Development and psychometric testing of a novel scale for shoulder assessment

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INTRODUCTION: Current patient-reported outcome measures (PROMs) are long, have complex scoring systems, suffer from ceiling/floor effects, are not universally applicable, and have a high administrative burden. In response, we have developed the Subjective Shoulder Scale (S3), a novel PROM designed to address these limitations and provide a comprehensive, efficient, and patient-centered evaluation of 7 key domains.

METHODS: Items for S3 were generated by reviewing existing questionnaires and refined using input from patients and an expert panel. Seven questions assess pain, range of motion, strength, shoulder stability, activities of daily living, sports and leisure activities, and mental well-being. After pilot testing in 20 participants, test-retest reliability was evaluated in 100 participants by calculating Cronbach's alpha and the intraclass correlation coefficient. To test validity and responsiveness, 124 participants completed both the S3 and the American Shoulder and Elbow Surgeons questionnaire before and after undergoing various shoulder procedures; Pearson's correlation coefficients, exploratory factor analysis, and responsiveness were determined by calculating the effect size and establishing thresholds for the minimal clinically important difference, substantial clinical benefit, and patient-acceptable symptom state.

RESULTS: Pilot testing confirmed clarity, relevance, readability, and ease of use. In the full psychometric evaluation cohort of 244 participants (mean age 59 ± 13 years; 50% females), the S3 exhibited excellent test-retest reliability (intraclass correlation coefficient = 0.96) and high internal consistency (Cronbach's α = 0.93). No ceiling/floor effects were observed. Exploratory factor analysis supported a unidimensional structure, and convergent validity was established through a strong positive correlation with the American Shoulder and Elbow Surgeons questionnaire ($r = 0.71$, $p < .001$). S3 is also responsive, with thresholds of 12.4 points for minimal clinically important difference, 19.9 points for substantial clinical benefit, and 38–83 points for patient acceptable symptom state.

DISCUSSION AND CONCLUSION: S3 is a reliable, valid, responsive PROM for capturing the effects of diverse shoulder conditions. By addressing weaknesses of existing questionnaires, S3 may facilitate personalized treatment planning through more efficient, meaningful patient evaluations.

Fig. 1 Depiction of the novel Subjective Shoulder Scale for measuring orthopaedic shoulder patient-reported outcomes.
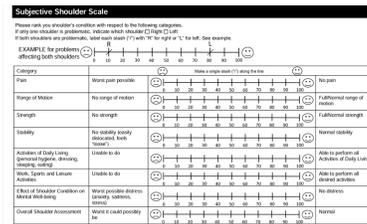

Fig. 2 Radar graph depicting a sample patient's Subjective Shoulder Scale Scores across 3 clinic visits. A larger circumference on the graph depicts better shoulder health, allowing easy visualization of score improvements or declines across multiple assessment points.

Table I. Characteristics of 244 adult patients treated by 1 orthopaedic shoulder and elbow surgeon from 2022 to 2024.

Characteristic	N (%)
Age, years	59 ± 13*
Gender	
Female	125 (51)
Male	119 (49)
Race	
Asian or Pacific Islander	9 (4)
Black or African American	57 (23)
White	172 (70)
Other	6 (2)
Involved shoulder	
Right	143 (59)
Left	97 (40)
Bilateral	4 (2)
Diagnosis	
Rotator cuff tear	161 (66)
Labral pathology	141 (58)
Biceps tendonitis	90 (37)
Chondromalacia	56 (23)
Glenohumeral osteoarthritis	52 (21)
AC joint arthritis	35 (14)
Shoulder instability	9 (4)
Adhesive capsulitis	8 (2)
Hill-Sachs lesion	6 (2)
Surgical procedures†	
Biceps tenodesis	165 (68)
Arthroscopic debridement	138 (57)
Subacromial decompression	137 (56)
Rotator cuff repair	99 (44)
TSA	47 (19)
AC joint resection	34 (14)
Lower trapezius muscle transfer	11 (5)
Revision TSA	7 (3)
Hemiarthroplasty	1 (0.45)

AC, acromioclavicular; TSA, total shoulder arthroplasty;
*Expressed as mean ± standard deviation.
†Procedures were performed in a total of 203 patients, with some patients undergoing more than 1 procedure.