BASIC SCIENCE

The American Shoulder and Elbow Surgeons score highly correlates with the Simple Shoulder Test

Keith M. Baumgarten, MD[a,b,*], Peter S. Chang, MD[c]

[a]Section of Sports Medicine and Shoulder Surgery, Orthopedic Institute, Sioux Falls, SD, USA
[b]Sanford School of Medicine, University of South Dakota, Sioux Falls, SD, USA
[c]Department of Orthopaedics, Washington University, St. Louis, MO, USA

Background/Hypothesis: There is no consensus to which patient-determined shoulder outcome scores should be considered when analyzing patient outcomes for either clinical or research purposes. The use of multiple outcome scores may be redundant and cause increased responder burden. The hypothesis of this study is that the American Shoulder and Elbow Surgeons score (ASES) will highly correlate with the Simple Shoulder Test (SST) for rotator cuff repair and total shoulder arthroplasty and have comparable responsiveness. If determined to be highly correlated, the use of these scores simultaneously may be redundant and one score may be eliminated.
Methods: A retrospective review of the senior author's database of patients undergoing rotator cuff repair and total shoulder arthroplasty was reviewed in which the ASES was recorded simultaneously with the SST. Correlations were determined using the Pearson correlation coefficient ($r > 0.7$ excellent; $r = 0.61$-0.7 strong-moderate; $r = 0.31$-0.6 moderate; $r = 0.2$-0.3 poor) for all interactions between the 2 scores. Subgroup analysis was performed to determine if correlations differed in (1) preoperative outcome and (2) postoperative outcome determinations. Responsiveness was determined by calculating the standardized response mean and the effect size of both scores.
Results: There were a total of 1810 simultaneous measurements (both rotator cuff repair and total shoulder arthroplasty) of the ASES and SST. The correlation was excellent for the ASES and SST for all patients (n = 1810; $r = 0.81$; $P < .0001$). The correlation of preoperative scores was strong-moderate (n = 1191; $r = 0.60$; $P < .0001$), and the correlation of postoperative scores was excellent (n = 619; $r = 0.78$; $P < .0001$). Both scores were determined to be highly responsive, but both the standardized response mean (2.8 vs. 2.1) and the effect size (2.2 vs. 1.8) of the ASES were greater than those of the SST.
Conclusion: In general, there was an excellent correlation between the ASES and the SST for all patients undergoing arthroscopic rotator cuff repair and total shoulder arthroplasty. Because there is an excellent correlation between the 2 scores, including these 2 scores simultaneously in tracking patient-determined outcomes appears to be redundant and therefore unnecessary. Because there is superior responsiveness of the ASES score compared with the SST, the authors recommend utilization of the ASES over the SST in patients undergoing rotator cuff repair and total shoulder arthroplasty.
Level of evidence: Basic Science Study; Validation of Outcome Instruments
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In an era of value-based medicine, it is essential that both clinicians and researchers track patient outcomes to ensure that we are providing value to our patients. Porter and Lee[26] suggested that the rigorous measurement of value (outcomes and costs) is perhaps the single most important step in improving health care.

Patient-determined outcome scores have become the standard for determining outcomes after treatment interventions. In a review of shoulder rating scales published in 2010, at least 26 different shoulder outcome scores were available to choose from in order to track patient outcomes.[41] At this time, there is no consensus as to which scales should be considered for either clinical or research purposes. It would be ideal to identify 1 single quality-of-life outcome score that could be universally accepted among shoulder clinicians and researchers to track outcomes in patients with shoulder pathology. However, at this time, that 1 ideal patient outcomes measure either does not exist or has not been identified.

Both the American Shoulder and Elbow Surgeons score (ASES)[29] and the Simple Shoulder Test (SST) are joint-specific, patient-determined outcome scores.[18] Both scores are commonly used simultaneously to assess outcomes in patients with rotator cuff tears and shoulder osteoarthritis. When examining the U.S. National Library of Medicine database, 124 references were found when using the search terms: "Simple Shoulder Test and American Shoulder and Elbow Surgeons score and rotator cuff repair."[13] One hundred and forty-six references were found when using the search terms: "Simple Shoulder Test and American Shoulder and Elbow Surgeons score and total shoulder arthroplasty."[14] Although it is a more comprehensive assessment, patients are burdened when asked to answer multiple scales simultaneously. In one study, patients required an average of 18-20 minutes to complete the multiple scales used.[27] The more questions that are asked of the patient and the longer it takes to complete the outcome forms leads to a higher potential for fatigue bias where the quality of the responses to the questionnaires degrades over time.[6,30] Thus, it is important to identify scores that may be redundant and unnecessarily increase responder burden without adding additional psychometric benefit. Scores that are highly correlated may be considered redundant, and an investigator may want to avoid using them simultaneously.

