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Reproducibility and Validity of the Kerlan-Jobe Orthopedic Clinic Shoulder and Elbow Score (Japanese Version)

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Abstract

Background: The Kerlan-Jobe Orthopedic Clinic (KJOC) questionnaire is a self-reported performance and functional assessment tool with good reliability and validity for overhead athletes with shoulder and elbow injuries. This study aimed to develop a Japanese version of the KJOC (J-KJOC) to clarify its reproducibility and validity for use by Japanese university baseball players.

Methods: The J-KJOC was translated according to the guidelines for cross-cultural adaptation. A total of 88 university baseball players completed the J-KJOC and the Quick-Disabilities of the Arm, Shoulder, and Hand (Q-DASH) questionnaires. Thirty players completed the J-KJOC two times after a median interval of two weeks. We assessed the absolute reliability, construct validity, internal consistency, and test-retest reliability.

Results: Cronbach's alpha coefficients ranged from 0.88 and the intraclass correlation coefficient for the total score was 0.91. A fixed bias was absent in the J-KJOC scores (mean difference: −2.2, 95% CI: −4.8 to 0.5). Furthermore, the J-KJOC score was correlated with the Q-DASH-disability/symptom ($r = -0.60$, $p<0.01$) and Q-DASH-sports/music ($r = -0.63$, $p<0.01$) scores but not correlated with the Q-DASH-work score ($r = -0.11$, $p = 0.316$).

Conclusions: The J-KJOC questionnaire demonstrated good reproducibility and validity for assessing upper arm performance in Japanese university baseball players. The results of this study support the use of the J-KJOC for Japanese-speaking baseball players. Further research using this instrument on other types of overhead athletes is needed to determine its wider utility in sports medicine applications.

Categories: Orthopedics, Sports Medicine
Keywords: patient-reported outcomes, overhead athlete, elbow injury, shoulder injury, q-dash, j-kjoc, kerlan–jobe orthopedic clinic shoulder and elbow

Introduction

Shoulder and elbow pain and injuries are common in overhead sports. Overhead activities, such as throwing and serving, impose significant stress on the shoulder and elbow [1,2], and the repetition of these stresses can lead to injuries [3]. The incidence of injury in baseball pitchers resulting from repetitive throwing is 3.5 times higher than that in healthy baseball pitchers [4]. Moreover, an injury progressing to a point requiring surgery can substantially impact the player's career. Professional tennis players who underwent arthroscopic shoulder surgery took an average of 279 days to resume playing, and their world ranking dropped for up to two years after the surgery, indicating a significant career impact [5]. Limited joint range of motion [6], muscle weakness [7], and scapular dyskinesis [8] are common physical dysfunctions that can contribute to injuries during athletic activities [9]. However, not all athletes with these dysfunctions necessarily develop injuries. Some reports have documented cases in which athletes with limited joint range of motion and scapular dyskinesis did not experience injuries [10,11], suggesting limitations in using specific dysfunctions as definitive outcomes. Therefore, early detection of injury in overhead sports athletes is crucial for injury prevention and identifying the need for more comprehensive evaluations of dysfunction, including closer monitoring of the number of games, training intensity, and subjective complaints from the athlete.

Traditionally, the evaluation of upper limb function and performance in athletes has relied on measures such as range of motion and muscle strength [12]. However, researchers have emphasized the use of patient-reported outcomes (PROs) to focus on the symptoms experienced by patients and athletes to develop appropriate treatments [13]. The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire [14] and

its shortened version, i.e., the Quick DASH (Q-DASH) questionnaire, are two of the commonly used PROs for upper limb assessments [15]. However, these questionnaires are not specific to athletes and may inadequately capture the functional status and performance of their upper limbs. In Japan, similar evaluation methods are often employed; however, an assessment tool that encompasses not only postoperative pain and joint function but also pitching performance is warranted for postoperative evaluation and injury prevention in athletes.

