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SHOULDER

The Degree of Shoulder Involvement in Sports (DOSIS) scale is a valid and responsive instrumentation for shoulder assessment in patients after surgery for anterior instability

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Abstract
Purpose The purpose of this study was to evaluate validity and responsiveness of the Degree of Shoulder Involvement in Sport (DOSIS) scale.
Methods A web-based survey was developed to test the construct validity of the DOSIS scale. Fifty-three patients with a median age of 33 years (range 17–59) were included in the study. Convergent validity was evaluated by external correlation (Spearman's rank correlation coefficient, *r*) of the DOSIS with the Brophy–Marx and Tegner activity scales, the Western Ontario shoulder instability index (WOSI), the Simple Shoulder Test (SST), and the Short-Form 36 (SF-36). Responsiveness was analysed by relative efficiency calculation of the DOSIS versus the Brophy–Marx and Tegner activity scales.
Results The DOSIS showed strong correlation with the Brophy–Marx and Tegner activity scales, a moderate correlation with the WOSI and SST scores, and a moderate correlation with the physical functioning, role physical and role emotional subscores of the SF-36. The distribution of the DOSIS scores had no serious ceiling or floor effects. The DOSIS demonstrated lesser responsiveness when compared to the Brophy–Marx and Tegner activity scales.
Conclusion The DOSIS showed an adequate validity and responsiveness. The clinical relevance of this study is that the DOSIS scale can be used for sport-specific shoulder assessment in patients after surgery for anterior instability.
Level of evidence III.

Keywords DOSIS scale · Tegner activity scale · Athletes · Shoulder instability · Validity · Responsiveness

Introduction

Patient-reported outcome measures (PROMs) have become an important component of determining patient outcomes after shoulder sports-related injuries. An important component of PROMs is the activity level of a patient, which is in effect a functional measure of musculoskeletal health. Although a large number of valid tools are available to measure the activity level in the general population, these tools can be less than ideal for the assessment of athletes [4]. The results of shoulder surgery in an athlete cannot be judged only according to the criteria used for nonathletes. For athletes affected by recurrent anterior shoulder instability, the main outcomes of treatment are the ability and time to return to play and to return to their previous level of function [19]. Other parameters such as ability to perform activities of daily life are generally less affected by shoulder problems. It is important to be able to quantify an athlete's sport activity so it can be evaluated within a context of other patients for both research needs and for comparison with population normative data when treating injuries. Moreover, treatment outcomes in terms of sport activity should match

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preoperative expectations of athletes, to improve overall patients' satisfaction [19].

The Tegner activity scale [17] is one of the most commonly used scales designed to quantify a patient's activity level. This scale ranks sports activities into subgroups that entail similar involvement of a knee affected by an anterior cruciate ligament lesion. Although being designed for the knee, the Tegner activity scale has been used to assess patients after shoulder surgery for recurrent anterior instability [14–16]. However, its use for the shoulder raises some obvious concerns. Since the original scale is weighted for the knee, it means, for example, that soccer is scored higher than swimming.

The Brophy–Marx activity scale for shoulder [5] evaluates a patient's overall shoulder activity level based on the frequency with which he or she completes five common activities of the shoulder, such as carrying objects as heavy as, or heavier than, a bag of groceries by hand, handling objects overhead, and participating in contact and overhead sports. However, it does not specify particular sports.

The Degree of Shoulder Involvement in Sport (DOSIS) scale is a modified Tegner activity scale weighted for the shoulder, developed by the Sport Committee of SIGASCOT (Società Italiana del Ginocchio Artroscopia Sport Cartilagine Tecnologie Ortopediche) to help the physician classify patients on the basis of their sport activity based on the specific involvement of the shoulder in that sport [4]. The psychometric features of the DOSIS scale has been measured and compared with the psychometric features of the original Tegner activity scale. No other studies have evaluated the validity of measurements obtained with the DOSIS scale. Evidence for construct validity of patient-reported outcome measures must be accumulated by hypothesized patterns of associations with other validated instruments to measure relatively similar constructs (for positive correlations) [8]. Other generic and shoulder-specific questionnaires incorporate an activity scale within the score. The aim of this study was to evaluate psychometric features of the DOSIS scale by testing convergent validity and responsiveness of the DOSIS scale.

