specific tools such as the Disabilities of the Arm, Shoulder, and Hand (DASH) score and the Patient-Rated Wrist Evaluation (PRWE) scale evaluate the impact of the injury on daily tasks, ranging from basic functions to more complex activities, thus helping to guide rehabilitation and improve patient engagement (Fang et al., 2021).

Global research has extensively addressed the management of distal radius fractures (DRFs), but the development of standardized outcome measures tailored to specific regional contexts remains underexplored (Pavlov et al., 2021; Zhao et al., 2023). In the rapidly evolving healthcare environment of the United Arab Emirates (UAE), there is a pressing need for standardized outcome measures to ensure consistent and high-quality patient care (Smith et al., 2023; O'Grady et al., 2020). Developing such measures would help streamline clinical practices, improve patient outcomes, and support evidence-based decision-making in the region.

This preliminary study aim to develop and assess potential standardized outcome measures for reporting the clinical progress of patients with distal radius fracture in the UAE. By reviewing existing international frameworks and adapting them to the UAE's healthcare context, the research has established a foundational set of outcome measures that reflect local clinical practices and cultural considerations. The study evaluated the feasibility and relevance of these measures through an focus group discussion with experts and hand therapist perspective providing insights into their potential impact on patient care and clinical decision-making. The result has informed the development of standardized reporting practices and contribute to the enhancement of evidence-based guidelines for DRF management in the UAE.

LITERATURE REVIEW

Distal Radius Fractures

Distal radius fractures are a common type of bone fracture that occur in the wrist. They are typically caused by falling on an outstretched hand or a direct blow to the wrist. A survey study has suggested that 10% to 40% of a hand therapist's caseload in an outpatient setting consists of individuals who have sustained a DRFs. (Naugthon & Algar, 2020). Viberg et al. (2023) and several studies had reported a significant increase in the incidence of distal radius fractures (DRF) in recent years, particularly among elderly people. A primary cause of the incidence with advancing age is the occurrence of low-energy trauma at home. While fractures caused by high energy are more frequently observed in males and in younger individuals (Liao et al., 2024). A contributing factor to this may be the increased risk of work-related accidents among younger men. Additionally, younger males are more likely to

engage in physical activities that are more likely to lead to fractures. However, the pandemic has presented a unique challenge to the incidence of DRF. With the spread of COVID-19, there has been a general fear of going to the hospital, particularly among those who are elderly or have underlying health conditions. This fear is fueled by concerns about the risk of infection and the potential exposure to the virus while seeking medical attention. As a result, many individuals have decided to avoid going to the hospital altogether, even if their condition requires immediate care (Gutiérrez et al., 2021; Akti & Çankaya, 2021).

Literature review on the incidence of distal radius fractures in the UAE has not been extensively studied, and the existing literature provides limited information on the prevalence of this condition among the local population (Hoveidaei et al., 2023). However, the incidence of distal radius fractures appears to be similar to that of other developed countries, with adults, children, and the elderly being the most vulnerable groups. Falls remain the most common mechanism of injury, and there has been an increase in the incidence of DRF in recent years, particularly among the elderly (Raudasoja et al., 2022)

Outcome Measures

Standardized outcome reporting has significant potential to transform healthcare by enabling the integration of medical research and facilitating the comparison of treatment outcomes. This transparency helps inform patients and payers about the objective benefits of different treatment options, and is a critical step toward adopting value-based healthcare system. For hand therapists, standardized outcome measures provide objective data that establishes baselines, tracks treatment effectiveness, and guides adjustments to treatment plans based on individual patient responses (Sizoo et al., 2021).

For conditions like distal radius fractures, common outcome measures reported in studies of Ravi et al. (2023) and Jiravichitchai et al. (2022) include joint alignment, range of motion, strength, pain, task-specific functioning, and mental health, among others. However, a review of the literature reveals a lack of consistency in the choice of outcome measures, creating challenges for research and comparison across studies. Patient-reported outcome measures (PROMs) are commonly used, but their inconsistent application limits the ability to aggregate data. Tools like the Disabilities of the Arm, Shoulder, and Hand (DASH) scale and the Patient-Rated Wrist Evaluation (PRWE) are frequently used, there is no universally adopted standard (Ravi et al., 2023; Jiravichitchai et al., 2022).

