



Available online at

SciVerse ScienceDirect
www.sciencedirect.com

Elsevier Masson France

EM|consulte
www.em-consulte.com/en

Orthopaedics
& Traumatology
Surgery & Research

ORIGINAL ARTICLE

Anterior shoulder instability arthroscopic treatment outcomes measures: The WOSI correlates with the Walch-Duplay score

F. Khiami^{a,*}, E. Sariali^a, M. Rosenheim^b, P. Hardy^c

^a Department of Orthopaedic Surgery, La Pitié-Salpêtrière Hospital, 75013 Paris, France

^b Department of Public Health, La Pitié-Salpêtrière Hospital, 75013 Paris, France

^c Department of Orthopaedic Surgery, Ambroise-Paré Hospital, 92100 Boulogne-Billancourt, France

Accepted: 13 September 2011

KEYWORDS

Self-administrated questionnaire;
Western Ontario Shoulder Stability Index;
WOSI;
Walch-Duplay score;
Shoulder instability;
Arthroscopy;
Patient reported outcomes measures

Summary

Purpose: New techniques and instrumentation for arthroscopic management of shoulder instability require accurate measurement tools to investigate possible clinical improvements. The aim of the study was to assess the self-administrated Western Ontario Shoulder Instability Index (WOSI), which is a subjective quality of life measurement tool specific to shoulder instability, and also to validate this score by comparison with the Walch-Duplay score, which is the gold standard score used in Europe. These two scores had never been compared.

Methods: Forty-eight patients, who underwent arthroscopic surgery for anterior shoulder instability, were evaluated using the WOSI and the Walch-Duplay score at 42.7 months' follow-up. The correlation between these two scores was investigated.

Results: The WOSI significantly correlated with the Walch-Duplay score (global score, and specific items of pain, stability, return to activity). The standard correlation coefficient was 0.8 and the Lin correlation coefficient was 0.65. The WOSI did not correlate with the mobility item of the Walch-Duplay score.

Discussion: The WOSI was found to correlate with the Walch-Duplay score. However, the WOSI was more sensitive than the Walch-Duplay score for the assessment of patient satisfaction. It is likely that both self-administrated questionnaires and physical examinations are complementary for an accurate investigation of the functional objective and subjective outcome after shoulder stabilization surgery.

Type of study: Retrospective. Level IV.

© 2011 Elsevier Masson SAS. All rights reserved.

* Corresponding author. Tel.: +33 1 42 17 70 49; fax: +33 1 42 17 74 15.
E-mail address: frederic.khiami@psl.aphp.fr (F. Khiami).

Introduction

The risk of traumatic dislocation of the shoulder has been estimated at 1–2% in a lifetime [1–3]. The growing interest for this pathology and the improvement of arthroscopic techniques stimulated the multiplication of innovative procedures. Slight changes in the techniques and instrumentation require accurate evaluation tools in order to demonstrate clinical improvements [4].

The European Society of Shoulder and Elbow Surgery recommended using the Walch-Duplay score [5] which was inspired by the Rowe rating scale [6] and takes into account both subjective and objective data (stability, pain, sport level recovery, mobility) to assess clinical outcome. However, the observer's interpretation remains a source of potential bias, since it is not self-administrated [7]. Indeed, many authors [8,9] proved that subjective evaluation using self-administrated questionnaire was mandatory to assess patient satisfaction.

The self-administrated Western Ontario Shoulder Instability Index (WOSI) is a quality of life measurement tool specific to shoulder instability. It was developed by A. Kirlkey in 1998 [10] and is widely used [11–13]. The 21 most informative questions out of the 300 that were tested have been kept in the definitive version. The WOSI was successfully compared with the Rowe rating scale, the UCLA shoulder rating scale, the Constant score, the SF-12, the Disability of the Arm, Shoulder and Hand scale (DASH), and the American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form. The Walch-Duplay score is the most currently used score in Europe for the assessment of the patient undergoing shoulder stabilization surgery [14–16]. However, it is not a self-administrated questionnaire. To our best knowledge, no series investigated the relationships between the WOSI and the Walch-Duplay score. The aim of this study was to compare the WOSI and the Walch-Duplay score in a group of patients undergoing an arthroscopic surgery treatment for anterior shoulder instability. The correlation between these two scores was analyzed. The results may help optimize the functional evaluation of patients in daily surgical activity, by including subjective self-evaluation in objective scores.