The Kerlan-Jobe Orthopedic Clinic (KJOC) questionnaire is a sport-specific questionnaire that evaluates the upper limb performance of overhead athletes. The KJOC score reflects small changes in athletes' upper limb function and performance sensitively [16]. It is characterized by PROs and consists of 10 items, with a maximum score of 100 points. The KJOC has been used primarily for postoperative evaluation [17] and as a scale for injury prevention [18] in overhead sports. Healthy baseball players typically score ⩾90 points on the KJOC [19], whereas healthy swimmers score ⩾85 points [20]; lower scores may increase the risk of disability. Another notable feature is its sensitivity to shoulder and elbow dysfunction, as well as minor changes in performance [16]. The KJOC has been extensively used in English-speaking countries, with demonstrated reliability and validity [16]. The translated versions have been validated in several languages [21,22]. However, its reliability and validity in the Japanese population have not yet been reported.

Japan has one of the largest baseball player populations worldwide, with many players competing at high levels. A substantial number of players suffer from injuries [23]. Developing a Japanese version of the KJOC (J-KJOC) and confirming its reliability and validity would have meaningful implications for Japanese athletes and the worldwide dissemination of information. We hypothesized that the J-KJOC would be a valid, reliable, and responsive tool to assess shoulder and elbow functionality in Japanese overhead athletes.

Materials And Methods

Translation and cross-cultural adaptation

For preparing the J-KJOC, we followed the guidelines for cross-cultural adaptation [24]. The original version of the KJOC questionnaire was first translated independently by two healthcare professionals (certified athletic trainers). These two professionals compared the two versions of the questionnaire and discussed inconsistencies until a consensus was achieved. Following the guidelines, the Japanese version was translated back into English by an English-Japanese bilingual (see Appendix A); subsequently, the back-translated version was reviewed by an expert in this research area who is a native English speaker and was carefully revised several times. In July 2023, the development of the final J-KJOC was completed.

Assessment tools

The KJOC is an athlete-specific functional and performance assessment of the shoulder and elbow consisting of two sections and 10 questions with a visual analog scale on a 10-cm line. The left and right ends of the scale have a score of 0 and 10, respectively. The higher the score, the better the shoulder and elbow function. The scores were measured using a ruler from the left end to the mark created by the respondent and were recorded to one decimal place. The overall KJOC score ranges from 0 to 100, with 100 indicating the best shoulder and elbow conditions. Moreover, the tool comprises five subsections about the current status of upper extremity injury, three about the current level of competition, and three about the impact of the injury on play [16].

The Q-DASH-disability/symptom comprises 11 items for assessing physical function and symptoms in the upper limbs (score: 0 denotes best, 100 denotes worst). The Q-DASH consists of two optional modules, namely the work module (Q-DASH-work, four items) for workers with a high degree of physical performance and the sports/music module (Q-DASH-sports/music, four items) for athletes or performing artists. The score cannot be calculated if more than one item is missing. An optional module score may also not be calculated if an item is missing.

Participants and ethical considerations

We enrolled 88 collegiate baseball players in Japan (age: 20.4 SD, 1.3 years; career: 11.6 SD, 2.8 years; fielders: 66; pitchers: 20), with Japanese as their first language. The inclusion criteria were collegiate baseball players who practice at least twice a week. The exclusion included a history of neuropathic pain, trauma, or surgery of the upper limb. No participant was excluded in this study. The Ethics Committee of Kitasato University approved this study (approval no. 2022-032-3). All participants provided written informed consent before participation.

Data collection

The questionnaires were administered at two time points from September to December 2023 at two university baseball clubs engaged in active training and competition. All 88 players were instructed to complete printed versions of the J-KJOC and Q-DASH to assess construct validity. The J-KJOC questionnaire was redistributed within four weeks to assess the test-retest reliability between the two time points (30 collegiate baseball players).

Sample size calculation

The sample size was calculated by an a priori power analysis using G*Power version 3.1 (Heinrich Heine University Düsseldorf, Düsseldorf, DEU) [25]. Based on an α of 0.05, a power of 0.80, the correlation coefficient of 0.72 [21], and the intraclass correlation coefficient (ICC) of 0.505 to 0.937 [21] with respect to the results of a previous study, size analysis indicated that a total sample size of 10 and 26 would be required to demonstrate a significant difference in the correlation coefficient and ICC, respectively.

