ORIGINAL ARTICLE

Clinical assessment of external rotation for the diagnosis of anterior shoulder hyperlaxity

M. Ropars\textsuperscript{a,b,*}, A. Fournier\textsuperscript{a}, B. Campillo\textsuperscript{c}, I. Bonan\textsuperscript{b}, P. Delamarche\textsuperscript{b}, A. Crétual\textsuperscript{b}, H. Thomazeau\textsuperscript{a}, the French Arthroscopy Society

\textsuperscript{a} Service de chirurgie orthopédique, hôpital Pontchaillou, centre hospitalier universitaire de Rennes, 2, rue Henri-le-Guilloux, 35033 Rennes, France
\textsuperscript{b} Laboratoire mouvement sport et santé (M2S), EA 1374, universités de Rennes 2-ENS Cachan, avenue Charles-Tillon, CS24414, 35044 Rennes, France
\textsuperscript{c} Département d’informatique médicale (DIM), centre hospitalier universitaire de Rennes, 2, rue Henri-le-Guilloux, 35033 Rennes, France

Accepted: 31 August 2010

KEYWORDS
Anterior instability of the shoulder; Clinical assessment of the shoulder; External rotation of the shoulder; Hyperlaxity

Summary  The aim of this study was to evaluate two methods of clinical assessment for external rotation of the shoulder to optimise the diagnosis of hyperlaxity in patients being selected for surgery for stabilisation of chronic anterior instability. External rotation was evaluated in 70 healthy student volunteers by two examiners (intertester study) using two methods of assessment at 15-day intervals (intratester study). The first method used was the protocol described for the Instability Severity Index Score (ISIS). In this case, the subject was evaluated in the sitting position, bilaterally with passive range of motion movements. The shoulder was considered hyperlax if ER1 was greater than 85°. With the second, so-called “elbow on the table” (EOT) method, the subject was evaluated in the decubitus dorsal position, unilaterally with passive range of motion. The subject was considered to be hyperlax if ER1 was greater than 90°. Kappa values for intra- and intertester agreement with the ISIS method were average, while they were satisfactory with the intraclass coefficient (ICC). Kappa values for inter- and intratester agreement with the EOT method were average and good, respectively. This tendency was confirmed by the ICC which went from good to excellent for the two examiners in both series of measurements using the EOT method, showing better reproducibility with this method. Our study confirms that the most reproducible method for assessing external rotation is obtained by unilateral assessment of the patient in the decubitus dorsal position, with passive range of motion. An ER1 of 90° is the necessary threshold for hyperlaxity because of elbow retropropulsion with this method, which provides immediate and visual evaluation and eliminates the necessity of goniometry.

© 2010 Elsevier Masson SAS. All rights reserved.

\* Corresponding author.
E-mail address: mickael.ropars@chu-rennes.fr (M. Ropars).

1877-0568/$ - see front matter © 2010 Elsevier Masson SAS. All rights reserved.
Clinical assessment of external rotation for the diagnosis of anterior shoulder hyperlaxity

Introduction

Recurrence after surgery for anterior stabilisation of the shoulder is between 5 and 15% [1,2]. Several factors have been associated with recurrence [2,3]: age less than 20 years old, the level and type of sports practiced, the presence of bone lesions or hyperlaxity. In 1980, Charles Neer was the first to identify patients with instability and hyperlaxity who presented with the clinical sulcus or Neer sign [4]. For many years, this sulcus sign was the most frequently chosen criterion for the diagnosis of hyperlaxity [5] before the criterion of external hyperrotation greater than 85° was proposed by G. Walch and H. Coudane in 2000 [6], then used by F. Balg and P. Boileau [3] in the Instability Severity Index Score (ISIS) in 2006. The ISIS classifies the level of risk in patients being selected for surgery for chronic instability of the shoulder on a scale from 0 to 10 by adding these prognostic factors. Patients whose score is 3 or less are candidates for arthroscopic Bankart repair, while others undergo a Latarjet procedure. The only clinical criterion used in this score is the presence of anterior or inferior hyperlaxity. This criterion is graded one point on the ISIS score but can exclude a patient from an indication of arthroscopic Bankart repair if he/she already has three points from other criteria. A diagnosis of anterior hyperlaxity is made on the ISIS score if elbow to body external rotation (ER1) is greater than 85° [3]. Although it is relatively simple, this clinical criterion raises several questions about the assessment technique, the threshold value and its reproducibility. The aim of this study was to analyse the inter- and intratester reproducibility of the assessment of ER1 using the ISIS method and a method proposed by the authors. The second aim was to confirm that the diagnosis of hyperlax subjects was similar with both methods.

Patients and methods

Seventy volunteer students participated in this study. There were 43 women and 27 men aged 20 to 25 (23.3 ± 2.1 years old), with no history of shoulder trauma or degeneration. Before the clinical assessment, subjects were questioned about the level of sports practiced using the DUPLA Y [7] score, and the dominant arm was identified.

ER1 was clinically assessed and compared using both methods.

The first method (ISIS) used the clinical protocol described by Balg and Boileau to determine ISIS score [3]. Based on this protocol, the patient was examined in a sitting position with the examiner standing behind him (Fig. 1). Assessment was visual, bilateral and no instruments were used. The subject was considered hyperlax if ER1 was greater than 85°. To be able to compare the measured values to those of the second method, goniometry was also performed on one randomly chosen side.

The second "Elbow on the table" or EOT method of assessment, was performed with the subject lying on his/her back on the examining table. The measurement was unilateral (on the side randomly chosen during the ISIS score assessment) and visual (Fig. 2). The subject was considered hyperlax if ER1 was greater than 90°, which corresponded to the forearm of the patient being below the horizontal plane of the table (Fig. 3).