Methods

Cohort description

Forty-eight consecutive patients (36 men and 12 women), who had arthroscopic surgery for anterior shoulder instability between May 1997 and December 2000, were reviewed retrospectively. The number of patients available for follow-up was 79% (37 patients). The average age at the time of surgery was 30.7 years (16 to 57). The operated shoulder was on the dominant side in 41 cases. Thirty-five patients practiced a sport, 25 of them throwing. The medical history began with an effective shoulder dislocation in 24 cases, subluxation and painful unstable shoulders in 24 patients. Thirty-three patients had a Hill-Sachs lesion, including 16 cases that had a lesion depth above 15% of the humeral head diameter. There was a bony lesion of the glenoid fossa in 28

cases. The average duration between the initial event and the surgical treatment was 51.8 months (range 0 to 288).

Methods

The patients were reviewed by an independent observer. The average follow-up was 42.7 ± 24 months (range 27 to 71). The Walch-Duplay score (0 to 100 points) and the WOSI [17] (0 to 2100 points) (Appendix A) were recorded at the last follow-up. The Walch-Duplay score is composed of four items: activity, stability, pain and mobility. According to the Walch-Duplay score, results were classified as excellent (91 and 100 points), good (76 and 90 points), fair (51–75 points) or poor (under 50). The WOSI consists of four sub-scales: physical symptoms and pain; sport, recreation, and work function; lifestyle and social functioning; and emotional well-being. Twenty-one items are scored using a visual analogue scale measuring 100 mm horizontally placed under each question. This questionnaire requires a minimum of explanations to the patient for the filling of scales. The best possible score indicating the highest possible shoulder-related quality of life is 0 and the worst possible score indicating the poorest quality of life is 2100.

There were four recurrent dislocations and six recurrent subluxations. The average time between surgery and recurrence was $17.7 \pm$ months (4 to 36). Four patients underwent a surgical revision using an open conventional technique. The Walch-Duplay score and the WOSI were not recorded at the last follow-up for these patients. The average Walch-Duplay score was 74.8 (5 to 100). The average WOSI was 335 (7 to 1338). At the last follow-up, 37 patients (77%) declared being satisfied with surgery.

Statistical analysis

The statistical analysis was performed at the biostatistics department of Paris VI University. For quantitative parameters, the correlation between Walch-Duplay score and the WOSI was investigated using the standard correlation test (linear regression), the Lin concordance method [18] and the Bland and Altman method for assessing agreement between two methods of clinical measurement [19,20]. Concerning qualitative parameters, the non-parametric Kruskal-Wallis test was used in order to compare the WOSI between the four groups corresponding to the Walch-Duplay stratification (excellent, good, fair, poor). A *P*-value of 0.05 was used for significance.

Results

The statistical analysis of correlation of these two scores is multiple. The values of WOSI, expressed in % by the formula $[(1 - \text{WOSI}/2100) * 100]$, were correlated in the values of Walch-Duplay with a correlation coefficient of 0.79 ($r^2 = 0.63$; 0.41 to 0.78). On the Fig. 1 are indicated the values of the WOSI and Walch-Duplay scores and the identity line (WOSI = Duplay). The correlation line should get closer to this identity line if the Walch-Duplay and WOSI scores were two different instruments to measure the same quantity. The concordance correlation coefficient of Lin Li [18]

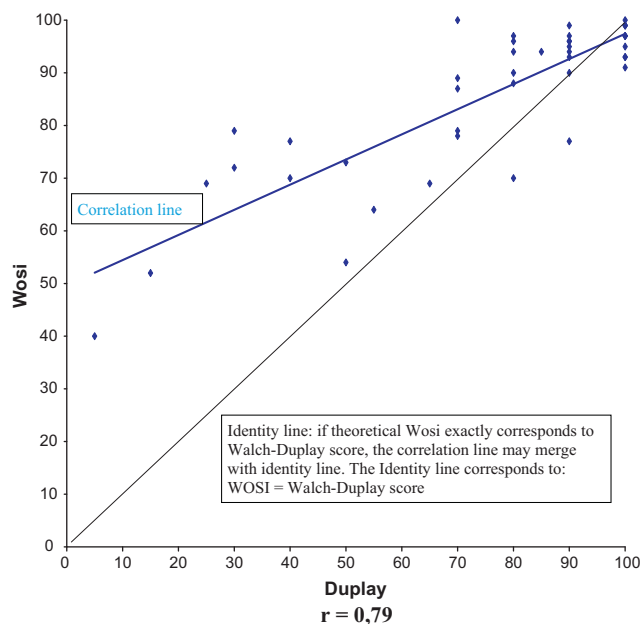


Figure 1 Statistical correlations between the self-administrated Western Ontario Shoulder Instability Index (WOSI) and each item of the stratified Walch-Duplay score. The correlation line should get closer to this identity line if the Walch-Duplay and WOSI were two different instruments to measure the same quantity.

was 0.648 (0.505–0.792 $P < 0.0001$) and was statistically different from 0. It thus indicates that there was a certain concordance between both measures, but not total, in which case would be close to 1.

