

Assessment Following Distal Radius Fractures: A Comparison of 4 Scoring Systems, Visual Numerical Scales, and Objective Measurements

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Purpose To compare 4 recognized upper-limb scoring systems that are regularly used to assess wrist function after injury.

Methods We reviewed 116 patients 6 months after volar locking plate fixation for distal radius fractures. Two purely subjective and 2 composite scoring systems composed of both subjective and objective components were compared along with visual numerical scores for pain and function and objective measures of function. Each score was standardized into a scale from 0 to 100.

Results The distribution of the standardized total scores was statistically significantly different and indicated marked variability between scoring systems and therefore the information provided. Overall, the subjective scoring systems correlated well with each other and with both visual numerical scores for pain and function. However, the composite scores and objective measures of function correlated poorly with the subjective scores including the visual numerical scores.

Conclusions Results from wrist scoring systems should be interpreted with caution. It is important to ensure that the component parts of each score are taken into consideration separately because total scores may be misleading.

Clinical relevance Composite scores may be outdated and should be avoided. (*J Hand Surg Am.* 2016;41(2):219–224. Copyright © 2016 by the American Society for Surgery of the Hand. All rights reserved.)

Key words Wrist, fracture, outcome score, volar plate, fixation.



DISTAL RADIUS FRACTURES ACCOUNT FOR 16% of all fractures and are one of the most common fractures treated operatively by surgeons.¹ Inadequate treatment can result in considerable morbidity and disability. Scoring systems can provide meaningful information about patients' level of pain and function after surgery. Subjective scoring systems

rely on patients' perception of pain and function defined by their response to questions. This type of instrument is a patient-reported outcome measure (PROM). Objective scoring systems provide a quantitative measure of function independent of the patient's perception. Subjective and objective measurements do not always correlate.^{2,3} Patient-related

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outcome measures have been shown to demonstrate variable correlation with standard clinical measurements such as movement and strength,^{2,4} and this dissociation can result in inconsistency when assessing disability.

An understanding of the performance of outcome instruments in reflecting patient function is of particular importance to surgeons. When used correctly, these tools can influence clinical practice. To ensure the quality of the outcome scoring system used, content validity and reliability are essential.⁵ Much research has been conducted on the validity and reliability of scoring systems for the shoulder after injury, but there is a paucity of literature on wrist assessment.^{6–9}

Our aim was to compare 2 commonly used PROMs with 2 established composite scoring systems (containing both subjective and objective data). We also assessed how these 4 scoring systems compared with basic subjective measures and objective tests.

MATERIALS AND METHODS

All patients (n = 223) with unstable distal radius fractures undergoing volar locking plate fixation at a tertiary care center between April 2009 and May 2011 were identified. All patients were invited for medium-term review. Patients were excluded if they resided out of the region (n = 15), had cognitive impairment (4), or had multiple ipsilateral upper-limb injuries (4). A total of 83 patients declined owing to work commitments or travel or social inconvenience. One patient died of causes unrelated to surgery.

Outcome measures

We collected data for the following outcome instruments and clinical measurements:

- Visual numerical scores (VNS) for pain (0–10; 0 = no pain and 10 = severe pain)
- VNS function (0–10; 0 = extremely poor function and 10 = excellent function)
- Patient-Rated Wrist Evaluation (PRWE) (PROM)
- Disabilities of the Arm, Shoulder, and Hand questionnaire (*QuickDASH*) (PROM)
- Gartland and Werley (GW) (composite system)
- Green and O'Brien (GB) (composite system)
- Range of wrist movement (degrees), grip strength and pinch grip

Scoring systems

A summary of the scoring systems is provided in [Appendix A](#) (available on the *Journal's* Web site at www.jhandsurg.org).

Statistical analysis

Because the scores were skewed, median and interquartile ranges are presented; nonparametric statistical tests were used. We used Cronbach alpha to assess internal consistency of the scores when appropriate subscales for pain and function could be established (PRWE and *QuickDASH*).

To enable direct comparison between total scores for each scoring system, each score was standardized to a scale of 0 to 100, with 0 representing the least pain and function and 100 the most pain and best function. The conversions were calculated:

$$\text{Standardized VNS Pain} = \text{VNS Pain} \times 10$$

$$\text{Standardized VNS function} = 100 - \text{VNS function} \times 10$$

$$\text{Standardized GB} = 100 - (\text{GB} / 80) \times 100$$

$$\text{Standardized PRWE} = \text{PRWE Total}$$

$$\text{Standardized QuickDASH} = \text{QuickDASH}$$

$$\text{Standardized GW} = (\text{GW}_{\text{total}}/27) \times 100$$

After conversion, further analysis was performed using the Spearman rank correlation coefficient to compare the standardized total scores for each instrument under investigation, with objective measures of grip and pinch strength and range of motion. We used the Friedman test to compare distributions of the standardized data.

We also calculated Spearman rank correlation for the PRWE subscales for pain and function, with the same objective measures (grip and pinch strength and range of motion).

We were able to conduct such studies locally as part of service evaluation without specific ethics approval. Occasionally local treatment protocols are altered following such studies, although this was not the case here. In a broader context, the data were used to correlate the initial injury with the final outcomes for the purposes of rationalizing treatment options our department had at its disposal.

RESULTS

A total of 116 patients were assessed 6 months after volar plate fixation of distal radius fractures. All fractures were deemed unstable and not amenable to nonsurgical treatment. Thirty-seven of the fractures were classified as AO/OTA type A (extra-articular), 11 were AO/OTA type B (simple intra-articular), and 68 were AO/OTA type C (combined intra-articular and extra-articular). Mean age of patients was 58 years (range, 25–83 years; SD, 17 years). A total of 94 patients (81%) were women.

Postoperative complications occurred in 10 patients. Two patients developed median nerve symptoms requiring subsequent carpal tunnel decompression. Eight

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