J Shoulder Elbow Surg (2021) 30, 1167–1173

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Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Single Assessment Numeric Evaluation for instability as an alternative to the Rowe score

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Background: Several functional outcome scores have been proposed for the evaluation of shoulder instability. Most are multiple-item questionnaires, which can be time-consuming and difficult for patients to understand, as well as leading to lack of compliance. The Single Assessment Numeric Evaluation (SANE) score is a single question that has recently gained widespread acceptance based on its simplicity and correlation with more complex scoring systems. The purpose of this study was to assess the correlation of a new modified version of the SANE score, the SANE-instability score, with the Rowe score after treatment for shoulder instability.

Materials and methods: We prospectively evaluated a consecutive series of 253 patients (268 shoulders) treated surgically or nonoperatively for shoulder instability between November 2017 and November 2019, for whom the Rowe and SANE-instability scores were collected before treatment and/or after treatment. The SANE-instability score was assessed with the following question: "What is the overall percent value of your shoulder if a completely stable shoulder represents 100%?" Correlations were tested using the Pearson coefficient (r) and interpreted as very high ($r = 0.90$-1.00), high ($r = 0.70$-0.89), moderate ($r = 0.50$-0.69), low ($r = 0.30$-0.49), or negligible ($r = 0.00$-0.29). Subgroup analyses were also performed to observe correlation variations according to follow-up length (before treatment and at 6, 12, 26, 52, and 104 weeks after treatment), patient age (<20, 20-29, 30-39, or ≥40 years), and type of treatment (nonoperative or surgical).

Results: The overall correlation between the SANE-instability and Rowe scores was high ($r = 0.85$, $P < .001$). Subgroup analyses revealed that the correlation between the 2 scores was high before treatment ($r = 0.74$); moderate at 6 and 12 weeks after treatment ($r = 0.66$ and $r = 0.57$, respectively); and then high at 26, 52, and 104 weeks after treatment ($r = 0.75$, $r = 0.75$, and $r = 0.78$, respectively) ($P < .001$). The correlation was high across all types of treatment ($r = 0.76$-0.85), high for patients aged ≥ 20 years ($r = 0.80$-0.86), and very high for patients aged < 20 years ($r = 0.93$) ($P < .001$).

Conclusion: This study demonstrated a significant correlation between the SANE-instability and Rowe scores before and after treatment, as well as across all patient age groups and treatments. Owing to its high simplicity, the SANE-instability score could be used as an alternative to the Rowe score for patient follow-up at various time points.

Institutional review board approval was obtained from the Association des Medicins du Canton de Geneve et Societe Medicale (no. 12-26).

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https://doi.org/10.1016/j.jse.2020.08.013

Level of evidence: Basic Science Study; Validation of Outcome Instrument

Keywords: Shoulder instability; single assessment numeric evaluation (SANE); Rowe; subjective shoulder value (SSV); patient-reported outcome measures (PROMs); score; WOSI; Walch-Duplay

Various outcome measures have been proposed for the assessment of shoulder instability, including the Western Ontario Shoulder Instability (WOSI),[11] Walch-Duplay,[23] and Rowe[19] scores. Such scoring systems are used to assess shoulder stability, evaluate treatment effectiveness, and identify risk factors for recurrent glenohumeral instability.[13,24]

Assessment of clinical outcomes is essential to evaluate treatment effectiveness and personalize rehabilitation programs but is also of importance for patient education and engagement in patients' own care over time. The majority of scoring systems for shoulder instability, such as the Rowe score, are multi-item questionnaires and may include a combination of subjective and objective responses. Although the aforementioned questionnaires can give useful and specific information, they are time-consuming and can be difficult for patients to understand, leading to clinical inefficiency, patient frustration, and often incomplete forms.