The method of Bland and Altman [20] consists in comparing for every measure the difference between the obtained values and the average of two values. If two values are identical, the graph of values differences according to the average of the values is a line parallel to the x-axis and the value on the y-axis is 0 (Fig. 2). As regards the WOSI and Walch-Duplay scores, the average of the differences was 9.7 ± 32 . We can consider that indistinctness tended to be small. The intraclass correlation coefficient was 0.65 (0.389–0.911) which can be considered as good agreement Table 1 [20].

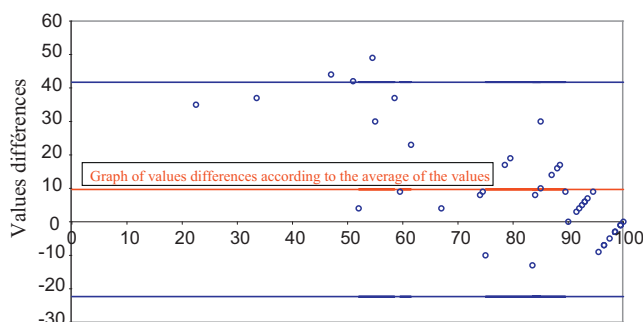


Figure 2 Bland et Altman graphic. As regards the Western Ontario Shoulder Instability Index (WOSI) and Walch-Duplay scores, the average of the differences is 9.7. We can consider that indistinctness tends to be small.

Table 1 Standard intraclass correlation coefficient interpretation.

Excellent	> 0.81
Good	0.80–0.61
Fair	0.60–0.41
Poor	< 0.40

Table 2 Global Walch-Duplay and Western Ontario Shoulder Instability Index (WOSI) scores.

	Duplay	Western Ontario Shoulder Instability Index (WOSI)	
Excellent	11 (25%)	85 ± 66	$P = 0.00023$
Good	16 (37%)	183 ± 162	
Fair	8 (18%)	528 ± 405	
Poor	9 (20%)	740 ± 176	
$N = 44$ (100%)			

The Walch-Duplay score was graded as excellent in 11 cases, good in 16 cases, fair in eight cases, and poor in nine cases. The corresponding WOSI was respectively 85 ± 66 , 183 ± 162 , 528 ± 405 , and 740 ± 176 (Table 2). There was a significant correlation between the Walch-Duplay score stratification and the WOSI ($P < 0.001$). For every specific item of the Walch-Duplay score (stability, pain, mobility and return to activity), the WOSI was calculated for each functional result of these items (Table 3). WOSI significantly correlated with the subjective items of the Walch-Duplay score (stability, pain, and return to activity), but not with the objective item of mobility (Table 3). Subjective evaluation was correlated with the Walch-Duplay score (81 ± 22 in the satisfied group vs 41 ± 20 in the disappointed group) and the WOSI (263 ± 296 in the satisfied group vs 715 ± 336 in the disappointed group) ($P = 0.02$) (Table 4).

Replacing the global value of the WOSI (2100 points) by four identical classes (0–525/526–1050/1051–1575/1576–2100) to verify the correlation with the Walch-Duplay score, which is used with four classes, the value of kappa was 0.19, certainly statistically different from 0, but tenuous (Table 5).

Discussion

Recurrence is not the only indicator for success/failure after arthroscopic shoulder stabilization [12]. While the basic evaluation of satisfaction/disappointment may summarize the proper opinion of the patient, the wide distribution of data in terms of the Walch-Duplay score or the WOSI demonstrates that results are not clear-cut. Therefore, accurate grading systems are necessary to quote the benefits of the surgical procedure precisely. This may particularly be difficult concerning shoulder instability, with the main complaint leading to surgery being subjective. In addition, the accuracy of patients' status grading may particularly be important, since various technical details in the arthroscopic procedure and the instrumentation (limits of dissection and

Table 3 Specific Walch-Duplay score items and the Western Ontario Shoulder Instability Index (WOSI). For every specific item of the Walch-Duplay score (stability, pain, mobility and return to activity), the WOSI was calculated for each functional result of these items.