The hypothesis of this study is that the ASES score will highly correlate with the SST for patients undergoing rotator cuff repair and total shoulder arthroplasty. If determined to be highly correlated, the use of these 2 scores simultaneously may be considered to be redundant and potentially unnecessary. Eliminating the simultaneous use of redundant scoring systems would decrease responder burden and may potentially make shoulder outcomes research more reliable and accurate, and decrease the percentage of subjects lost to follow-up.

The secondary aim of his study was to determine if the 2 scales had comparable responsiveness (the sensitivity to change). If the 2 scores had an excellent correlation but 1 score was more responsive to change, then it would make sense to consider eliminating the use of the less responsive score. The secondary hypothesis of this study was that the SST and ASES scores would both be highly responsive and comparable to each other in regard to sensitivity to change of clinical status.

Materials and methods

The senior author's (KMB) registry of patients undergoing arthroscopic rotator cuff repair was de-identified and then retrospectively reviewed to determine which subjects had an ASES score recorded simultaneously with an SST score. Data from this registry have been included in previously published papers.[2,3] Correlations between scores were determined using a Pearson correlation coefficient ($r > 0.7$ excellent, $r = 0.61$-0.7 strong-moderate, $r = 0.31$-0.6 moderate, $r = 0.2$-0.3 poor). Correlation analysis was also stratified for preoperative scores and postoperative scores. Responsiveness was measured by determining (1) the standardized response mean (SRM) and (2) the effect size (ES). The SRM was calculated by dividing the mean change in the outcome scores by the standard deviation of the amount of change of each score. Greater magnitudes in the SRM demonstrate greater sensitivity to change.[11] The ES was calculated by subtracting the mean preoperative score from the mean postoperative score and dividing it by the standard deviation of the preoperative score. Large ES were considered >0.80.[16]

Results

There were a total of 1810 simultaneous measurements (both rotator cuff repair and total shoulder arthroplasty) of the ASES score and SST. The mean age at the time of the subjects' simultaneous measurements of the ASES and SST was 63.6 ± 10.8 years. The correlation was excellent for the ASES score and SST for all patients (n = 1810; $r = 0.81$; $P < .0001$). The correlation of preoperative scores was strong-moderate (n = 1191; $r = 0.60$; $P < .0001$), and the correlation of postoperative scores was excellent (n = 619; $r = 0.78$; $P < .0001$). Both scores were determined to be highly responsive, but both the SRM (2.8 vs. 2.1) and the ES (2.2 vs. 1.8) of the ASES score were greater than those of the SST.

There were 1337 simultaneous measurements of the ASES score and SST for patients undergoing arthroscopic rotator cuff repair. The correlation was excellent for the ASES and SST for all patients (n = 1337; $r = 0.81$; $P < .0001$). The correlation of preoperative scores was strong-moderate (n = 846; $r = 0.61$; $P < .0001$), and the correlation of postoperative scores was excellent (n = 491; $r = 0.82$; $P < .0001$). Postoperative score assessment occurred at 6 weeks (n = 36; $r = 0.54$; $P = .0006$), 12 weeks (n = 48; $r = 0.69$; $P < .0001$), 18 weeks (n = 37; $r = 0.79$; $P < .0001$), 6 months (n = 43; $r = 0.68$; $P < .0001$), 1 year (n = 47; $r = 0.87$; $P < .0001$), and final follow-up (mean, 3.7 years), which ranged from 2 to 7.5 years (n = 280; $r = 0.76$; $P < .0001$). For patients undergoing rotator cuff repair, both the SRM (2.1 vs. 1.8) and the ES (2.8 vs. 2.1) of the ASES score were greater than those of the SST.

The correlation was excellent for the 473 simultaneous measurements of the ASES score and SST for patients

undergoing total shoulder arthroplasty ($r = 0.77$; $P < .0001$). Of these measurements, 280 were completed in patients undergoing anatomic total shoulder arthroplasties ($r = 0.80$; $P < .0001$) and 193 completed in patients undergoing reverse total shoulder arthroplasties ($r = 0.72$; $P < .0001$). The correlation of preoperative scores in patients undergoing total shoulder arthroplasty was moderate (n = 345; $r = 0.44$; $P < .0001$). The correlation of postoperative scores in patients undergoing total shoulder arthroplasty at the final follow-up (mean, 3.7 years; range, 2-7.5 years) was strong-moderate (n = 128; $r = 0.64$; $P < .0001$). For patients undergoing total shoulder arthroplasty, both the SRM (2.2 vs. 1.6) and the ES (3.1 vs. 2.4) of the ASES score were greater than those of the SST.