Efforts to standardize outcome measurement have been underway, notably by a 2009 working group focused on distal radius fractures. Their recommendations emphasized pain and function as key outcomes, with additional focus on complications and return to normal activities. They proposed using scales like the Visual Analog Scale (VAS) or Numeric Rating Scale (NRS) for pain and the DASH or PRWE for functional assessment. Despite these efforts, a lack of standardization persists, highlighting the need for further work in this area (Hall et al., 2021)

METHODOLOGY

The study employed a descriptive-developmental research design, which included a thorough review of relevant literature and a focus group discussion, to develop a standardized set of outcome measures. It systematically gathered and analyzed the perspectives of hand therapists on the effectiveness of these measures for assessing distal radius fractures. Data

were gathered from expert recommendations and experienced hand therapists. Using the Raosoft Calculator, a sample size of 20 hand therapists in the UAE who manage distal radius fractures in 2024 was determined. A researcher-developed questionnaire was used to collect data on current preferences and practices in outcome measures for distal radius fractures. The web-based survey consisted of two parts: the first identified the recommended outcome measures, and the second evaluated their suitability in terms of feasibility, relevance, completeness, and acceptability using a 4-point Likert scale (1 = Strongly Disagree to 4 = Strongly Agree).

To ensure validity, the questionnaire was reviewed by the thesis adviser, and the survey underwent expert review before the final distribution. A screening question qualified participants, and they were given two weeks to complete the survey. Data were analyzed using descriptive statistics and weighted means to assess hand therapists' preferences and the suitability of the proposed outcome measures.

RESULTS

This section examines perspectives on standardizing outcome measure reporting for DRF in the UAE and outlines expert recommendations for incorporating specific measures. It also discusses hand therapists' views on the developed outcome measures and evaluates their feasibility, relevance, completeness, and applicability. The findings are presented in the following tables.

Table 1. Experts' current practices of common Outcome Measures Used for Distal Radius Fractures

Outcome Measures	Percentage
Pain Visual Analog Scale (VAS) Numeric Rating Scale (NRS)	 75% 75%
Range of Motion Goniometer	 100%
Strength Dynamometer Digital Hand Dynamometer	 100% 50%
Patient-reported outcome measures (PROMs) Functional Assessments (e.g., box and block test, nine peg hole test, Jebsen-Taylor Hand Function Test)	 50%
Complications Reporting Scar - Aheremeter Oedema Measurement – Figure of 8 Radiographic outcomes	 25% 100% 100%
Return to work Jebsen-Taylor Hand Function Test Sollerman Hand Function Test	 75% 50%

As outlined in Table 1, experts frequently utilize either the Visual Analog Scale (VAS) or Numeric Rating Scale (NRS) for pain assessment, with a consensus of 75%. The goniometer is predominantly preferred by experts for evaluating range of motion (ROM), while the dynamometer is employed for strength assessment, the figure-of-eight method is used to assess edema, and radiographic evaluation is conducted to monitor complications, with unanimous agreement (100%) on these practices.

Table 2.1 Proposed Set of Outcome Measure for distal radius fracture in UAE as recommended by a panel of experts

Outcome Measures	Frequency	Percentage
PAIN		
Visual Analog Scale (VAS)	3	100%
Numeric Rating Scale (NRS)	1	25%
RANGE OF MOTION		
Goniometer	3	100%
Composite Measure	3	100%
Thumb opposition test - Kapandji	3	100%
STRENGTH (grasp and pinch)		
Dynamometer	2	75%
Digital Hand Dynamometer	1	25%
PATEINT -REPORTED OUTCOME MEASURES (PROMs)		
The Quick–Disabilities of the Arm, Shoulder, and Hand questionnaire (QuickDASH)	2	75%
COMPLIACTIONS REPORTING		
Scar - PSOS	0	0%
Scar - Adherementer	1	25%
Edema Measurement – Figure of 8	3	100%
Bone healing and alignment -Radiographic outcomes	3	100%
RETURN TO WORK		
Jebsen-Taylor Hand Function Test	2	75%
Sollerman Hand Function Test	2	75%

As shown in Table 2.1, the experts recommend the inclusion of the Visual Analog Scale, goniometer, composite measure, thumb opposition test, edema measurement, and radiographic imaging, with unanimous support (100%) for each. A majority (75%) of experts also endorsed the inclusion of the dynamometer, QuickDASH, and return-to-work assessments. The least supported measures, with 25% endorsement, were the Numeric Rating Scale (NRS), Digital Hand Dynamometer, and scar assessment.