Duplay		Western Ontario Shoulder Instability Index (WOSI)	
Stability	Excellent	143 ± 137	<i>P</i> = 0.000042
	Good	533 ± 382	
	Fair	732 ± 341	
	Poor	768 ± 305	
Pain	No pain	227 ± 271	<i>P</i> = 0.027
	Pain for extreme mobility	453 ± 377	
	Daily pain	/	
Mobility	Excellent	264 ± 253	<i>P</i> = 0.12
	Good	434 ± 427	
	Fair	534 ± 539	
	Poor	/	
Activities recovery	Excellent	146 ± 160	<i>P</i> = 0.000064
	Good	489 ± 353	
	Fair	736 ± 420	
	Poor	715 ± 230	

reinsertion, choice of anchors, types of suture wires) can dramatically influence the outcomes. Objective evaluation by the surgeon can reveal huge complications of the treatment, such as a neurological deficit and limitation of passive range of motion. However, subjective items are more relevant for assessing the actual benefits of surgery on the initial complaints of instability and pain. In this purpose, the WOSI has been developed as a disease-specific quality of life questionnaire, promoted by A. Kirkley [10]. The WOSI is a rigorously designed and evaluated measurement tool for patients with shoulder instability. It has been shown to be highly reliable, has been validated in this population, and has shown excellent responsiveness in patients with anterior and posterior instability. Since the form is self-administrated, no bias of interpretation by the physician (mainly overestimation of the good results) is theoretically possible. The WOSI shows more sensitivity than the ASES and DASH scales to assess functional results after surgical stabilization of the shoulder [21]. Detractors suggest using the

Table 5 Western Ontario Shoulder Instability Index (WOSI) and Walch-Duplay scores correlation and Kappa interpretation.

Western Ontario Shoulder Instability Index (WOSI)					
Duplay	1	2	3	4	Total
1	2	5	2	0	9
2	1	2	4	1	8
3	0	1	4	11	16
4	0	0	1	10	11
Total	3	8	11	22	44
Kappa = 0.1983 ± 0.0835					
Less than 0			Bad		
0.00–0.20			Tenuous		
0.21–0.40			Poor		
0.41–0.60			Moderate		
0.61–0.80			Good		
0.81–1.00			Virtually perfect		
Kappa interpretation					

WOSI for non-sporty people and amateur sportsmen only [22], since return to the initial sport level, which would be the best outcome measure in athletes, was taken into account in the DASH Outcome Measure, but not in the WOSI.

The benefit of the WOSI is very important and its translation is authorized in Swedish and German [13,23]. The Walch-Duplays score, both objective and subjective, is the reference score in Europe to evaluate shoulder instability. It had never been compared with the WOSI.

The correlation between the Walch-Duplay score and the WOSI is strong. The better the Walch-Duplay score is, the lower the WOSI is. Standard deviations can be important, but they take into account the high value of the WOSI on 2100 points. Nevertheless, the subjective character of this score increases naturally the scattering of data and their indistinctness.

We demonstrate the self-administrated WOSI significantly correlates with the physician-administrated Walch-Duplay score, in terms of global scores and specific items of stability, pain, and return to activity. This retrospective study confirms a correlation of two postoperative scores. The limitation is in the assessment of shoulders' range of motion, which requires a physical examination. We recommend using both scores (one being totally subjective and self-administrated, the other one being objective and subjective) to measure all the functional disturbances, in

Table 4 Subjective score results.

	Subjective results	Duplay	Western Ontario Shoulder Instability Index (WOSI)	
Satisfied	37 (77%)	81 ± 22	263 ± 296	<i>P</i> = 0.02
Fair and poor	11 (23%)	41 ± 20	715 ± 336	

particular, the small abnormalities whose screening makes all the quality of a functional score.

As a conclusion, it is likely that both types of evaluation are complementary. The present correlation between the WOSI and Walch-Duplay scores reinforces the confidence in the WOSI to assess the clinical status of the patient suffering from shoulder instability, with emphasizing assessment of quality of life. We recommend using the WOSI in addition to the Walch-Duplay score in future studies concerning shoulder instability to combine patients' and surgeon's points of view in order to refine the evaluation of surgical techniques.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

Appendix A.