Statistical analysis

The construct validity of the J-KJOC was assessed by the correlations between the J-KJOC score and scores of the Q-DASH modules of disability/symptom, work, and sports/music, which were determined using the Spearman correlation coefficients and their corresponding p-values. The internal consistency of the J-KJOC reliability was evaluated using Cronbach's alpha. The Cronbach's alpha coefficients ranged from 0 to 1, with a value of 0.7 indicating internal consistency [26]. The test-retest reliability was determined using the ICC (1, 1) and the corresponding 95% CI. Good correlation was defined as excellent reliability with coefficients ranging from 0.75 to 1.00, good reliability with coefficients ranging from 0.60 to 0.74, fair reliability with coefficients ranging from 0.40 to 0.59, and poor reliability with coefficients <0.40 [27]. The standard errors of the mean (SEM) and minimal detectable change (MDC) were estimated using the following formulas [28]: $SEM=SD\times(\sqrt{1}-ICC)$ and $MDC=SEM\times1.96\times\sqrt{2}n$.

The Bland-Altman plot was created by plotting differences against the mean between the test and retest to assess absolute reliability [29]. A fixed bias was identified when the 95% CI for the mean difference did not include zero. The 95% CI for the lower and upper limits of agreement were calculated using the following formula [29]: $(\text{mean} \pm 1.96 \times SD) \pm t \times\sqrt{(3SD2/n)}$ where 'mean' is the mean difference between the test and retest, 'SD' is the standard deviation of the difference, and 'n' is the sample size. All statistical analyses were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, JPN) [30], which is used in R software (RStudio, Boston, MA, USA). More precisely, it is a modified version of the R Commander designed to add statistical functions frequently used in biostatistics. The significant level was set at $\alpha = 0.05$.

Results

Translation and cross-cultural adaptation of the KJOC

In the original version of the KJOC, the questionnaire asked participants to select their current performance level from the following options: professional major league, professional minor league, intercollegiate, and high school. On the other hand, in Japan, there are two categories between the minor league (professional second league) and the intercollegiate, namely the independent league and the Shakaijin league, as a semi-professional league. Thus, we added these two leagues to the options in the J-KJOC.

Participant characteristics

Table *1* and Table *2* summarize the participant characteristics (n = 88) and mean values of the J-KJOC and Q-DASH scores.

Characteristics	No. of players (%)	Mean (SD)	Range
Age (years)		20.4 (1.3)	18.0–23.0
Career (years)		11.6 (2.8)	5–18
Position			
Pitcher	20 (22.7)		
Fielder	68 (77.3)		
Current injury	22 (27.5)		
Previous injury	33 (37.5)		
Previous surgery	1 (0.01)		

TABLE 1: Participant characteristics (n=88)

Questionaire items	Mean (SD)	Range	95% CI
J-KJOC total score	76.9 (17.1)	30–100	72.1–79.5
Item 1	7.2 (2.7)	0–10	6.6–7.7
Item 2	7.3 (2.4)	0.6–10	6.8–7.8
Item 3	7.0 (3.0)	1.2–10	6.4–7.6
Item 4	9.1 (1.6)	0.3–10	8.8–9.4
Item 5	7.4 (2.9)	3.3–10	6.8–8.0
Item 6	7.3 (2.7)	0–10	6.7–7.8
Item 7	7.5 (2.7)	1.8–10	6.9–8.1
Item 8	7.6 (2.6)	0.4–10	7.1–8.2
Item 9	7.8 (1.9)	1.2–10	7.4–8.2
Item 10	7.2 (2.5)	3.2–10	6.7–7.7
Q-DASH score			
Disability/symptom	3.5 (4.7)	0–22.7	2.5–4.5
Work	0.1 (0.9)	0–6.5	-0.1–0.3
Sports/music	10.1 (15.8)	0–81.2	6.7–13.5

TABLE 2: Absolute values of all scores at the first test (n = 88)

J-KJOC: Japanese version of Kerlan–Jobe Orthopedic Clinic questionnaire; Q-DASH: Quick-Disabilities of the Arm, Shoulder, and Hand questionnaire

Reproducibility and validity

We performed a correlation analysis between the J-KJOC and Q-DASH (disability/symptoms, work, and sports/music) scores of the 88 players (Table *3*). The J-KJOC score was correlated with the Q-DASH-disability/symptom (r = -0.60, p<0.01), work (r = -0.11, p = 0.316), and sports/music (r = -0.63, p<0.01) scores. The internal consistency of the J-KJOC was evaluated as excellent (test: α = 0.88), which indicates good homogeneity within the questionnaire regarding the 10 items (Table *3*).