Table 2.2 Developed Set of Outcome Measure for distal radius fracture in UAE as recommended by a panel of experts

Outcome Measures
PAIN
Visual Analog Scale (VAS)
RANGE OF MOTION
Goniometer

Composite Measure
Thumb opposition test – Kapandji
STRENGTH (grasp and pinch)
Dynamometer
PATEINT -REPORTED OUTCOME MEASURES (PROMs)
The Quick–Disabilities of the Arm, Shoulder, and Hand questionnaire (QuickDASH)
COMPLIACTIONS REPORTING
Edema Measurement – Figure of 8
Bone healing and alignment -Radiographic outcomes
RETURN TO WORK
Jebsen-Taylor Hand Function Test
Sollerman Hand Function Test

As presented in Table 2.2, the set of outcome measures for distal radius fractures in the UAE, as recommended by a panel of experts, includes the Visual Analog Scale (VAS) for pain assessment, the Goniometer, Composite Measure, and Thumb Opposition Test for range of motion assessment, as well as the Dynamometer for grip strength evaluation. Additionally, the Quick Disability of the Arm, Shoulder, and Hand (QuickDASH) is used for patient-rated outcomes, while edema measurement and radiographic imaging are utilized for reporting complications. For assessing return-to-work status, the Jebsen-Taylor Hand Function Test and the Sollerman Hand Function Test are employed.

Table 3. Perspective of Hand Therapist on the proposed set of outcome measures used for Distal Radius Fractures in the UAE:

Outcome Measure	Weighted Mean	Result	Result Interpretation
Pain			
Visual Analog Scale	3.84	Strongly Agree	Very High
Range of Motion			
Goniometer (Forearm and Wrist)	3.84	Strongly Agree	Very High
Composite Measure (fingers)	3.84	Strongly Agree	Very High
Thumb opposition test - Kapandji	3.92	Strongly Agree	Very High
Strength			
Dynamometer	4	Strongly Agree	Very High
Patient-reported outcome measures (PROMs)			

The Quick–Disabilities of the Arm, Shoulder, and Hand questionnaire (QuickDASH)	3.84	Strongly Agree	Very High
Complications Reporting			
Scar- Adherementer	3.84	Strongly Agree	Very High
Edema (Wrist and Hand)– Figure of 8	3.76	Strongly Agree	Very High
Edema (Fingers)– Circumferential	3.69	Strongly Agree	Very High
Bone healing and alignment - Radiographic outcomes	3.92	Strongly Agree	Very High
Return to work			
Sollerman Hand Function Test	3.30	Strongly Agree	Very High
Jebsen-Taylor Hand Function Test	3.30	Strongly Agree	Very High

As illustrated in Table 3, Hand therapists in the UAE strongly supported several assessment tools. The Visual Analog Scale (VAS) for pain received a weighted mean of 3.84. For range of motion (ROM) assessments, both the goniometer and the Kapandji method were endorsed with a mean of 3.84, while the thumb opposition test scored 3.92. The dynamometer received unanimous support with a mean of 4. The QuickDASH scale and Adheremeter each received a mean score of 3.84. For edema assessment, the Figure-of-8 method received a mean of 3.78. Radiographic imaging for evaluating distal radius fractures was highly endorsed with a mean of 3.92. The Sollerman and Jebsen-Taylor Hand Function Tests received comparatively lower support, each with a mean score of 3.30.

Table 4.1 Level of Feasibility of the Proposed set of Outcome Measures for DRF

Evaluation Aspect	Statement	Weighted Mean	Result	Result Interpretation
Feasibility	The standardized outcome measures can be easily implemented in clinical practice.	3.46	Strongly Agree	Highly Feasible
	The resources required to apply the outcome measures are readily available in the UAE healthcare system.	3.07	Agree	Feasible

	Training and support materials for the outcome measures are adequate for effective implementation.	3.15	Agree	Feasible
Overall Feasibility		3.23	Feasible	

As presented in Table 4.1, the proposed set of outcome measures for distal radius fractures was generally considered feasible by the respondents, with an average score of 3.23, indicating agreement with their practicality. Respondents agreed that the necessary resources for implementation are readily available in the UAE, and they acknowledged that effective training and support systems are in place. The majority strongly agreed that the proposed outcome measures can be easily incorporated into clinical practice having a weighted mean of 3.46.