The Single Assessment Numeric Evaluation (SANE) score is a single patient-reported question that has recently gained widespread acceptance based on its simplicity and ability to truly reflect patients' perceptions.[22] This improves efficiency and has the potential to improve patient compliance whether administered in the clinic or via remote evaluation. Several authors have evaluated the association between the SANE score and functional scores for other shoulder pathology (Constant score,[7] American Shoulder and Elbow Surgeons [ASES] shoulder score,[3,8,18] or Rowe score[25]) and reported high correlations. The classic SANE score for shoulder evaluation, also known as the subjective shoulder value (SSV),[6] remains nonspecific to any shoulder pathology, however, which renders its use suboptimal for complex disorders. Therefore, we recently developed a modified SANE score specific to shoulder instability, which will be presented and investigated for the first time in this study.

The purpose of this study was to assess the correlation of a new modified version of the SANE score, the SANE-instability score, with the Rowe score for shoulder instability. The hypothesis was that the SANE-instability score would highly correlate with the Rowe score at different follow-up time points.

Materials and methods

Patients

We performed a prospective evaluation of a consecutive series of patients with shoulder instability treated either surgically or nonoperatively between November 2017 and November 2019 at 1 institution by a single surgeon (A.L.) (Table I). All patients provided written informed consent for their participation and for the use of their data and images for research and publishing purposes. The inclusion criteria were age $\geq$ 16 years at the time of treatment and the presence of anterior and/or posterior glenohumeral instability. The exclusion criteria included age $<$ 16 years.

Nonoperative treatment

For patients treated nonoperatively, rehabilitation was centered on the glenohumeral joint itself, with progressive gain in range of motion, as well as reinforcement of the posterior cuff and the shoulder blade stabilizers. Furthermore, a multidisciplinary approach including "reafferentation" focused on proprioceptive work, biofeedback therapy, a cognitive behavioral approach, and electrical stimulation was used.[12]

Surgical techniques

Patients who were treated surgically underwent either the open Latarjet procedure or arthroscopic Bankart repair. The open Latarjet procedure was indicated for patients practicing overhead sports or for those presenting with anterior glenoid bone loss $>$ 20% based on computed tomography scans. Arthroscopic Bankart repair was indicated for patients with glenoid bone loss $<$ 20% or for those who did not practice sports considered at risk of shoulder instability. Arthroscopic Bankart repair was performed in isolation in 15 shoulders (41%), whereas it was performed with adjuvant dynamic anterior stabilization in 22 shoulders (59%) to provide an additional sling effect, as described by Collin and Lädermann.[2]

Table I Patient characteristics for all shoulders (N = 268)

Characteristic	Data
Age, yr	
Mean ± SD	30.0 ± 10.5
Median (range)	28.0 (15.0-68.0)
Male sex, n (%)	211 (78.7)
Operation on dominant side, n (%)	203 (75.7)
Treatment, n (%)	
Nonoperative	56 (20.9)
Surgical	212 (79.1)
Arthroscopic Bankart	37 (13.8)
Open Latarjet	175 (65.3)

SD, standard deviation.

Glenohumeral instability scores

Patients were evaluated during their follow-up visits by a single surgeon (A.L.). Our questionnaire included the traditional Rowe score[19] (1978 version) and a SANE value modified for glenohumeral instability (SANE-instability score). The Rowe score was chosen over the WOSI score as the former provides the strongest link between shoulder apprehension and both motor and cognitive functions.[4] The Rowe score was calculated with the 3 following items: stability (50 points), motion (20 points), and function (30 points). The SANE-instability score (100 points) was assessed with a single question: "What is the overall percent value of your shoulder if a completely stable shoulder represents 100%?" Scores were collected prior to treatment and at 6, 12, 26, 52, and 104 weeks after treatment.