	Cronbach's α	Pearson correlation coefficient (r)		
J-KJOC total score		Q-DASH (disability/symptom)	Q-DASH (work)	Q-DASH (sports/music)
	0.88	−0.60*	−0.11	−0.63*

TABLE 3: Internal consistency and construct validity of the J-KJOC (n = 88)

*Indicates p<0.05

J-KJOC: Japanese version of the Kerlan-Jobe Orthopedic Clinic questionnaire; Q-DASH: Quick Disabilities of the Arm, Shoulder, and Hand questionnaire

The median duration of the test-retest score was two weeks. The ICC of the J-KJOC total score was 0.91 (0.40-0.88 for single items, p<0.01) (Table *4*). The SEM and MDC of the J-KJOC total score were 4.2 and 1.5, respectively.

J-KJOC	Test (SD)	Retest (SD)	$ICC_{1.1}$ (95% CI)	LOA (95% CI for lower/upper LOA)
Item 1	7.3 (2.6)	8.0 (2.0)	0.64 (0.38–0.81)	
Item 2	7.3 (2.6)	7.1 (2.4)	0.52 (0.20–0.74)	
Item 3	7.8 (2.1)	8.0 (2.1)	0.84 (0.69–0.92)	
Item 4	7.4 (3.6)	7.0 (2.6)	0.78 (0.59–0.89)	
Item 5	9.2 (1.4)	9.3 (1.3)	0.63 (0.35–0.80)	
Item 6	7.1 (2.7)	7.7 (2.7)	0.85 (0.70–0.92)	
Item 7	7.2 (2.7)	7.6 (2.5)	0.88 (0.72–0.94)	
Item 8	8.0 (2.3)	8.5 (1.9)	0.74 (0.53–0.87)	
Item 9	7.8 (2.4)	8.0 (2.4)	0.86 (0.72–0.93)	
Item 10	7.8 (1.7)	7.9 (1.8)	0.55 (0.24–0.76)	
Total score	76.9 (15.8)	79.1 (17.1)	0.91 (0.81–0.95)	−4.8 to 0.5 (−21.4 to −1.5 / −2.8 to 17.1)

TABLE 4: Test-retest and absolute reliability of the J-KJOC (n = 30)

J-KJOC: Japanese version of the Kerlan-Jobe Orthopedic Clinic questionnaire; LOA: Limits of agreement; ICC: Intraclass correlation coefficient

The Bland-Altman plot indicates the difference in distribution against the mean between the test and retest scores (Figure *1*). A fixed bias did not exist in the J-KJOC scores (mean difference: −2.2; 95% CI: −4.8 to 0.5).