Materials and methods

Subjects and procedures for assessment of validity

This study includes human subjects. However, according to Italian law, no ethical approval was mandatory for this study. The study has been performed in accordance with the ethical standards in the 1964 Declaration of Helsinki and has been carried out in accordance with relevant regulations of the Italian National Healthcare System.

The study was conducted as a questionnaire-based survey in an independent population of patients who were affected by recurrent anterior shoulder instability and who underwent an arthroscopic Bankart repair or an open Bristow-Latarjet procedure. An open-source platform (https://drive.google.com) was configured to collect the responses anonymously. The digital patient database of the Orthopaedic and Traumatology Department was retrospectively reviewed to identify all of the patients surgically treated for recurrent anterior shoulder instability. Patients younger than 16 were not included, nor were patients whose first language was not Italian. A total of 63 patients treated between January 2005 and December 2015 were enrolled in this study. All patients gave their informed consent upon receiving complete information on the study. The patients were contacted by phone to present the research and to invite them to participate in the study. The subjects were required to fill the following self-reported outcome measures online: the DOSIS scale, the Brophy–Marx [5] and Tegner [17] activity scales, and the validated Italian versions of the Western Ontario shoulder instability index (WOSI) [6], the Simple Shoulder Test (SST) [12] and the Short-Form 36 (SF-36) [1]. The patients were asked to answer the DOSIS, Marx and Tegner scales retrospectively by recalling the period of time before the onset of shoulder instability (baseline scores) and at follow-up examination (postoperative scores).

DOSIS analysis plan

Convergent validity was defined as the extent to which the DOSIS correlated with measures consistent with its theoretically derived construct. Spearman's rank correlation coefficient (r) was used to assess the association between the DOSIS and the Brophy–Marx and Tegner activity scales, the validated Italian versions of the WOSI, the SST and different SF-36 subscales. It was hypothesized that: (1) the correlation between the DOSIS and the Brophy–Marx and Tegner activity scales would be moderate to high; (2) the correlations between the DOSIS and the WOSI, the SST function would be moderate to high; and (3) the correlations between the DOSIS and the subscales of physical functioning and role physical of the SF-36 would be moderate to high. Spearman's coefficient was read as follows: strong correlation for values >0.50; moderate correlation for values between 0.35 and 0.50; and weak correlation for values <0.35 [10].

The DOSIS scale [4] is a patient self-administered scale used to score a sport activity based on 3 parameters: (1) the type of sport classified (no or minimal demand, moderate demand, high demand), (2) the frequency at which the sport was played (occasionally, at least twice a week), and (3) the level at which the sport was played (recreational, low level

of competition, high level of competition) ("Appendices 1, 2"). According to these parameters, the DOSIS scale is calculated by the researchers using an allocation table ("Appendix 3"). Patients then obtain a score from 0 (no sport) to 10 (high-demand sport played by national-/international-level or professional athlete).

The Brophy–Marx shoulder activity scale [5] evaluates patients' overall shoulder activity level based on the frequency with which they participated in 5 specific activities of the shoulder at their most active state over the previous 12 months, which generates a numeric score ranging from 0 (least active) to 20 (most active).

The Tegner activity scale [17] is a one-item instrument that assesses activity levels for sports and occupational activities. It evaluates patients' level of work and sports activity on an 11-level scale, with higher scores representing higher levels of physical activity.

The WOSI is a disease-specific PROM designed to be used as a primary outcome measure in clinical trials that evaluated treatments for patients with shoulder instability [6]. The 21-item questionnaire consists of four domains, referring to physical symptoms, sport/recreation/work function, lifestyle function, and emotional function. Originally, responses range from no complaints (0) to severe complaints (10).