Statistical analysis

For baseline characteristics, variables were reported as mean ± standard deviation or proportions. Pearson correlation coefficients (r) were used to establish correlations between the SANE-instability and Rowe scores. Correlation strength was interpreted as very high ($r = 0.90$-1.00), high ($r = 0.70$-0.89), moderate ($r = 0.50$-0.69), low ($r = 0.30$-0.49), or negligible ($r = 0.00$-0.29).[16] The sample size necessary to test the hypothesis that there is a high or very high correlation ($r > 0.70$) between SANE-instability and Rowe scores was determined a priori to be a minimum of 21 patients on the basis of the recommendations of Looney.[1,14] Subgroup analyses were also performed to observe correlation variations according to follow-up length (before treatment and at 6, 12, 26, 52, and 104 weeks after treatment), patient age (<20, 20-29, 30-39, or ≥40 years), and type of treatment (nonoperative or surgical). Statistical analyses were performed using R, version 3.6.2 (R Foundation for Statistical Computing, Vienna, Austria). $P < .05$ was considered statistically significant.

Results

Study cohort

A total of 257 patients (272 shoulders) met the study criteria. We excluded 4 of these patients because of incomplete forms, leaving a final cohort of 253 patients (268 shoulders). There were 198 male patients (211 shoulders, 78.7%) and 54 female patients (57 shoulders, 21.3%), with a mean age of 30.0 ± 10.5 years at the time of treatment (Table I). The instability was mostly anterior (258 shoulders, 96.2%) and on the dominant side (203 shoulders, 75.7%). Nonoperative treatment was carried out in 56 shoulders (20.9%), whereas surgery was performed in 212 cases (79.1%), by either the open Latarjet procedure (175 shoulders, 65.3%) or arthroscopic Bankart repair (37 shoulders, 13.8%). Rowe and SANE-instability scores were available for 164 cases before treatment and for 219 cases after treatment at ≥1 follow-up time point (6 weeks, n = 90; 12 weeks, n = 37; 26 weeks, n = 31; 52 weeks, n = 44; and 104 weeks, n = 81). Notably, both pretreatment and post-treatment scores (at ≥1 follow-up time point) were available for 107 patients (115 shoulders).

Before treatment, the mean SANE-instability and Rowe scores were 45.8 ± 19.9 points (median, 45.0 points; range, 0-100 points) and 44.0 ± 19.6 points (median, 45.0 points; range, 0-90 points), respectively (Table II). At final follow-up of 53.4 ± 41.7 weeks (median, 52 weeks; range, 6-104 weeks), the mean SANE-instability and Rowe scores were 85.9 ± 15.1 points (median, 90 points; range, 30-100 points) and 83.3 ± 17.6 points (median, 90 points; range, 20-100 points), respectively.

Score correlations

The overall correlation, including the most recent data for each patient, between the SANE-instability and Rowe scores was high ($r = 0.85$; 95% confidence interval, 0.81-0.88; $P < .001$) (Fig. 1). Subgroup analyses revealed that the correlation between the 2 scores was high before treatment ($r = 0.74$, $P < .001$); moderate at 6 and 12 weeks after treatment ($r = 0.66$ and $r = 0.57$, respectively; $P < .001$); and then high at 26, 52, and 104 weeks after treatment ($r = 0.75$, $r = 0.75$, and $r = 0.78$, respectively; $P < .001$) (Table III, Fig. 2). The correlation was high for nonoperative treatment ($r = 0.85$, $P < .001$) and surgical treatment ($r = 0.77$, $P < .001$). Regarding patient age, the correlation was high for patients aged ≥ 20 years ($r = 0.80$-0.86, $P < .001$) and very high for patients aged < 20 years ($r = 0.93$, $P < .001$).

Discussion

In addition to clinical research, the assessment of functional outcomes is essential to better analyze shoulder pathology, guide surgeons through different treatment options, and evaluate patients over time. In contrast to common shoulder instability outcomes, including the WOSI, Walch-Duplay, or Rowe score, the classic SANE, or SSV, can be quickly assessed and easy to understand for patients. However, the latter is too general and cannot give specific information on the disorder that affects the patient. We therefore aimed to present, for the first time, a new SANE score modified for glenohumeral instability (SANE-instability score) and evaluate its correlation with the traditional Rowe score. The primary finding of our study was a high correlation between the Rowe and SANE-instability scores for shoulder instability.