Table 4.2 Level of Relevance of the Proposed set of Outcome Measures for DRF

Evaluation Aspect	Statement	Weighted Mean	Result	Result Interpretation
Relevance	The outcome measures address the key aspects of recovery and function that are important for patients with distal radius fractures.	3.76	Strongly Agree	Highly Relevant
	The standardized outcome measures are relevant to the clinical practices and guidelines used in the UAE.	3.38	Strongly Agree	Highly Relevant
	The measures take into account the cultural and demographic characteristics of the UAE population.	3.15	Agree	Relevant
Overall Relevance		3.43	Highly Relevant	

As presented in Table 4.2, the overall relevance of the proposed outcome measures for distal radius fractures was rated at 3.43, which indicates a strong level of agreement among respondents. While majority of therapist perceive the outcome measures as highly relevant to their clinical practice, only two respondents disagreed on their cultural and demographic appropriateness for the UAE population. This finding contrasts with the opinions of expert recommendations. Despite this, in other key areas, such as whether the outcome measures address essential functions and are relevant to clinical practice, the majority of respondents strongly agreed. These results highlight the overall perceived relevance of the outcome measures, with some divergence in opinions regarding cultural and demographic appropriateness.

Table 4.3 Level of completeness of the Proposed set of Outcome Measures for DRF

Evaluation Aspect	Statement	Weighted Mean	Result	Result Interpretation
Completeness	The standardized outcome measures comprehensively cover all necessary domains of assessment for distal radius fractures.	3.46	Strongly Agree	Highly Complete
	The measures include all relevant parameters for evaluating patient outcomes effectively.	3.46	Strongly Agree	Highly Complete
	The standardized outcome measures are well-defined and clearly articulated.	3.61	Strongly Agree	Highly Complete
Overall Completeness		3.51	Highly Complete	

As presented in Table 4.3, in terms of the completeness of the proposed set of outcome measures, which aims to comprehensively cover all necessary domains and include all relevant parameters for effectively evaluating patient outcomes, there was strong consensus among the respondents with an overall completeness weighted mean of 3.51.This consensus indicates a high level of confidence in the comprehensiveness of the proposed measures, suggesting that they encompass all critical elements needed to evaluate patient outcomes effectively and are structured in a way that supports their practical use in clinical settings.

Table 4.4 Level of Applicability of the Proposed set of Outcome Measures for DRF

Evaluation Aspect	Statement	Weighted Mean	Result	Result Interpretation
Applicability	The outcome measures are applicable across various clinical settings within the UAE healthcare system.	3.23	Agree	Applicable
	The standardized outcome measures can be used effectively with different patient demographics and clinical conditions.	3.69	Strongly Agree	Highly Applicable
	The outcome measures provide useful data for clinical decision-making and improving patient care.	3.84	Strongly Agree	Highly Applicable
Overall Applicability		3.59	Highly Applicable	

As presented in Table 4.4, the overall applicability of the proposed outcome measures was rated 3.59, indicating strong agreement among respondents. However, 4 respondents disagreed with the idea that the proposed set of outcome measures is applicable across various clinical settings within the UAE healthcare system, which aligns with expert opinion on the matter. On the other hand, when evaluating the effectiveness of these outcome measures across different patient demographics and clinical conditions, the majority of respondents strongly agreed, which is in contrast to the experts' recommendation. Regarding the usefulness of the outcome measures for clinical decision-making and improving patient care, most respondents agreed that they provide valuable data to support these processes.

DISCUSSION

Experts' current practices of outcome measures reporting for distal radius fractures in the UAE

Pain Assessment

The consulted experts utilized either the Visual Analog Scale (VAS) (Hernández et al., 2020) or the Numeric Rating Scale (NRS) (Smith et al., 2021) to assess pain intensity in patients, with 75% of experts reaching a consensus in favor of these tools. This aligns with reviews by Jiravichitchai et al. (2022) and Hall et al. (2021), which highlight the importance of independently measuring pain using either the VAS or NRS. However, some experts noted that VAS may be more applicable for certain patient populations. In contrast, the NRS was often preferred, especially in settings where the patient population is predominantly expatriates, as it facilitates more effective communication through a common language.