Both methods of assessment were performed by two surgeons (intertester study) 15 days apart (intratester study). For each subject and examiner, the mean of three consecutive measurements was used as the final value. The intraclass coefficient (ICC) described by Fleiss and Shrout was used to determine the intra- and intertester agreement for each method [8]. The intratester ICC was calculated by comparing values obtained in the same subject by the same examiner and the intertester ICC by comparing the values obtained by both examiners. The Kappa value showed the level of agreement between the two methods of assessment. With the Kappa value, agreement could...
According to the "Elbow on the table method" (EOT) method, the shoulder is considered hyperlax if ER1 is above 90°. Diagnosis is made without measurement devices, the shoulder is hyperlax if the forearm is below the table.

Table 1 | Instability Severity Index Score (ISIS) intertester correlation: study of agreement between the two examiners with the ISIS method.

<table>
<thead>
<tr>
<th></th>
<th>Kappa</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examiner 1</td>
<td>0.42</td>
<td>0.79</td>
</tr>
<tr>
<td>Examiner 2</td>
<td>0.52</td>
<td>0.64</td>
</tr>
</tbody>
</table>

Table 2 | Elbow on the table method (EOT) intertester correlation: study of the agreement between the two examiners with the EOT method.

<table>
<thead>
<tr>
<th></th>
<th>Kappa</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examiner 1</td>
<td>0.58</td>
<td>0.76</td>
</tr>
<tr>
<td>Examiner 2</td>
<td>0.57</td>
<td>0.73</td>
</tr>
</tbody>
</table>

Table 3 | Instability Severity Index Score (ISIS) intratester correlation: study of agreement with the ISIS method between two measurements by the same examiner 15 days apart.

<table>
<thead>
<tr>
<th></th>
<th>Kappa</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading 1 (D0)</td>
<td>0.51</td>
<td>0.63</td>
</tr>
<tr>
<td>Reading 2 (D15)</td>
<td>0.44</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Table 4 | Elbow on the table method (EOT) intraobserver correlation: study of the agreement of the EOT in two measurements by the same examiner 15 days apart.

<table>
<thead>
<tr>
<th></th>
<th>Kappa</th>
<th>ICC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reader 1 (j0)</td>
<td>0.75</td>
<td>0.83</td>
</tr>
<tr>
<td>Reader 2 (j15)</td>
<td>0.61</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Moreover, there was no correlation between the different values obtained and the type of sports practiced or the dominant side (P = 0.5).

Mean lateral rotation with the ISIS and EOT methods was 82.2° (62°–102°) and 89° (70°–112°), respectively. ER1 with the EOT method was at least 5° more than that with the ISIS method in all patients (P < 0.0001). The hyperlax population identified by the ISIS method was statistically the same as that identified by the EOT method (P < 0.001).

Discussion

The diagnosis of shoulder hyperlaxity based on a definition of external hyperrotation of the shoulder has never been confirmed in a study. The only studies available in the literature report results of shoulder range of motion using measurement devices [9–12]. Thus, this study was performed to rectify this and confirm this definition. The results of our study suggest that assessment with the patient lying on his/her back simplifies the measurement of ER1. Placing the patient in the decubitus dorsal position provides a reference for the position of the shoulder in the flexion–extension sector of mobility and provides reliable intratester results compared to the standing or sitting position. This was also reported by Macdermid et al. [13] in a comparative study. The third sector of mobility (abduction–adduction) is also neutralised in the "elbow to body" position, depending on the patient’s morphology. However, the decubitus position increases the value of ER1 compared to the seated or standing position. Despite the relative immobilisation of the
Clinical assessment of external rotation for the diagnosis of anterior shoulder hyperlaxity

The threshold of 85° to define hyperlaxity was proposed by Walch and Coudane in 2000 [6], taking into account mean lateral rotation in a general population. Nevertheless, this threshold value is difficult to assess and raises several questions. The first problem is the measurement technique to be used for exact determination of the threshold of 85°, no more, no less, for the diagnosis of hyperlaxity versus normal laxity. Indeed, visual precision of the examiner is poorly discriminant, in particular for lateral rotation, with a measurement error of 15°, which is less reliable than the measurement error of 8° with goniometry [17,18]. Other more reliable methods (1° measurement error) have been proposed, such as goniometry with 6° of freedom [14], but this cannot be used in clinical practice. Using the ISIS method, visual precision is even less exact, because the examiner is standing behind the patient and cannot measure ER1 with goniometry because testing is bilateral. Moreover, the examiner cannot see the angle measured on the orthogonal plane, which is possible in the decubitus position.

It should be noted that one of the biases of our study was that goniometry was used for the ISIS method, for statistical reasons. The intraterster differential, or even the interterster study may have been modified in favor of the EOT method if a visual assessment had been used. This limit to our study is justified by the absence of existing reference criteria for the diagnosis of hyperlaxity [19], inevitably resulting in difficulty in defining a measurable threshold value.

Conclusion

The EOT method reported in this study provides a simple, reproducible method of evaluation using lateral rotation of the shoulder. Using a diagnostic threshold of 90° for hyperlaxity, goniometry is not necessary. Unilateral assessment is made with passive range of motion movements with the subject in the decubitus dorsal position. This simple, reproducible method can be used as an initial diagnostic tool of hyperlaxity. Its intraterster agreement makes it a good method to monitor lateral rotation mobility in cases of instability, or for any other shoulder pathologies.

Conflict of interest statement

No conflict of interest.

References