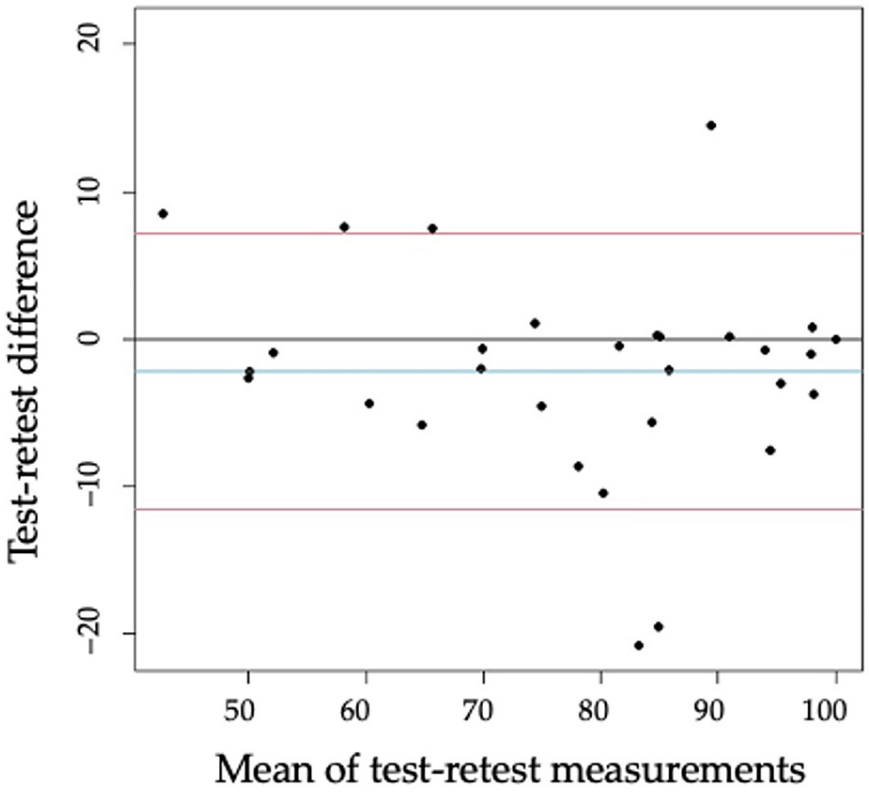


FIGURE 1: Bland–Altman plot describing the test-retest reliability of the J-KJOC

The blue line indicates the mean, the grey line indicates zero, and the red line marks the lower and upper bounds of the 95% CI.

J-KJOC: Japanese version of Kerlan-Jobe Orthopedic Clinic questionnaire

Discussion

This study demonstrated that the J-KJOC questionnaire is a valid and reliable tool for assessing upper limb performance in Japanese-speaking overhead athletes. A standardized cross-cultural adaptation process is necessary when translating and introducing evaluations into Japan [24]. Furthermore, this method was used to translate the KJOC, indicating the usefulness of this evaluation. Furthermore, a few cultural and linguistic adjustments were required to produce an equivalent to the original questionnaire. Therefore, the J-KJOC is easy to understand for athletes.

Regarding validity, the J-KJOC scores were negatively correlated with the Q-DASH- disability/symptom ($r = -0.60$, $p<0.01$) and Q-DASH-sports/music ($r = -0.63$, $p<0.01$) scores. Contrastingly, it was not correlated with Q-DASH-work scores. Regarding the correlation with the J-KJOC, Q-DASH-disability/symptom and Q-DASH-work demonstrated lower correlation coefficients than those in a previous study, whereas Q-DASH-sports/music demonstrated correlation coefficients similar to those in a previous study [21]. The participants in that previous study were professional baseball players, whereas those in the present study were university students. In our study, the J-KJOC scores correlated strongly with the Q-DASH-sports/music scores, which is consistent with a previous study, confirming the validity of the J-KJOC as an athlete-specific upper-limb function assessment.

The J-KJOC demonstrated high internal consistency and intra-rater reliability. Its Cronbach's α coefficient was ⩾0.7, indicating good internal consistency [26]. In this study, Cronbach's α for the test and retest was 0.88, respectively, similar to the results of previous studies [21,22]. Regarding intra-rater reliability, the criteria for ICC were referenced from previous studies as follows: excellent: 0.75 to 1, good: 0.6 to 0.74, fair: 0.4 to 0.59, and poor: ⩽0.4 [27]. The ICC for the total score (0.91) was excellent, indicating that it is a highly reliable assessment method. The Bland-Altman analysis demonstrated no mean difference errors, and the J-KJOC demonstrated consistency with the retest method. Thus, the J-KJOC is a reliable evaluation method.

The ICC should be ideally ⩾0.7 as a criterion for good reliability [27]; however, items 1, 2, 5, and 10 did not

meet that requirement in our study (Table *4*). Item 1 assessed muscle fatigue, item 2 assessed shoulder and elbow pain, and item 10 assessed the effect of arm condition on the competition level, which may depend on the fatigue on the day of assessment. Item 5 assessed the relationship with the team. We targeted amateur athletes and several players who supposedly did not have contracts. This finding is partly attributed to the inclusion of a limited population of collegiate athletes. Older, higher-level athletes are more likely to provide accurate answers about their athletic abilities [22]. Compared with the participants of a previous study, our participants were younger (24.1 in the previous study vs. 20.1 in this study), and they were inferior in terms of athletic history (14.0 in the previous study vs. 11.6 in this study) and athletic level (professional in the previous study vs. collegiate in this study); as such, they may have provided less accurate responses regarding athletic ability [21].