Original WOSI. Twenty-one items are scored using a visual analogue scale measuring 100 mm horizontally placed under each question.

Instructions to patients

In Sections A, B, C, and D you will be asked to answer questions in the following format and you should give your answer by putting a slash "/" across the horizontal line.

Note:

1. If you put a slash "/" at the left end of the line, i.e.

No pain / _____ Extreme pain
then you are indicating that you have no pain.

2. If you put your slash "/" at the right end of the line,

i.e.

no pain _____ / extreme pain
then you are indicating that your pain is extreme.

3. Please note:

- that the further to the right you put your slash "/", the **more** you experience that symptom;
- that the further to the left you put your slash "/", the **less** you experience that symptom;
- please do not place your slash "/" outside the end markers.

You are asked to indicate on this questionnaire, the amount of a symptom you have experienced in the past week as related to your problematic shoulder. If you are unsure about the shoulder that is involved or you have any other questions, please ask before filling out the questionnaire. If for some reason you do not understand a question, please refer to the explanations that can be found at the end of the questionnaire. You can then place your slash "/" across the horizontal line at the appropriate place. **If an item does not pertain to you or you have not experienced it in the past week, please make your "best guess" as to which response would be the most accurate.**

Section A: physical symptoms

Instructions to patients

The following questions concern the physical symptoms you have experienced due to your shoulder problem. In all cases, please enter the amount of the symptom you have experienced in the last week. (Please answer with a slash "/" across the horizontal line.)

1. How much pain do you experience in your shoulder with overhead activities?

no pain _____ extreme pain

2. How much aching or throbbing do you experience in your shoulder?

no extreme aching/throbbing _____

aching/throbbing

3. How much weakness or lack of strength do you experience in your shoulder?

no extreme weakness _____ weakness

4. How much fatigue or lack of stamina do you experience in your shoulder?

no extreme fatigue _____ fatigue

5. How much clicking, cracking or snapping do you experience in your shoulder?

no extreme clicking _____ clicking

6. How much stiffness do you experience in your shoulder?

no extreme stiffness _____ stiffness

7. How much discomfort do you experience in your neck muscles as a result of your shoulder?

no extreme discomfort _____ discomfort

8. How much feeling of instability or looseness do you experience in your shoulder?

no extreme instability _____

instability

9. How much do you compensate for your shoulder with other muscles?

not extreme _____ extreme

10. How much loss of range of motion do you have in your shoulder?

no extreme loss _____ loss

Section B: sports/recreation/work

Instructions to patients

The following section concerns how your shoulder problem has affected your work, sports or recreational activities in the past week. For each question, please indicate the amount with a slash "/" across the horizontal line.

11. How much has your shoulder limited the amount you can participate in sports or recreational activities?

not extremely limited _____

limited

12. How much has your shoulder affected your ability to perform the specific skills required for your sport or work? (If your shoulder affects both sports and work, consider the area that is most affected.)

not extremely affected _____

affected

13. How much do you feel the need to protect your arm during activities?

not extreme _____ extreme

14. How much difficulty do you experience lifting heavy objects below shoulder level?

no extreme difficulty _____
difficulty

Section C: lifestyle

Instructions to patients

The following section concerns the amount that your shoulder problem has affected or changed your lifestyle. Again, please indicate the appropriate amount for the past week with a slash “/” across the horizontal line.

15. How much fear do you have of falling on your shoulder?

no extreme fear _____ fear

16. How much difficulty do you experience maintaining your desired level of fitness?

no extreme difficulty _____
difficulty

17. How much difficulty do you have “roughhousing or horsing around” with family or friends?

no extreme difficulty _____
difficulty

18. How much difficulty do you have sleeping because of your shoulder?

no extreme difficulty _____
difficulty

Section D: emotions

Instructions to patients

The following questions relate to how you have felt in the past week with regard to your shoulder problem. Please indicate your answer with a slash “/” across the horizontal line.

19. How conscious are you of your shoulder?

not extremely conscious _____
conscious

20. How concerned are you about your shoulder becoming worse?

no extremely concern _____
concerned

21. How much frustration do you feel because of your shoulder?

no extremely frustration _____
frustrated

Thank you for completing the questionnaire.