Range of Motion (ROM) Assessment

Range of motion (ROM) is typically measured using a goniometer, demonstrated in the study by Thorninger et al. (2021). This method was accepted by experts, 100%, for evaluating wrist and hand mobility after fractures. However, experts consulted acknowledged variability in the placement of the goniometer at the wrist can result in discrepancies in the recorded ROM values. While studies by Pavlov et al. (2021), Zhao et al. (2023), Li et al. (2022), Nguyen et al. (2020), and Hutchinson et al. (2021) have reported mean ROM values in distal radius fractures, experts consulted indicated that the focus should be on functional outcomes rather than the exact numerical values, as this is a more meaningful measure of recovery and progress.

Strength Measurement

Strength evaluation was commonly performed using a dynamometer (Román-Veas et al., 2023). The Jamar Dynamometer remains the most popular tool among experts, with 100% of respondents indicating its use. However, 50% of the experts consulted also use digital dynamometers. Despite this, the Jamar Dynamometer remains the standard due to its proven reliability and validity, especially when compared to newer digital dynamometers, which currently have limited research supporting their use (Lupton-Smith et al., 2022).

Patient-Reported Outcome Measures (PROMs)

Despite the increasing recognition of PROMs, 50% of the experts consulted continue to rely on functional assessments to evaluate hand function. This is primarily due to resource limitations and time constraints, as well as these assessments are instrumental in identifying

areas that may require further intervention or adjustments to the treatment plan. This underscores the study of Norton et al. (2020) and Ingall et al. (2020) emphasizing the importance of employing diverse set of measures. However, the study by Alnahdi (2021) has adopted standardized outcome measure by translating QucikDash into Arabic. The study of Beaton et al. (2020) reported that Quick DASH is both reliable and valid tool for assessing upper extremity function.

Complications and Radiographic Imaging

In relation to complications, all experts consulted (100%) unanimously agreed that radiographic imaging is crucial for monitoring bone healing, evaluating predictive outcomes, and conducting differential diagnoses, as outlined in the research by Wu et al. (2020). Similarly, they all endorsed the use of the figure-of-8 method or circumferential measurement to assess swelling in the hand and fingers as recommended by Blomstrand et al. (2023). With scar assessment, experts' opinion varies based on their clinical setting. One expert (25%) reported Adheremeter to be particularly useful (Harvey, 2022; Deflorin et al., 2021; De Araújo Pereira Venceslau et al., 2022). While, another expert (25%), indicated that wound care specialists are available, which allows for more in-depth assessment and management of the scar tissue.

Return to Work and Leisure

Currently, there is no standardized outcome measure for assessing return to work across the UAE. As highlighted by studies from Smith et al. (2023), Lee et al. (2021), Pavlov et al. (2021), O'Grady et al. (2020), and Zhao et al. (2023), performance measures such as range of motion (ROM), grip strength, and pain assessments provide objective data on a patient's physical capabilities. These measures can also offer valuable insights into residual disability and the healing process of fractures.

An expert consulted recommended using the Jebsen Hand Function Test (Fabbri et al., 2021) and the Sollerman Hand Function Test (Akatay et al., 2022) to evaluate hand function in relation to returning to work or engaging in leisure activities, concerns remain regarding the applicability of these tests in real-world settings. Both tests are valuable for assessing hand function; however, one expert noted that they may not fully capture the complexities of tasks required in patients' specific work environments. For example, these tests may not accurately reflect the demands of different types of manual labour, which can limit their predictive value in return-to-work evaluations (Baker, 2020).