This study has some limitations. First, the measurements were conducted on a limited sample size, which resulted in bias in the players' conditions. Several players without injuries were included in this study (Table *1*). Therefore, further research should verify how more severely injured athletes respond to the J-KJOC. Second, we focused on university baseball players without considering other overhead sports or age groups. Thus, our results are inclined toward the function and performance of baseball players. Previous studies included a wide range of athletes from various overhead sports and age groups [16,22]. Moreover, baseline scores for factors contributing to the risk of injury in the KJOC vary across sports [19,20]. Therefore, examining the reliability and validity of the J-KJOC in overhead athletes comprehensively requires a diverse range of sports and age groups. However, the KJOC has been demonstrated to more clearly evaluate function and performance in overhead athletes, unlike conventional upper limb function assessment methods such as Q-DASH, which could be a useful assessment scale for training, rehabilitation, and conditioning plans.

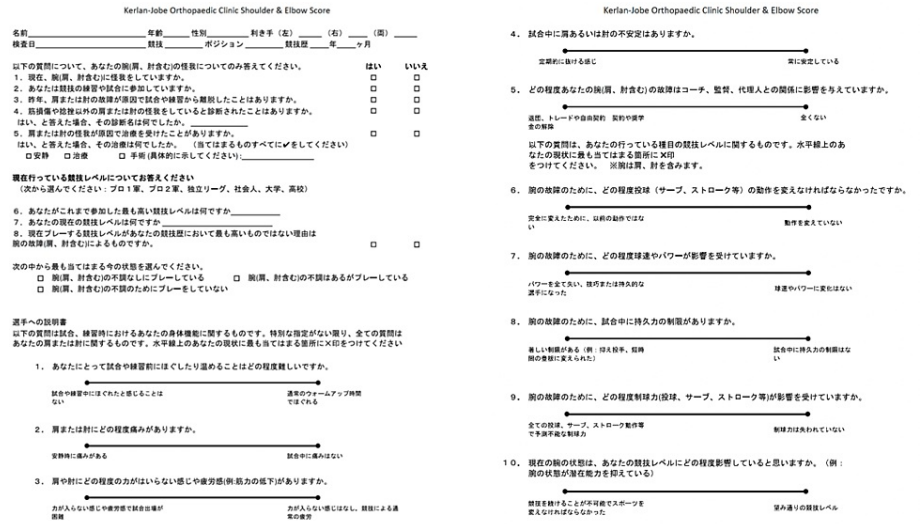
Conclusions

The J-KJOC questionnaire exhibited good reproducibility and validity in evaluating upper arm function among Japanese university baseball players. Our findings endorse the applicability of the J-KJOC among Japanese-speaking baseball players. Future research should explore its suitability across diverse overhead athlete populations to ascertain its broader relevance in sports medicine applications.

Appendices

Appendix A

Figure *2* features the J-KJOC questionnaire and Figure *3* is the English back-translation of the J-KJOC questionnaire.


Kerlan-Jobe Orthopaedic Clinic Shoulder & Elbow Score

名前_____ 年齢_____ 性別_____ 利き手（左）_____（右）_____（両）_____
検査日_____ 競技_____ ポジション _____ 競技歴 ____年____ヶ月

以下の質問について、あなたの腕(肩、肘含む)の怪我についてのみ答えてください。 はい いいえ
1．現在、腕(肩、肘含む)に怪我をしていますか。 □ □
2．あなたは競技の練習や試合に参加していますか。 □ □
3．昨年、肩または肘の故障が原因で試合や練習から離脱したことはありますか。 □ □
4．筋損傷や投球以外の肩または肘の怪我をしていると診断されたことはありますか。 □ □
はい、と答えた場合、その診断名は何でしたか。_____
5．肩または肘の怪我が原因で治療を受けたことがありますか。 □ □
はい、と答えた場合、その治療は何でしたか。（当てはまるものすべてに✔をしてください）
□ 安静 □ 治療 □ 手術 (具体的に示してください):_____