The SST consists of 12 questions about physical function with dichotomous (yes or no) response options. The scores range from 0 (worst) to 100 (best) and are reported as the percentage of items that a person answers in the affirmative [12].

The SF-36 consists of 36 questions on the general health status of patients [1] with eight health concept subscales (physical function, role physical, bodily pain, general health, vitality, social function, role emotional, and mental health), which are then aggregated into two main scores. The physical and mental component summary scores represent weighted composite scores derived from the eight health concept scales. Each subscale score can vary from 0 to 100, with higher scores representing more desirable health states.

Responsiveness is defined as the ability of a scale to detect clinically important changes over time [18]. For the DOSIS to be responsive, it needs to demonstrate a lack of floor or ceiling effects, which were considered to be present when more than 15% of the patients received either the lowest or highest possible scores [18]. This was followed by a relative efficiency calculation to analyse responsiveness of the DOSIS versus the Brophy–Marx and Tegner activity scales according to Barr et al. [3]. Using this method, a score of greater than 1 would indicate the DOSIS was more responsive than the Brophy–Marx and Tegner activity scales and a score less than 1 would indicate the DOSIS to be less responsive than the Brophy–Marx and Tegner activity scales. The standardized effect size and standardized response mean were also evaluated. The effect size is the difference between the mean baseline scores and posttreatment scores on the measure, divided by the standard deviation of baseline scores. The standardized response mean is equal to the mean change in score divided by the standard deviation of the change scores. The standardized effect size values >0.2, >0.5, and >0.8 were considered small, moderate, and large, respectively [10].

Statistical analysis

There is no agreed optimum method for determining an appropriate sample size to evaluate aspects of validity for patient-reported outcome measures. However, 50 patients have been advocated as the minimum requirement [13, 18]. Therefore, it was deemed that the planned case series of 63 patients could provide sufficient power to investigate important aspects of validity for the DOSIS scale and allow for 20% loss. The DOSIS scale was considered a continuous variable. Descriptive statistics was used to report patients' demographics as mean and standard deviation (SD). The Kolmogorov–Smirnov test was used to assess the assumption of normality, showing a distribution of the values distant from a normal distribution. Therefore, the results are described using median and respective interquartile range (percentile 25–percentile 75). A nonparametric analysis of the data (Spearman's rank correlation coefficient and Wilcoxon sign rank test) was therefore performed. A $p < 0.05$ was considered statistically significant. Data were entered into a Microsoft Excel spreadsheet (Microsoft Corporation, Redmond WA) and analysed using PSPP software (Free Software Foundation, Inc.) for windows.

Results

A total of 53 patients (84%) completed the questionnaires. The demographic data of the cohort are listed in Table 1.

Table 1 Demographics of study cohorts

Patients (*n*)	53
Gender	
Male	40
Female	13
Side	
Right	31
Left	22
Age (y)	
Mean (SD)	34.5 (9.7)
Range	17–59
Follow-up (*m*)	
Mean (SD)	59.1 (37.9)
Range	9–156

Table 2 Absolute values of all scores

Score	Median (interquartile range percentile 25–percentile 75)
DOSIS	3 (1–7.5)
BROPHY–MARX	1 (6–14)
TEGNER	6 (4–7)
WOSI	2.95 (1.81–5.24)
SST	9.1 (8.2–10)
SF-36	
Physical functioning	100 (95–100)
Pain	90 (67.5–100)
Vitality	60 (55–70)
Role emotional	100 (66.7–100)
Role physical	100 (75–100)
Social functioning	75 (62.5–87.5)
Mental health	76 (64–80)
General health	75 (65–85)

DOSIS Degree of Shoulder Involvement in Sport; *WOSI* Western Ontario shoulder instability index; *SST* Simple Shoulder Test; *SF*-36 Short-Form 36

