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Original research

Correlation between Single Assessment Numerical Evaluation score and Lysholm score in primary total knee arthroplasty patients

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ABSTRACT

Background: There are numerous subjective rating scales available to evaluate outcomes of total knee arthroplasty (TKA). Single Assessment Numerical Evaluation (SANE) score was developed to reduce the burden of patients or clinicians to evaluate patients' status by asking patients to simply rate the current status of their injured body part on a scale of 0-100. The purpose of this study is to investigate the correlation between SANE score and Lysholm score in patients who underwent primary TKA.

Methods: Forty-nine patients who underwent primary TKA participated. Patients who underwent bilateral TKA or revision TKA were excluded from this study. They were asked to respond to SANE and Lysholm scores. Regression analysis was used to evaluate the correlation between 2 scores. Bilateral isometric quadriceps strength and limb symmetry index were also measured and recorded.

Results: There were a total of 49 patients in the study. The mean age of the subjects was 73.04 ± 6.63 years. The mean height and body weight were 153.37 ± 8.81 cm and 55.51 ± 8.61 kg, respectively. The mean scores for SNAE and Lysholm scores were 66.08 ± 16.77 and 71.0 ± 17.55, respectively. Pearson *r* correlation coefficient between SANE and Lysholm scores was 0.38 ($P = .003$). Regression analysis showed statistically significant correlation between 2 scores with r^2 of 0.15 ($P = .005$). The average time from surgery was 16.02 weeks. The mean isometric quadriceps strength was 26.76 ± 11.30 kgf for the involved knee and 40.58 ± 11.55 kgf for the non-involved knee. The limb symmetry index was 66.10% ± 21.51%.

Conclusions: The results of the investigation showed that there was a statistically significant, however relatively weak, correlation between SANE score and Lysholm score. SANE score may serve as an alternative method to assess TKA patients' subjective post-operative outcomes to Lysholm score.

Introduction

There are numerous rating scales that have been introduced and used in the clinical setting as a clinical assessment tool in order to evaluate patients' outcomes and status such as Knee injury and Osteoarthritis Outcome Score (KOOS), Lower Extremity Functional Scale, Knee Society Score, and Western Ontario and McMaster Score [1-4]. There have been studies that investigated their reliability and validity. Roos and Toksvig-Larsen [5] investigated the reliability and validity of KOOS and suggested that it is highly reliable and valid in assessing total knee arthroplasty (TKA) patients. Naal et al [6] conducted a study on TKA and total hip arthroplasty patients and suggested that University of California, Los Angeles scale was more appropriate to assess physical activity levels of those patients.

Lysholm score was introduced in 1980s as a patient-oriented subjective assessment tool to evaluate patients with knee ligament injury [7]. Its reliability and validly has been studied and established by the past literature [8,9]. Briggs et al studied the reliability and validity of Lysholm score and reported that it was a reliable and valid patient-administered tool to assess patients with anterior cruciate ligament (ACL) tear. They also suggested that

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Lysholm score showed acceptable responsiveness to be used in return to function after ACL injury [8]. Even though Lysholm score was developed to assess patients with knee ligament injury, it has been used to assess other patients including TKA [9].

The past literature suggests that those patient-oriented rating scales are reliable and valid tools to assess patients' subjective outcomes after knee surgery and injury. However, it is time-consuming and some questions are difficult to answer. Single Assessment Numerical Evaluation (SANE) score is a subjective rating scale to assess patients' outcomes by asking "How would you rate your injured body part on a scale of 0 to 100?" [10,11] It is short and less time-consuming without patients having to answer multiple questions compared to other subjective rating scales. It has also been used in assessing patients after shoulder surgery as well as other rating scales for shoulders [12]. Past studies show that SANE score is well correlated with shoulder subjective rating scale such as Rowe score and American Shoulder and Elbow Surgeons score after shoulder surgery [10,13]. Also, it is shown that SANE score is well correlated with knee rating scales such as International Knee Documentation Committee score and Knee Outcome Survey (KOS) [14,15].