Discussion

This study demonstrates that in general the ASES score and the SST score have an excellent correlation. Postoperative scores (strong-moderate to excellent) had uniformly stronger correlations than preoperative scores (moderate to strong-moderate). In addition, this study confirmed that although both scores were highly responsive, the ASES score appears to be superior to the SST in detecting change in clinical status after arthroscopic rotator cuff repair and total shoulder arthroplasty.

The ASES score was developed in 1994 to be a general shoulder score that could be applied to all patients regardless of the diagnosis.[29,41] The self-assessment section has 3 domains that include a single visual analog scale and 10 question activities of the daily living scale.[29] The duration required for patients to complete the ASES score ranged from 1.8 to 10 minutes.[8,20,21,24,29,30,35] The ease of scoring has been considered difficult[5] although Razmjou et al[28] have stated that the superiority of the ASES score is its "practicality of being administered in and scored under 5 minutes as compared to 10 to 15 minutes for more lengthy measures," and Roy et al[32] suggested that the administrative burden was low. The ASES score has been shown to be a reliable, valid, and responsive outcome tool.[21,32] A systematic review determined that the ASES score had one of the smallest absolute error of measurements compared with multiple outcome scores.[36] The American Shoulder and Elbow Surgeons Value Committee has recommended it as an outcome tool that should be used for all patients with shoulder pathology.[10]

The SST was developed at the University of Washington in 1992.[17,18] It consists of 12 binary yes/no questions that require between 90 seconds and 3 minutes to complete.[5,20,22,23,30] It is considered easy to score with an average time of 1 minute to score the test.[20] The SST has been shown to be valid[5,9,12] and responsive for assessing outcomes of shoulder arthroplasty.[12]

Several authors have questioned the use of the SST score as a metric secondary to its binary answer format, which may make it less sensitive to small but clinically relevant changes in function and less likely to differentiate between patients with varying severities of the same condition.[1,7,9,15,22,25,32]

The correlation of the SST with the ASES score has varied between studies. Two studies have shown a strong correlation between the SST and ASES scores in patients with shoulder injuries,[30] rotator cuff disease and shoulder instability,[9] and total shoulder arthroplasty.[19] Similar to our study, correlations between scores were stronger postoperatively than preoperatively.[19] One study demonstrated a moderate correlation between the ASES score and SST ($r = 0.54$).[4] Another study revealed poor correlations in a heterogeneous group of patients undergoing shoulder surgery ($r = 0.35$).[25]

When directly compared with the ASES score, the SST had significantly greater floor and ceiling effects compared with the ASES score when examining patients with rotator cuff disease and osteoarthritis.[4,23,30] Similar to our study, superior responsiveness after shoulder surgery was found for the ASES score over the SST.[25] When examining responsiveness as a function of the minimal clinically important difference (MCID), the MCID of the ASES score ranged from 6% to 21% and the MCID of the SST ranged from 12.5% to 36% of the maximum score.[31,34,37-39]

When comparing scores, several authors recommended the use of the ASES score over the SST[33] due to the lower measurements of error for the ASES score,[30,32] better correlation with strength and range of motion,[40] and superior responsiveness.[25]

Because there are excellent correlations in general between the scores when examining patients undergoing rotator cuff repair and total shoulder arthroplasty, it appears that their simultaneous use may be redundant. One may consider eliminating one of these scores when tracking patient outcomes to decrease responder burden. Secondary to the superior responsiveness of the ASES score over the SST, the authors recommend the use of the ASES score when examining patients undergoing rotator cuff repair or total shoulder arthroplasty over the SST.

The limitations of this study are that other than correlation with other scores and responsiveness, this study was not structured to determine other psychometric properties such as reliability, internal consistency, or minimal clinically important differences. The strengths of this study include the large sample size, which significantly exceeds similar previous studies,[4,9,25,30] and the inclusion of both preoperative and postoperative scores, which is rare in previous studies.[19,25]

Conclusion

This study makes a step forward in trying to simplify the decision making into which outcome scores to use when examining outcomes in patients with rotator cuff tears and shoulder osteoarthritis. It demonstrates that the

ASES score and the SST score have an excellent correlation in general. Thus, it appears that their simultaneous use may be redundant, and one may consider eliminating one of these scores when tracking patient outcomes to decrease responder burden. Secondary to the superior responsiveness of the ASES score, we recommend the use of the ASES score over the SST in patients undergoing arthroscopic rotator cuff repair and total shoulder arthroplasty.

Disclaimer

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