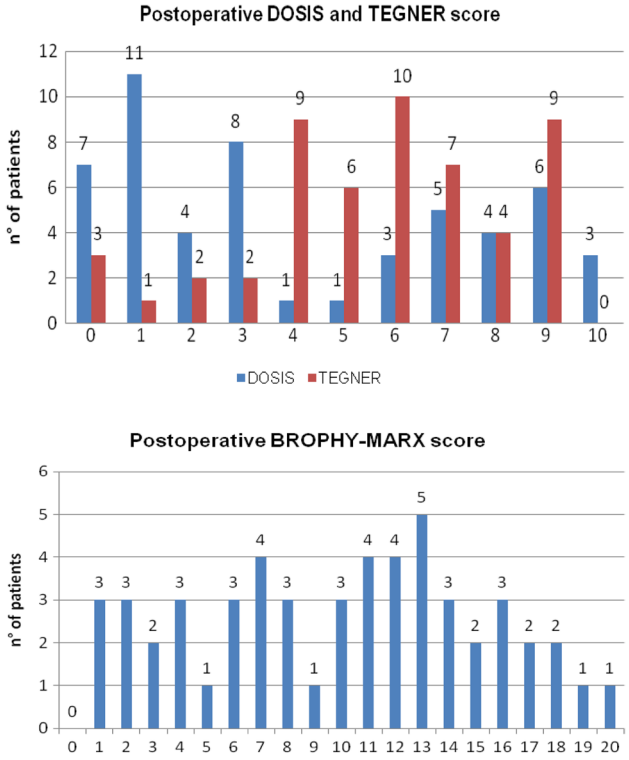
There were no missing data for any DOSIS item. Table 2 reports absolute values of all postoperative scores.

The DOSIS showed strong correlation with the Brophy–Marx and Tegner activity scales, a moderate correlation with the WOSI and SST scores, and a moderate correlation with the physical functioning, role physical and role emotional subscores of the SF-36 (Table 3).

Table 3 Correlation between the DOSIS and the Brophy–Marx and Tegner activity scales, the WOSI, the SST and different SF-36 subscales

Score	Correlation with DOSIS	*P*
Brophy–Marx	0.50	0.0002
Tegner	0.65	<0.0001
WOSI	−0.41	0.0032
SST	0.48	0.0002
SF-36		
Physical functioning	0.39	0.0048
Pain	0.25	n.s.
Vitality	0.24	n.s.
Role emotional	0.48	0.0031
Role physical	0.38	0.0061
Social functioning	0.15	n.s.
Mental health	0.02	n.s.
General health	0.25	n.s.

DOSIS Degree of Shoulder Involvement in Sport; *WOSI* Western Ontario shoulder instability index; *SST* Simple Shoulder Test; *SF*-36 Short-Form 36



Figs. 1 and 2 Floor and ceiling effect and score distribution are showed graphically by reporting the number of outcomes for each score

The distribution of the DOSIS scale had no serious ceiling or floor effects. The distribution of the Brophy–Marx and Tegner activity scales was computed: neither of the 2 scales showed a floor or ceiling effect (Figs. 1 and 2). Table 4 shows the relative efficiency of the DOSIS in relation to the Brophy–Marx and Tegner activity scales. The DOSIS demonstrated lesser responsiveness when compared to the Brophy–Marx and Tegner activity scales. The standardized effect size was 0.53, and the standardized response mean was 0.58.

Discussion

The most important finding of the present study was that the DOSIS scale showed acceptable psychometric properties in patients after shoulder surgery for recurrent anterior instability.

The DOSIS was published in 2015 and advocated by the authors as a modified Tegner activity scale weighted for the shoulder [4]. There have been no subsequent validation studies. Therefore, this study represents the first paper to investigate aspects of validity, outside of the developing centre.

Validity evaluation usually consists of aspects of criterion validity, represented by the ability of the proposed

Table 4 Relative efficiency of the baseline/postoperative DOSIS

DOSIS: Z statistic derived from	Tegner: Z statistic derived from	Brophy–Marx: Z statistic derived from	Relative efficiency	Relative efficiency
From Wilcoxon sign rank test	From Wilcoxon sign rank test	From Wilcoxon sign rank test	DOSIS versus Tegner	DOSIS versus Brophy–Marx
−3.6	−4.0	−3.9	$(-3.6/-4.0)^2 = 0.8$	$(-3.6/-3.9)^2 = 0.9$

DOSIS Degree of Shoulder Involvement in Sport

score to agree with a gold-standard measure, and content validity, assessed by an analysis of the floor/ceiling effect and the ability of a scale to recognize differences between preoperative and postoperative status (responsiveness).