現在行っている競技レベルについてお答えください
（次から選んでください：プロ１軍、プロ２軍、独立リーグ、社会人、大学、高校）

6．あなたがこれまで参加した最も高い競技レベルは何ですか_____
7．あなたの現在の競技レベルは何ですか_____
8．現在プレーする競技レベルがあなたの競技歴において最も高いものではない理由は
腕の故障(肩、肘含む)によるものですか。 □ □

次の中から最も当てはまる今の状態を選んでください。
□ 腕(肩、肘含む)の不調なしにプレーしている □ 腕(肩、肘含む)の不調はあるがプレーしている
□ 腕(肩、肘含む)の不調のためにプレーをしていない

選手への説明書
以下の質問は試合、練習時におけるあなたの身体機能に関するものです。特別な指定がない限り、全ての質問はあなたの肩または肘に関するものです。水平線上のあなたの現状に最も当てはまる箇所にX印をつけてください

1．あなたにとって試合や練習前にほぐしたり温めることはどの程度難しいですか。
試合や練習中にほぐれたと感じることはない ― 通常のウォームアップ時間ではぐれる

2．肩または肘にどの程度痛みがありますか。
安静時に痛みがある ― 試合中に痛みはない

3．肩や肘にどの程度の力がはいらない感じや疲労感(例:筋力の低下)がありますか。
力が入らない感じや疲労感で試合出場が困難 ― 力が入らない感じはなし。競技による通常の疲労

Kerlan-Jobe Orthopaedic Clinic Shoulder & Elbow Score

4．試合中に肩あるいは肘の不安定はありますか。
定期的に抜ける感じ ― 常に安定している

5．どの程度あなたの腕(肩、肘含む)の故障はコーチ、監督、代理人との関係に影響を与えていますか。
退団、トレードや自由契約 契約や選手生命の解放 ― 全くない

以下の質問は、あなたの行っている種目の競技レベルに関するものです。水平線上のあなたの現状に最も当てはまる箇所に X印をつけてください。 ※腕は肩、肘を含みます。

6．腕の故障のために、どの程度投球（サーブ、ストローク等）の動作を変えなければならなかったですか。
完全に変えたために、以前の動作ではない ― 動作を変えていない

7．腕の故障のために、どの程度球速やパワーが影響を受けていますか。
パワーを全て失い、技巧または持久的な選手になった ― 球速やパワーに変化はない

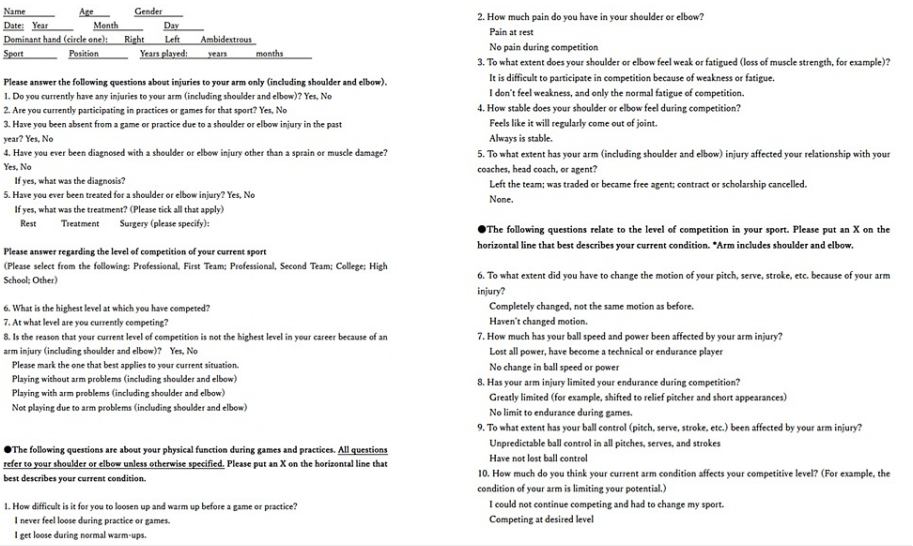
8．腕の故障のために、試合中に持久力の制限がありますか。
著しい制限がある（例：投え投手、指腕の登板に変えられた） ― 試合中に持久力の制限はない

9．腕の故障のために、どの程度制球力(投球、サーブ、ストローク等)が影響を受けていますか。
全ての投球、サーブ、ストローク動作等で予測不能な制球力 ― 制球力は失われていない