Several scores have been reported for the assessment of shoulder stability,[10] among which the Rowe score is the most frequently used.[24] Described in 1978 by Rowe et al,[19] this score is a combination of patient and surgeon responses regarding stability, range of motion, and function.[13] Cunningham et al[4] reported that the Rowe score strongly reflects patient shoulder apprehension owing to its motor

Table II Patient characteristics and scores at different follow-up time points

	Before treatment (164 shoulders)	Follow-up				
		6 weeks (90 shoulders)	12 weeks (37 shoulders)	26 weeks (31 shoulders)	52 weeks (44 shoulders)	104 weeks (81 shoulders)
Patient characteristics						
Age, yr	29.4 ± 10.4 (15.0-68.0)	28.1 ± 8.4 (15.0-51.0)	32.1 ± 9.3 (15.0-51.0)	28.1 ± 9.4 (15.0-47.0)	30.1 ± 11.1 (18.0-59.0)	30.4 ± 10.4 (16.0-60.0)
<20	26 (15.9)	15 (16.7)	4 (10.8)	8 (25.8)	7 (15.9)	7 (8.6)
20-29	29 (17.7)	10 (11.1)	8 (21.6)	5 (16.1)	9 (20.5)	15 (18.5)
30-39	68 (41.5)	41 (45.6)	13 (35.1)	10 (32.3)	18 (40.9)	37 (45.7)
≥40	41 (25.0)	24 (26.7)	12 (32.4)	8 (25.8)	10 (22.7)	21 (25.9)
Male sex	125 (76.2)	74 (82.2)	27 (73.0)	22 (71.0)	35 (79.5)	66 (81.5)
Operation on dominant side	134 (81.7)	69 (76.7)	32 (86.5)	27 (87.1)	39 (88.6)	50 (61.7)
Treatment						
Nonoperative	53 (32.3)	3 (3.3)	5 (13.5)	4 (12.9)	0 (0.0)	2 (2.5)
Surgical	111 (67.7)	87 (96.7)	32 (86.5)	27 (87.1)	44 (100.0)	78 (96.3)
Arthroscopic Bankart	20 (12.2)	15 (16.7)	8 (21.6)	10 (32.3)	10 (22.7)	16 (19.8)
Open Latarjet	91 (55.5)	72 (80.0)	24 (64.9)	17 (54.8)	34 (77.3)	62 (76.5)
Scores, points						
SANE-instability	45.8 ± 19.9 (0.0-100.0)	75.4 ± 17.0 (40.0-100.0)	84.4 ± 11.5 (60.0-100.0)	85.1 ± 13.6 (40.0-100.0)	85.9 ± 16.7 (30.0-100.0)	93.0 ± 11.0 (30.0-100.0)
Rowe	44.0 ± 19.6 (0.0-90.0)	76.6 ± 16.7 (30.0-100.0)	82.3 ± 13.0 (45.0-100.0)	85.6 ± 19.1 (20.0-100.0)	82.0 ± 19.6 (20.0-100.0)	86.9 ± 17.2 (20.0-100.0)

SANE, Single Assessment Numeric Evaluation.
Data are presented as mean ± standard deviation (range) or number (percentage).