However, it is unsure whether asking a single question is enough to accurately evaluate patients' outcomes and status. There are not many studies that investigated correlation between SANE score and Lysholm score. Thus, we decided to investigate correlation between SANE score and Lysholm score in patients who underwent primary TKA.

The purpose of this study is to investigate whether SANE and Lysholm scores correlate in patients who underwent primary TKA. It was hypothesized that the 2 scores would show statistically significant positive correlation between each other.

Material and methods

Forty-nine patients who underwent primary TKA at Emoto Knee and Sport Clinic were recruited for this study. All agreed to participate and provided signed informed consent. They were asked to answer a questionnaire which included patients' demographic information such as date of birth, age, sex, time from surgery, surgical side, Lysholm score, and SANE score. For SANE score, patients were instructed to rate their surgical knee on a scale of 0-100 with 100 being normal [11]. The patients' current body weight and height were measured at the time of data collection by an author (T.Y.). Patients' names were not recorded. Instead, the subject number was used to identify each subject. The patients who underwent bilateral TKA or revision TKA were excluded from this study. All patients were currently being treated at the clinic at the time of data collection.

After completing the questionnaire, each subject was measured for bilateral isometric quadriceps strength using Mobie (SAKAImed, Japan). The patients sat on a chair upright with the hips and knees flexed at 90°. Mobie that was attached to the chair was placed right above the ankle of the knee being measured. Then, the patient's knee was extended to 60° of knee flexion. The patient was instructed to slowly kick their leg up and forward against the device as hard as they could for 5 seconds while keeping their hands flat on the chair right by their thighs. This was repeated twice and the highest number was recorded as their strength measure. This procedure was repeated again for the other knee. The order of strength test was randomized between involved knee and contralateral knee. All measurements were done during their rehabilitation session. The test was discontinued if patients had pain with the test.

Collected data were analyzed and regression analysis was used to determine correlation between 2 scores. Pearson r correlation coefficients were calculated for the rest of the measured independent variables including age, body weight, height, time from surgery, isometric quadriceps strength for involved and non-involved knees, and limb symmetry index (LSI) and their correlation to SANE score. Also, Pearson r correlation coefficients were calculated between Lysholm score and the rest of measured variables. This study was approved by the Institutional Review Board of Emoto Knee and Sport Clinic.

Results

There were 49 patients (12 men and 37 women) who underwent primary TKA in this study. The mean age (mean ± SD) of the subjects were 73.04 ± 6.63 years. The mean height and weight (mean ± SD) were 153.37 ± 8.81 cm and 55.51 ± 8.61 kg, respectively. The patients were 16.02 weeks post-operatively on average ranging from 2 to 46 weeks. The average scores for Lysholm and SNAE scores (mean ± SD) were 71.0 ± 17.55 and 66.08 ± 16.77, respectively. Both scores were scored out of 100 points. Isometric quadriceps strength was 26.76 ± 11.30 kgf for the involved knee and 40.58 ± 11.55 kgf for the non-involved knee. The mean LSI was 66.10% ± 21.51% (Table 1). All patients were able to complete the isometric strength test without having increased pain.

Regression analysis showed statistically significant correlation between SANE score and Lysholm score ($r^2 = 0.15$, $P = .005$) (Fig. 1). Pearson correlation coefficients revealed moderate correlation between SANE score and quadriceps strength of involved knee ($r = 0.42$, $P = .001$), LSI ($r = 0.41$, $P = .001$), Lyshom score ($r = 0.38$, $P = .003$), and time from surgery ($r = 0.33$, $P = .01$). The correlations were statistically significant. The results of analysis are summarized in Table 1.

Pearson r correlation coefficients revealed that there was a statistically significant correlation between Lysholm score and time from surgery ($r = 0.27$, $P = .02$), quadriceps strength of involved knee ($r = 0.39$, $P = .002$), and LSI ($r = 0.34$, $P = .008$) (Table 2).