Aspects of convergent validity and responsiveness of the DOSIS scale were investigated, using a sample of 53 patients. Criterion validity was assessed by comparing the DOSIS scale with selected outcome measures. The Brophy–Marx [5] activity scale, the WOSI [6, 11], the SST [9] and the Short-Form 36 (SF-36) [7] have been proven to be valid outcome tools for shoulder disorders. The Tegner activity scale [17] is one of the most commonly used scales designed specifically to assess activity levels for sports and occupational activities. Although designed for the knee, the Tegner activity scale has been used for the shoulder [14–16]. Despite some low correlation, all of the a priori hypotheses were mainly confirmed in our sample. This finding is supported by the statistically significant correlations between the DOSIS and the Brophy–Marx and Tegner activity scales, and the WOSI and SST scores, as well as by the higher correlations between the SF-36 subscales assessing related constructs (convergent validity) and the lower correlations between the subscales measuring different constructs (divergent validity).

The DOSIS showed only moderate correlation with the WOSI and SST scores. These results do provide some evidence that the DOSIS is measuring similar aspects of outcome when compared to the WOSI and SST. However, this element of validity should be interpreted with caution as the WOSI and SST scores measure more generic physical function, as opposed to the alternative construct of sports activity, measured by the DOSIS. The DOSIS scale had a greater correlation with the Tegner knee activity scale than with other shoulder instruments, suggesting that the other instruments do not accurately assess sports activity.

The moderate correlation of the DOSIS with the physical functioning and physical role functioning subscores of the SF-36 can be explained by the dominance of lower extremity items. Pain as measured with the SF-36 pain scale was not correlated with the DOSIS. Blonna et al. [4] found a poor correlation between the DOSIS scale and "pain during sport activity". The reasons for this poor correlation could be that athletes affected by shoulder instability are usually not significantly impaired by pain at follow-up.

A higher-than-expected correlation was found between the DOSIS scale and the role emotional subscore of the SF-36 (limitations in usual role activities because of emotional problems). However, psychological factors have been shown to be associated with returning to sport following athletic injury [2].

In accordance with the original development article, the DOSIS scale had a different distribution of scores compared with the original Tegner activity scale. One possible explanation is that the DOSIS scale classifies patients according to specific involvement of the shoulder in their sport activity and has distinct features compared with the original Tegner activity scale, providing a different distribution of scores. The postoperative DOSIS scale was shown to have higher percentage of reported responses at the bottom (floor) of the possible score when compared to the Brophy–Marx and Tegner activity scales although neither score had significant floor or ceiling effects. This may represent the more specific outcome measure provided by the DOSIS scale, since it is reasonable to state that the percentage to return to sports after surgery for shoulder instability is different between runners and swimmers.

Authors do not have a direct answer as to why the DOSIS scale would be less responsive than the Brophy–Marx and Tegner outcome measure, though it is possible that this may be representative of the greater floor effect seen within the postoperative DOSIS scale.

The standardized effect size and the standardized response mean were only moderate (>0.5), compared with the large (>0.8) effect size reported in the original development article. This result is most likely the consequence of the small sample size.

This study has some limitations that need to be discussed. Due to the small sample size, generalizations to other samples with shoulder disorders may be affected. As the DOSIS scale has been tested in patients affected only by shoulder instability and not by other shoulder conditions, the psychometric features measured in this study cannot be extrapolated to patients with degenerative disorders of the shoulder.

Another limitation is that the data were collected in a retrospective manner in part, since we asked patients to recall their sport activity levels (baseline and preoperative DOSIS). The relevancy of this limitation was tested in the original

validation study by comparing the test–retest reliability of the DOSIS scale measured retrospectively and the DOSIS scale measured at follow-up (postoperative DOSIS). No significant differences were found, suggesting that the DOSIS scale is reliable even when it is measured retrospectively [4].