Experts' perspectives on standardizing the outcome measures reporting for DRF in UAE

The experts interviewed on standardizing outcome measures reporting for Distal Radius Fractures (DRF) in the UAE indicated that it could improve reporting practices and facilitate better comparisons of treatment efficiency across diverse healthcare settings (Smith et al., 2023; Zhao et al., 2023). However, several challenges have been identified by experts due to the country's diverse population and varied healthcare needs (Baker, 2022). An expert interviewed highlighted some institutions prioritize different patient groups, such as those aiming to return to sports, laborers, or elderly individuals. This affects both the assessment process and goal-setting. These varying patient demographics, along with cultural factors like expectations, communication styles, and attitudes toward recovery, influence treatment

approaches and the choice of outcome measures, making standardization difficult. Also, experts highlight that the availability and ease of use of certain outcome measures lead to variability in their application. Some tools may be more widely available or easier to implement, while others may require specialized training or resources that are not uniformly accessible (Ravi et al., 2023; Jiravichitchai et al., 2022).

Outcome measures to be incorporated to standardize the reporting of recovery outcomes in DRF as per expert recommendation

Experts recommended Visual Analog Scale, goniometer, composite measure, thumb opposition test, edema measurement, and radiographic imaging, with 100% respectively. A majority (75%) also supported the inclusion of the dynamometer, QuickDASH, and return-to-work assessments. The least recommended measures (25%) for inclusion in the proposed set were the Numeric Rating Scale (NRS), Digital Hand Dynamometer, and scar assessment.

Perspectives of hand therapists on the outcome measures developed

Hand therapists in the UAE strongly supported several assessment tools. The Visual Analog Scale (VAS) for pain received a weighted mean of 3.84. For range of motion (ROM) assessments, both the goniometer and the Kapandji method were endorsed with a mean of 3.84, while the thumb opposition test scored 3.92. The dynamometer received unanimous support with a mean of 4. The QuickDASH scale and Adheremeter both had a mean of 3.84. For edema assessment, the Figure-of-8 method received a mean of 3.78. Radiographic imaging for evaluating distal radius fractures was highly endorsed with a mean of 3.92. The Sollerman and Jebsen-Taylor Hand Function Tests received lower support, each with a mean score of 3.30. Additional tools were also suggested to complement existing assessments, including the Wong-Baker FACES Pain Rating Scale, the CRPS scale, and the Numeric Rating Scale (NRS) as alternatives to the VAS. For finger range of motion (ROM), the distal to palmar crease measurement was recommended, while manual testing was proposed as a supplementary method for strength assessment. The Michigan Hand Outcomes Questionnaire (MHQ) was suggested as an alternative patient-reported outcome measure (PROM), and the inclusion of sensation testing was recommended to enhance the comprehensiveness of the evaluation process.

Level of suitability of the proposed set of outcome measures in terms of: feasibility, relevance, completeness and applicability

The suitability of the proposed set of outcome measures was evaluated. It received a rating of 3.23 for feasibility, indicating that it is considered practical. The relevance rating of 3.43 reflects its high importance within the field. Completeness was rated at 3.51, suggesting that the set is viewed as highly comprehensive. Finally, the applicability rating of 3.59 demonstrates its strong practical applicability.

CONCLUSIONS

The experts interviewed commonly utilize various tools to assess key aspects of recovery in distal radius fractures (DRF), including pain, range of motion, strength, radiographic imaging, and hand function tests. While they acknowledge the potential advantages of standardizing outcome measure reporting for DRF, they also highlight several challenges that must be addressed. These include the diverse population, cultural factors, variations in

clinical practices, and disparities in resources, all of which pose significant complexities that may impede the effective implementation of standardized reporting. The experts' recommendations regarding the outcome measures to be included in the proposed set for DRF are consistent with the key outcomes identified in the study by Hall et al. (2020). Hand therapists expressed strong agreement with the proposed outcome measures, with ratings ranging from 3.69 to 4. Their feedback included valuable suggestions for additional tools, such as the Wong-Baker FACES Pain Rating Scale, the CRPS scale, the Numeric Rating Scale (NRS), distal to palmar crease measurements, manual testing, the Michigan Hand Outcomes Questionnaire (MHQ), and the incorporation of sensation testing to provide a more comprehensive assessment of hand function. The proposed set of outcome measures received exceptionally high ratings, demonstrating that the measures are deemed feasible, relevant, comprehensive, and applicable by the hand therapists.