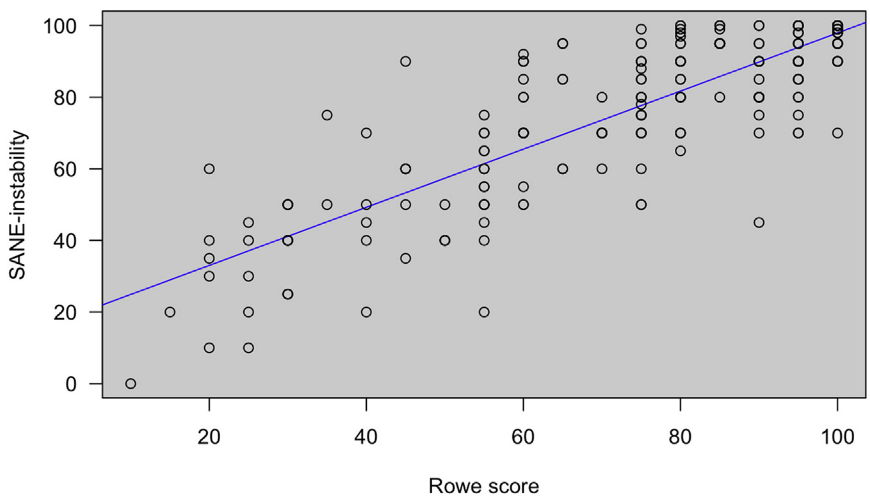

Figure 1 Scatter plot showing high overall correlation between Single Assessment Numeric Evaluation *(SANE)*–instability and Rowe scores.

Table III Subgroup analyses of correlation strength between SANE-instability and Rowe scores at most recent follow-up

	Pearson correlation				
	n	r^*	95% CI	*P* value	Strength
Patient age					
<20 yr	38	0.93	0.86-0.96	<.001	Very high
20-29 yr	114	0.86	0.81-0.90	<.001	High
30-39 yr	66	0.80	0.69-0.87	<.001	High
≥40 yr	50	0.82	0.70-0.89	<.001	High
Type of treatment					
Nonoperative	56	0.85	0.75-0.91	<.001	High
Surgical	212	0.77	0.71-0.82	<.001	High
Open Latarjet	175	0.76	0.69-0.82	<.001	High
Arthroscopic Bankart	37	0.82	0.68-0.90	<.001	High
Follow-up					
Before treatment	164	0.74	0.66-0.80	<.001	High
After treatment					
6 weeks		0.66	0.53-0.76	<.001	Moderate
12 weeks	37	0.57	0.31-0.76	<.001	Moderate
26 weeks	31	0.75	0.55-0.87	<.001	High
52 weeks	44	0.75	0.58-0.86	<.001	High
104 weeks	81	0.78	0.67-0.85	<.001	High

SANE, Single Assessment Numeric Evaluation; *CI*, confidence interval.
* Pearson correlation coefficient.

(stability and motion) and cognitive (pain or discomfort) components. However, the strength of a score is based on its responsiveness, reliability, and validity.[9] The Rowe score requires surgeon assessment of range of motion, which may be subject to bias.

Understanding the patient's perspective is important in determining the outcome. This need has driven the transition to patient-reported outcome measures (PROMs) in daily practice and is fundamental to delivering high-value, patient-centered care.[21] Recent systematic reviews have identified that high patient burden during outcome assessment was a risk factor for lack of patient compliance and therefore recommended the use of PROMs that comprise a low number of questions.[15,17] The classic SANE score is a single-question PROM that reflects the patient's perspective of his or her clinical status. This score is easy to collect and use because it can be collected in the office or remotely, thereby saving considerable time and potentially improving compliance. For this reason, several authors have studied its association with functional outcomes. A significant correlation with the Constant (r = 0.61), ASES (r = 0.69), and Rowe (r = 0.77) scores was