The clinical relevance of this study is that the DOSIS scale can be used for sport-specific shoulder assessment in patients after surgery for anterior instability.

Conclusion

This study provides further evidence regarding the validity of a newly developed measurement tool. Overall, the DOSIS scale demonstrated evidence of convergent validity with the Brophy–Marx and Tegner activity scales, although these tools do measure slightly different constructs.

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Compliance with ethical standards

Conflict of interest All the authors declare that they have no conflict of interest related to the topic of this article.

Funding No funding was received for this study.

Ethical approval According to Italian law, no ethical approval was mandatory for this study.

Informed consent All patients gave their informed consent upon receiving complete information on the study.

Appendix 1: The Degree of Shoulder Involvement in Sports (DOSIS) scale [4]

The DOSIS scale is calculated for the most important or predominant sport. The information regarding dominant and nondominant arm was used to classify the sport according to "Appendix 2".

1. What sports did you play before the onset of your shoulder problem? List the sports below and indicate which was the most important/predominant for you		
List of sports	Most important/predominant	
1)	Yes	No
2)	Yes	No
3)	Yes	No
…	Yes	No
2. How frequently did you participate in sports?[a]		
Occasionally		
≥2 times a week, most of the weeks of the year		
3. What level of sport did you play?		
Recreational		
Low level of competition (regional, local)		
High level of competition (national or international or professional)		
4. Which was your dominant arm during your sports activities?		

[a] For seasonal sports, the frequency during the season is considered

Appendix 2: Classification of sports according to demand on the upper extremity [4]

No or minimal demand	Moderate demand	High demand
Jogging	Soccer	Swimming
Road cycling	Bowling, dominant	Rugby
Horseback riding	Nordic skiing	American football
Bowling, nondominant	Rowing	Martial arts
Mountain biking	Motocross	Gymnastics
Alpine skiing	Golfing	Volleyball, dominant
Nordic walking	Bodybuilding	Tennis/squash, dominant
Hiking	Track and field (running and jumping)	Water polo
	Track and field (throwing), nondominant	Baseball, dominant
	Kayaking	Baseball (pitcher)
	Dancing	Soccer (goal keeper)
	Basketball	Rock climbing
	Volleyball, nondominant	Track and field (throwing), dominant
	Tennis/squash, nondominant	
	Baseball, nondominant	

The list of sports included in each group is an open list. Other sports not listed here can be added by using the instructions in the original validation studyAppendix 3: Allocation table [4]

Using this table, the researcher scores the patient according to type of sport, frequency in which the sport is played, and level of the sport. For example, an occasional tennis player (high-demand sport), with involvement of the dominant arm, is assigned a DOSIS scale of 6 points (in grey)

		Type of sport			Frequency of playing the sport		Level of sport		
DOSIS SCALE	No sport	No/minimal demand	Moderate demand	High demand	Occasionally	≥ 2 times per week	Recreational	Lower level of competition: Local/Regional divisions	Higher level of competition: National or International level or Professional athlete
10				*					*
9				*				*	
8				*		*	*		
8			*						*
7			*					*	
6				*	*		*		
6		*							*
5		*						*	
4			*			*	*		
3			*		*		*		
2		*				*	*		
1		*			*		*		
0	*								