Discussion

The results of this investigation supported our hypothesis that there would be a statistically significant positive correlation between SANE score and Lysholm score. SANE score showed statistically significant, however relatively weak, correlation to Lysholm score in TKA patients. Even though this was not the primary purpose of this current investigation, we also calculated the correlation coefficients between SANE and Lysholm scores to the rest of independent variables separately. Interestingly, the strongest correlation was found between SANE score and quadriceps

Table 1
Demographic data of measured variables and their correlation to SANE score.

Measured variables	Mean ± SD	R	95% CI		P value
			Lower	Upper	
Age	73.04 ± 6.63	−0.07	−0.34	0.21	.31
Height (cm)	153.37 ± 8.81	−0.03	−0.31	0.25	.41
Weight (kg)	55.51 ± 8.61	0.11	−0.17	0.37	.22
Time from surgery (wk)	16.02 ± 11.43	0.33	0.05	0.55	.01
Lysholm	71.0 ± 17.55	0.38	0.11	0.59	.003[a]
SANE	66.08 ± 16.77	Not applicable			
INV (kgf)	26.76 ± 11.30	0.42	0.15	0.62	.001[a]
Non-INV (kgf)	40.58 ± 11.55	0.18	−0.11	0.43	.11
LSI (%)	66.10 ± 21.51	0.41	0.14	0.62	.001[a]

CI, confidence interval; INV, isometric quadriceps strength of involved knee in kgf.
[a] Statistically significant correlation to SANE score (P is significant at <.05).

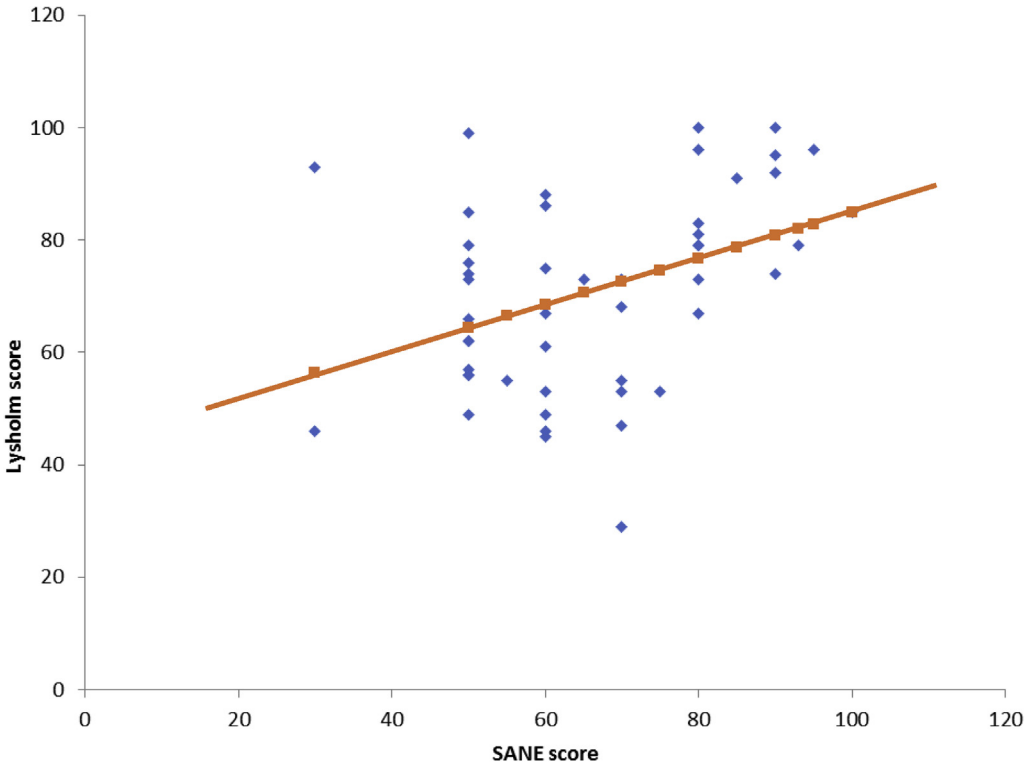

Figure 1. Data plots of SANE and Lysholm scores. $r^2 = 0.15$, $P = .005$, intercept = 44.08.

strength of involved knee. The LSI was better correlated to SANE score than Lysholm score. For Lysholm score, the strongest correlation was found between Lysholm score and quadriceps strength of involved knee. Overall, SANE score showed stronger correlation to the measured variables as shown in Tables 1 and 2.