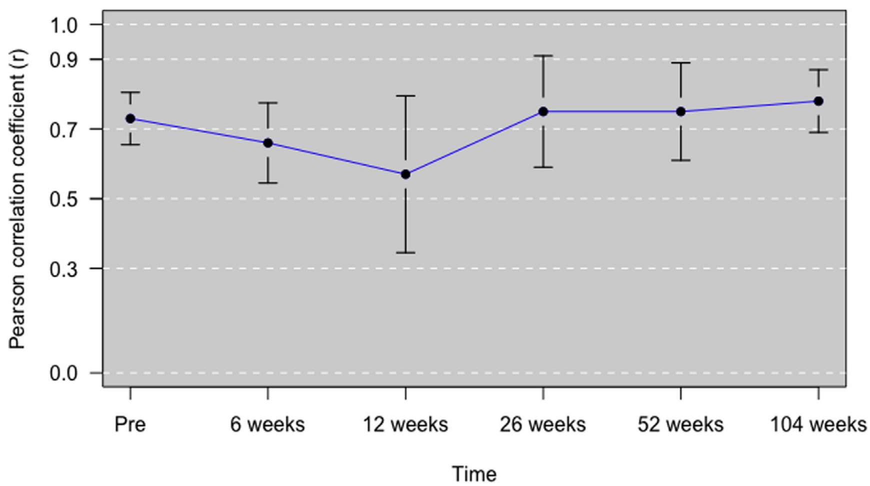

Figure 2 Correlation analysis between Single Assessment Numeric Evaluation–instability and Rowe scores at different time points. *Pre*, before treatment.

found for shoulder instability.[7,25] Similarly, a significant correlation with the ASES score was observed after primary ($r = 0.75$) or revision ($r = 0.88$) rotator cuff repair and superior labrum anterior-posterior (SLAP) treatment ($r = 0.78$).[4]

The management of shoulder instability is challenging owing to its multifactorial origin, comprising bony and soft tissue abnormalities, rotator cuff or deltoid muscle insufficiencies, and/or excessive ligamentous laxity.[5,20] The classic SANE score for shoulder evaluation, also called the SSV, however, is unspecific; this question asks the patient what his or her "shoulder is as a percentage of normal." In our study, we adjusted this question to specify the stability of the shoulder. With this adjustment, we observed a significant correlation with the Rowe score before and after treatment, as well as for different patient age groups and treatment types. The correlation between SANE-instability and Rowe scores was the lowest, even though of moderate strength, at 6 and 12 weeks after treatment ($r = 0.62$ and $r = 0.63$, respectively). It is worth noting that our results revealed a greater correlation strength at longer follow-up (≥26 weeks).

Limitations

This study has several limitations. First, the Rowe and SANE-instability scores were not available at all follow-up points for all patients, which prevented us from performing analyses on patients' evolution over time with correlations of their net improvement values. This can be explained by our development of the SANE-instability score only recently, which rendered its pretreatment collection impossible for patients who had already been treated at the beginning of the study. Second, we did not collect the classic SANE score, which could have been interesting to allow a comparison of the results of its correlation with the Rowe score against those obtained in this study with the SANE-instability score. However, it has already been proved that the classic SANE score, being shoulder specific but condition unspecific, does not accurately capture apprehension processing.[4] Thus, shoulder-specific and condition-specific evaluation has to be prioritized in shoulder instability. Third, we did not differentiate the isolated Bankart procedures from the Bankart repairs performed with dynamic anterior stabilization in the analyses because of insufficient data. Fourth, subgroup correlation analyses at each time point (treatment, age group, and so on) could not be performed because of insufficient data. Finally, given the differences at short-term time points (6-12 weeks), further investigation may be needed to evaluate whether surgeons need to additionally collect the Rowe score at very short follow-up time points to optimize patient evaluation. Nevertheless, we do not believe that the Rowe score is valuable at short-term follow-up as the function section relates to sport activities that are still not recommended.

Conclusion

This study demonstrated a significant correlation between the SANE-instability and Rowe scores before and after treatment, as well as across all patient age groups and treatments. Owing to its high simplicity, the SANE-instability score could be used as an alternative to the Rowe score for patient follow-up at various time points.

Disclaimer

Alexandre Lädermann is a paid consultant for Wright, Arthrex, and Medacta, outside the submitted work, and received royalties from Wright.

Philippe Collin reports consultant fees from Wright, Arthrex, Smith & Nephew, and ConMed, outside the submitted work, and received royalties from Wright.

Patrick J. Denard reports grants and personal fees from Arthrex, outside the submitted work.

The other authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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