References

1. Apolone G, Mosconi P (1998) The Italian health survey: translation, validation and norming. J Clin Epidemiol 51:1025–1036
2. Ardern CL, Taylor NF, Feller JA, Webster KE (2013) A systematic review of the psychological factors associated with returning to sport following injury. Br J Sports Med 47:1120–1126
3. Barr S, Bellamy N, Buchanan WW, Chalmers A, Ford PM, Kean WF, Kraag GR, Gerecz-Simon E, Campbell J (1994) A comparative study of signal versus aggregate methods of outcome measurement based on the WOMAC Osteoarthritis Index. Western Ontario and McMaster Universities Osteoarthritis Index. J Rheumatol 21:2106–2112
4. Blonna D, Bellato E, Bonasia DE, Canata GL, Rossi R, Marmotti A, Castoldi F (2015) Design and testing of the Degree of Shoulder Involvement in Sports (DOSIS) scale. Am J Sports Med 43(10):2423–2430
5. Brophy RH, Beauvais RL, Jones EC, Cordasco FA, Marx RG (2005) Measurement of shoulder activity level. Clin Orthop Relat Res 439:101–108
6. Cacchio A, Paoloni M, Griffin SH, Rosa F, Properzi G, Padua L, Padua R, Carnelli F, Calvisi V, Santilli V (2012) Cross-cultural adaptation and measurement properties of an Italian version of the Western Ontario Shoulder Instability Index (WOSI). J Orthop Sports Phys Ther 42(6):559–567
7. Dawson J, Fitzpatrick R, Carr A (1996) Questionnaire on the perceptions of patients about shoulder surgery. J Bone Joint Surg Br 78(4):593–600
8. Froberg DG, Kane RL (1989) Methodology for measuring healthstate preferences—II: scaling methods. J Clin Epidemiol 42:459–471
9. Godfrey J, Hamman R, Lowenstein S, Briggs K, Kocher M (2007) Reliability, validity, and responsiveness of the simple shoulder test: psychometric properties by age and injury type. J Shoulder Elbow Surg 16(3):260–267
10. Husted JA, Cook RJ, Farewell VT, Gladman DD (2000) Methods for assessing responsiveness: a critical review and recommendations. J Clin Epidemiol 53:459–468
11. Kirkley A, Griffin S, McLintock H, Ng L (1998) The development and evaluation of a disease-specific quality of life measurement tool for shoulder instability. The Western Ontario Shoulder Instability Index (WOSI). Am J Sports Med 26(6):764–772
12. Marchese C, Cristalli G, Pichi B, Manciocco V, Mercante G, Pellini R, Marchesi P, Sperduti I, Ruscito P, Spriano G (2012) Italian cross-cultural adaptation and validation of three different scales for the evaluation of shoulder pain and dysfunction after neck dissection: University of California - Los Angeles (UCLA) Shoulder Scale, Shoulder Pain and Disability Index (SPADI) and Simple Shoulder Test (SST). Acta Otorhinolaryngol Ital 32(1):12–17
13. Naal FD, Impellizzeri FM, Rippstein PF (2010) Which are the most frequently used outcome instruments in studies on total ankle arthroplasty? Clin Orthop Relat Res 468:815–826
14. Owens BD, DeBerardino TM, Nelson BJ, Thurman J, Cameron KL, Taylor DC, Uhorchak JM, Arciero RA (2009) Long-term follow-up of acute arthroscopic Bankart repair for initial anterior shoulder dislocations in young athletes. Am J Sports Med 37(4):669–673
15. Owens BD, Cameron KL, Peck KY, DeBerardino TM, Nelson BJ, Taylor DC, Tenuta J, Svoboda SJ (2015) Arthroscopic versus open stabilization for anterior shoulder subluxations. Orthop J Sports Med 3(1):2325967115571084
16. Plath JE, Feucht MJ, Saier T, Minzlaff P, Seppel G, Braun S, Imhoff AB (2015) Sporting activity after arthroscopic bankart repair for chronic glenohumeral instability. Arthroscopy 31(10):1996–2003
17. Tegner Y, Lysholm J (1985) Rating systems in the evaluation of knee ligament injuries. Clin Orthop Relat Res 198:43–49

18. Terwee CB, Bot SD, de Boer MR, van der Windt DA, Knol DL, Dekker J, Bouter LM, de Vet HC (2007) Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 60:34–42

19. Warth RJ, Briggs KK, Dornan GJ, Horan MP, Millett PJ (2013) Patient expectations before arthroscopic shoulder surgery: correlation with patients' reasons for seeking treatment. J Shoulder Elbow Surg 22(12):1676–1681