References

- [1] Hovelius L. Incidence of shoulder dislocation in Sweden. *Clin Orthop Relat Res* 1982;166:127–31.
- [2] Simonet WT, Melton 3rd LJ, Cofield RH, Ilstrup DM. Incidence of anterior shoulder dislocation in Olmsted County, Minnesota. *Clin Orthop Relat Res* 1984;(186):186–91.
- [3] Sprangers MA, Aaronson NK. The role of health care providers and significant others in evaluating the quality of life of patients with chronic disease: a review. *J Clin Epidemiol* 1992;45:743–60.
- [4] Romeo AA, Bach Jr BR, O’Halloran KL. Scoring systems for shoulder conditions. *Am J Sports Med* 1996;24:472–6.
- [5] Walch G. The Walch-Duplay Score for Instability of the Shoulder. Directions for the use of the quotation of anterior instabilities of the shoulder. Abstracts of the First Open Congress of the European Society of Surgery of the Shoulder and Elbow, Paris, 1987, pp. 51–55. <http://www.secec.org/data/upload/files/The%20Walch-Duplay%20Score.pdf>.
- [6] Rowe CR, Patel D, Southmayd WW. The Bankart procedure: a long-term end-result study. *J Bone Joint Surg Am* 1978;60:1–16.
- [7] McGrory A, Assmann S. A study investigating primary nursing, discharge teaching, and patient satisfaction of ambulatory cataract patients. *Insight* 1994;19:8–13.
- [8] Clancy C. How do we involve patients in their own healthcare decisions? *MedGenMed* 2007;9(4):30–46.
- [9] Mohtadi N. Development and validation of the quality of life outcome measure (questionnaire) for chronic anterior cruciate ligament deficiency. *Am J Sports Med* 1990;26:350–9.
- [10] Kirkley A, Griffin S, McLintock H, Ng L. 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* 1998;26:764–72.
- [11] Mologne TS, Provencher MT, Menzel KA, Vachon TA, Dewing CB. Arthroscopic stabilization in patients with an inverted pear glenoid: results in patients with bone loss of the anterior glenoid. *Am J Sports Med* 2007;35:1276–83.
- [12] Salomonsson B, Abbaszadegan H, Revay S, Lillkrona U. The Bankart repair versus the Putti-Platt procedure: a randomized study with WOSI score at 10-year follow-up in 62 patients. *Acta Orthop* 2009;80:351–6.
- [13] Salomonsson B, Ahlström S, Dalén N, Lillkrona U. The Western Ontario Shoulder Instability Index (WOSI): validity, reliability, and responsiveness retested with a Swedish translation. *Acta Orthop* 2009;80:233–8.
- [14] Cassagnaud X, Maynou C, Mestdagh H. Clinical and computed tomography results of 106 Latarjet-Patte procedures at mean 7.5-year follow-up. *Rev Chir Orthop* 2003;89:683–92.
- [15] Collin P, Rochcongar P, Thomazeau HR. Treatment of chronic anterior shoulder instability using a coracoid bone block (Latarjet procedure): 74 cases. *Rev Chir Orthop* 2007;93:126–32.
- [16] Servien E, Walch G, Cortes ZE, Edwards TB, O’Connor DP. Posterior bone block procedure for posterior shoulder instability. *Knee Surg Sports Traumatol Arthrosc* 2007;15:1130–6.
- [17] De Mulder K, Marynissen H, Van Laere C, Lagae K, Declercq G. Arthroscopic transglenoid suture of Bankart lesions. *Acta Orthop Belg* 1998;64:160–6.
- [18] Lin Li. A concordance correlation coefficient to evaluate reproducibility. *Biometrics* 1989;45:255–68.
- [19] Fermanian J. Mesure de l’accord entre deux juges. Cas quantitatif. *Rev Epidemiol Sante Publique* 1984;1:307–10.
- [20] Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. *Lancet* 1986;1(8476):307–10.
- [21] Kirkley A, Werstine R, Ratjek A, Griffin S. Prospective randomized clinical trial comparing the effectiveness of immediate arthroscopic stabilization versus immobilization and rehabilitation in first traumatic anterior dislocations of the shoulder: long-term evaluation. *Arthroscopy* 2005;21:55–63.
- [22] Fayad F, Mace Y, Lefevre-Colau MM, Poiraudou S, Rannou F, Revel M. Measurement of shoulder disability in the athlete: a systematic review. *Ann Readapt Med Phys* 2004;47:389–95.
- [23] Hofstaetter JG, Hanslik-Schnabel B, Hofstaetter SG, Wurnig C, Huber W. Cross-cultural adaptation and validation of the German version of the Western Ontario Shoulder Instability index. *Arch Orthop Trauma Surg* 2010;130:787–96.