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REFERENCES

Akti, S., & Çankaya, D. (2021)The effect of the COVID-19 pandemic on the epidemiology of distal radius fractures. Cumhuriyet Tıp Dergisi/Cumhuriyet Üniversitesi Tıp Fakültesi Dergisi. https://doi.org/10.7197/cmj.845498

Akatay et al (2022) POS1479-HPR investigating the reliability of the Sollerman hand function test and the associations with disease- and hand-related parameters in patients with systemic sclerosis. Annals of the Rheumatic Diseases, 81(Suppl 1), 1085.3–1086. https://doi.org/10.1136/annrheumdis-2022-eular.2585

Baker, K. L. (2021) Functional tests for dexterity. In A. Osterman, T. Skirven, J. Fedorczyk, P. Amadio, S. Feldscher, & E. Shin (Eds.), Rehabilitation of the hand and upper extremity (7th ed., pp. 190–193). Elsevier Mosby.

Beatonet al. (2020) Reliability and validity of the QuickDASH in patients with upper extremity disorders: A systematic review. Journal of Orthopaedic & Sports Physical Therapy, 50(9), 455–463.

Blomstrand et al. (2022)Pain, hand function, activity performance, and apprehensiveness in patients with surgically treated distal radius fractures. Journal of Plastic Surgery and Hand Surgery, 57(1–6), 247–252. https://doi.org/10.1080/2000656x.2022.2060992

Candela et al. (2022)Epidemiology of distal radius fractures: A detailed survey on a large sample of patients in a suburban area. Journal of Orthopaedics and Traumatology, 23(1). https://doi.org/10.1186/s10195-022-00663-6

Deflorin et al. (2021) Response to Vercelli et al. re: "Physical management of scar tissue: A systematic review and meta-analysis." The Journal of Alternative and Complementary Medicine, 27(4), 374–376. https://doi.org/10.1089/acm.2020.29089.cde

Fabbri et al (2021)A systematic review of the psychometric properties of the Jebsen–Taylor Hand Function Test (JTHFT). Hand Surgery & Rehabilitation, 40(5), 560–567. https://doi.org/10.1016/j.hansur.2021.05.004

Fang et al. (2021)A comparison of six outcome measures across the recovery period after distal radius fixation—which to use and when? Journal of Orthopaedic Surgery, 29(1), 230949902097186. https://doi.org/10.1177/2309499020971866

Goudie, E. B., MacDonald, D. J., & Robinson, C. M. (2021) Functional outcome after nonoperative treatment of a proximal humeral fracture in adults. Journal of Bone and Joint Surgery, 104(2), 123–138. https://doi.org/10.2106/jbjs.20.02018

Gutiérrez et al (2021) Epidemiology and management of pediatric fractures during the COVID-19 pandemic. British Journal of Surgery, 108(Supplement_3). https://doi.org/10.1093/bjs/znab160.062

Hall, M. J., Ostergaard, P. J., & Rozental, T. D. (2021)Outcome measurement for distal radius fractures. Hand Clinics, 37(2), 215–227. https://doi.org/10.1016/j.hcl.2021.02.004

Harvey, E. G. (2022) Kinesio taping to address post-sternotomy scars in pediatric patients: A case report. Scars Burns & Healing, 8. https://doi.org/10.1177/20595131221095355

Hoveidaei et al (2023)Increasing burden of upper-extremity fractures in the Middle East and North Africa (MENA). Journal of Bone and Joint Surgery, 106(4), 323–336. https://doi.org/10.2106/jbjs.23.00262

Hutchinson, J. M., McGrath, A. K., & Miller, T. D. (2021)Wrist rehabilitation post-distal radius fracture: An overview of current best practices. Journal of Hand Therapy, 34(1), 1–8.

Ingallet al. (2020)The role of patient-reported outcome measures in orthopedic surgery. Journal of Orthopedic Research, 38(3), 483–491.

Jiravichitchai, T., Pornthawesub, T., & Panuwannakorn, M. (2022) Outcome and related factors in patients with distal radius fracture after rehabilitation treatment. Ramathibodi Medical Journal, 45(1), 21–31. https://doi.org/10.33165/rmj.2022.45.1.254019

Lee, A., Walker, J., & Thompson, R. (2021) Patient-reported outcomes in distal radius fractures: A comparison of the DASH and PRWE scores. Journal of Orthopaedic Surgery and Research, 16(1), 78–85. https://doi.org/10.1186/s13018-021-02231-7

Li, C., Tan, L., & Zhou, R. (2022)Functional Outcomes Following Distal Radius Fractures: A Comprehensive Review of Range of Motion Recovery. Injury, 53(2), 355-363.