The results of past studies showed a stronger correlation between SANE score and other subjective rating scales than the results of our investigation [14-16]. Winterstein et al suggested based on the results of their investigation that moderate to high correlation was found between SANE and International Knee Documentation Committee score with Pearson coefficient between 0.65-0.83 [16]. The investigation done by Bradbury et al observed correlation between SANE score and KOS being 0.85-0.88 [14]. Correlation coefficient seen between SANE score and Lysholm score in our study was weaker. This might be explained by the ages of the subjects in each of those studies. Out investigation included older population who underwent TKA. Also, different rating scales used in the study likely affected the results. One can argue that using a different rating score would be more appropriate in assessing TKA patients. However, it has been used in clinical settings and past literature suggests that Lysholm score is a reliable and valid tool to be used for TKA patients [9].

Our study suggests that age of the subjects does not correlate with either SANE score or Lysholm score. This is consistent with the work done by Briggs et al. They studied Lysholm score in healthy adults without history of knee injury or surgery and found that there was no correlation between Lysholm score and age [17].

While limited, there is past literature reporting moderate to strong correlation between SANE score and Lysholm score [11]. Williams et al examined the correlation between SANE score and Lysholm score and found that SANE score correlated well with Lysholm score with the correlation coefficient of 0.58-0.87 [11]. Their results showed stronger correlation between 2 scores than our study. However, their subjects were college-aged subjects who underwent ACL reconstruction where our study included older patients who underwent TKA.

There were several limitations to our study. We only used Lysholm score in our investigation and are not sure whether SANE score correlates with other subjective rating scores such as KOOS, KOS, Western Ontario and McMaster Score, and Lower Extremity Functional Scale, and to what extent if there is a correlation. There was relatively fewer number of subjects in our study than past research studies. Including larger sample might have been more appropriate and this could have affected the results. We only included patients having undergone TKA and we are not sure the results of this current investigation could be generalizable to other population with different knee conditions. Also, scores of rating scales may not reflect patients' satisfaction level. Patient who scored 100 on Lysholm score did not report 100 on SANE score. Subjective rating scales and the level of patients' satisfaction after surgery or injury are areas of interest that needs further research.

Table 2
Correlation between Lysholm score and other measure variables.

Measured variables	*r*	95% CI		*P* value
		Lower	Upper	
Age	0.028	−0.25	0.31	.42
Height (cm)	−0.10	−0.37	0.18	.24
Weight (kg)	0.016	−0.26	0.29	.45
Time from surgery (wk)	0.27	−0.012	0.51	.02[a]
INV (kgf)	0.39	0.12	0.60	.002[a]
Non-INV (kgf)	0.20	−0.086	0.45	.08
LSI (%)	0.34	0.066	0.56	.008[a]

CI, confidence interval; INV, isometric quadriceps strength of involved knee in kgf.
[a] Statistically significant correlation to Lysholm score (*P* is significant at <.05).

Conclusions

In conclusion, SANE and Lysholm scores showed relatively weak, even though correlation was statistically significant, correlation in patients who underwent primary TKA. SANE score also showed better correlation to other measured variables including time from surgery, isometric quadriceps strength of involved knee, and LSI than Lysholm score. SANE score could be used as an alternative method to assess post-operative outcomes of TKA patients to Lysholm score. However, it is unsure whether SANE score could be used in place of Lysholm score in those population. Even though this was not the primary purpose of this study, both SANE score and Lysholm score showed the strongest correlation to isometric strength of quadriceps muscle in involved knee followed by LSI. This may indicate that using both subjective and objective assessment tools is more appropriate in evaluating patients. Further research is needed to better understand correlations among available subjective rating scales and their use in accurately assessing patients with different injuries.

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