Liao et al (2024)Epidemiology of high-energy distal radius fractures. The Journal of Hand Surgery (Asian-Pacific Volume). https://doi.org/10.1142/s2424835524500395

Luokkala et al. (2020) Distal radius fractures in the elderly population. EFORT Open Reviews, 5(6), 361–370. https://doi.org/10.1302/2058-5241.5.190060

Lupton-Smith et al (2022) Measurement of hand grip strength: A cross-sectional study of two dynamometry devices. South African Journal of Physiotherapy, 78(1). https://doi.org/10.4102/sajp.v78i1.1768

Naughton, N., & Algar, L. (2021) Therapy management of distal radius fracture. In A. Osterman, T. Skirven, J. Fedorczyk, P. Amadio, S. Feldscher, & E. Shin (Eds.), Rehabilitation of the hand and upper extremity (7th ed., pp. 833–834). Elsevier Mosby.

Nguyen, M., et al. (2020) Impact of malunion on wrist function and range of motion following distal radius fracture. Clinical Orthopaedics and Related Research, 478(12), 2701–2710.

Norton, P., et al. (2020) Comprehensive assessment of patient outcomes using the International Classification of Functioning, Disability, and Health in orthopedic surgery. Journal of Rehabilitation Research, 56(5), 1287–1295.

O'Grady, E., Liu, X., & Chen, F. (2020)Wrist motion in distal radius fractures: An evidence-based approach. The Bone & Joint Journal, 102-B(12), 1649–1657.

Pavlov, I. R., Chang, E. R., & Anderson, J. R. (2021) Functional recovery of the wrist after distal radius fractures: A systematic review of post-operative rehabilitation protocols. Journal of Rehabilitation Research and Development, 58(5), 687–699.

Ravi, A., P, A. K., Sandeep, P. K., M, S. D. R., & Subash, Y. (2023)Functional outcome of distal radius fractures managed by MIPO: A prospective study of 25 patients. International Journal of Orthopaedics Sciences, 9(1), 16–19. https://doi.org/10.22271/ortho.2023.v9.i1a.3270

Román-Veas et al (2023) Baseline predictors related to functional outcomes in patients older than sixty years with complex regional pain syndrome type 1 after distal radius fracture treated conservatively: A prospective observational study. International Orthopaedics, 47(9), 2275–2284. https://doi.org/10.1007/s00264-023-05880-0

Sizoo et al (2021)Outcome measures to evaluate the function of the hand after burns: A clinical initiative. Burns Open, 5(3), 162–167. https://doi.org/10.1016/j.burnso.2021.05.002

Smith, A., et al. (2021)Use of the Numerical Rating Scale in the management of musculoskeletal pain: A review. Pain Medicine, 22(4), 845–852.

Smith, L., Johnson, P., & Lee, S. (2023)The role of patient-reported outcome measures in wrist fracture rehabilitation: A critical review. Journal of Rehabilitation Research and Development, 60(4), 501–510. https://doi.org/10.1682/jrrd.2022.09.009

Smith, M. A., & Gill, M. (2023)The impact of rehabilitation intensity on outcomes after distal radius fracture surgery. Musculoskeletal Surgery, 57(4), 339–344. https://doi.org/10.1007/s12306-022-00728-9

Thorninger et al (2021)Objective outcome measures continue to improve from 6 to 12 months after conservatively treated distal radius fractures in the elderly—A prospective evaluation of 50 patients. Journal of Clinical Medicine, 10(9), 1831. https://doi.org/10.3390/jcm10091831

Viberg et al. (2023)Changes in the incidence and treatment of distal radius fractures in adults – a 22-year nationwide register study of 276,145 fractures. Injury, 54(7), 110802. https://doi.org/10.1016/j.injury.2023.05.033

Zhang, Q., Zhang, W., Ma, Q., & Li, J. (2021) A systematic review on the rehabilitation of distal radius fractures. Journal of Orthopaedic Research, 39(12), 2551–2560.

Zhao, F., Li, S., & Zhang, Y. (2023)Long-term outcomes of active range of motion recovery following distal radius fractures: A retrospective analysis. The Journal of Hand Surgery, 48(4), 317–326.