10．現在の腕の状態は、あなたの競技レベルにどの程度影響していると思いますか。（例：腕の状態が潜在能力を抑えている）
競技を続けることが不可能でスポーツを変えなければならなかった ― 望み通りの競技レベル

FIGURE 2: The J-KJOC shoulder and elbow questionnaire

J-KJOC: Japanese version of the Kerlan-Jobe Orthopedic Clinic questionnaire



Name Age Gender
Date: Year Month Day
Dominant hand (circle one): Right Left Ambidextrous
Sport Position Years played: years months

Please answer the following questions about injuries to your arm only (including shoulder and elbow).
1. Do you currently have any injuries to your arm (including shoulder and elbow)? Yes, No
2. Are you currently participating in practices or games for that sport? Yes, No
3. Have you been absent from a game or practice due to a shoulder or elbow injury in the past year? Yes, No
4. Have you ever been diagnosed with a shoulder or elbow injury other than a sprain or muscle damage? Yes, No
If yes, what was the diagnosis?
5. Have you ever been treated for a shoulder or elbow injury? Yes, No
If yes, what was the treatment? (Please tick all that apply)
Rest Treatment Surgery (please specify):

Please answer regarding the level of competition of your current sport
(Please select from the following: Professional, First Team; Professional, Second Team; College; High School; Other)

6. What is the highest level at which you have competed?
7. At what level are you currently competing?
8. Is the reason that your current level of competition is not the highest level in your career because of an arm injury (including shoulder and elbow)? Yes, No
Please mark the one that best applies to your current situation.
Playing without arm problems (including shoulder and elbow)
Playing with arm problems (including shoulder and elbow)
Not playing due to arm problems (including shoulder and elbow)

●The following questions are about your physical function during games and practices. All questions refer to your shoulder or elbow unless otherwise specified. Please put an X on the horizontal line that best describes your current condition.

1. How difficult is it for you to loosen up and warm up before a game or practice?
I never feel loose during practice or games.
I get loose during normal warm-ups.

2. How much pain do you have in your shoulder or elbow?
Pain at rest
No pain during competition
3. To what extent does your shoulder or elbow feel weak or fatigued (loss of muscle strength, for example)?
It is difficult to participate in competition because of weakness or fatigue.
I don't feel weakness, and only the normal fatigue of competition.
4. How stable does your shoulder or elbow feel during competition?
Feels like it will regularly come out of joint.
Always is stable.
5. To what extent has your arm (including shoulder and elbow) injury affected your relationship with your coaches, head coach, or agent?
Left the team; was traded or became free agent; contract or scholarship cancelled.
None.

●The following questions relate to the level of competition in your sport. Please put an X on the horizontal line that best describes your current condition. *Arm includes shoulder and elbow.

6. To what extent did you have to change the motion of your pitch, serve, stroke, etc. because of your arm injury?
Completely changed, not the same motion as before.
Haven't changed motion.
7. How much has your ball speed and power been affected by your arm injury?
Lost all power, have become a technical or endurance player
No change in ball speed or power
8. Has your arm injury limited your endurance during competition?
Greatly limited (for example, shifted to relief pitcher and short appearances)
No limit to endurance during games.
9. To what extent has your ball control (pitch, serve, stroke, etc.) been affected by your arm injury?
Unpredictable ball control in all pitches, serves, and strokes
Have not lost ball control
10. How much do you think your current arm condition affects your competitive level? (For example, the condition of your arm is limiting your potential.)
I could not continue competing and had to change my sport.
Competing at desired level

FIGURE 3: English back-translation of the J-KJOC questionnaire

J-KJOC: Japanese version of the Kerlan-Jobe Orthopedic Clinic questionnaire

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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References

1. Dillman CJ, Fleisig GS, Andrews JR: Biomechanics of pitching with emphasis upon shoulder kinematics . J

Orthop Sports Phys Ther. 1993, 18:402-408. 10.2519/jospt.1993.18.2.402
2. Fleisig G, Nicholls R, Elliott B, Escamilla R: Kinematics used by world class tennis players to produce high-velocity serves. Sports Biomech. 2003, 2:51-64. 10.1080/14763140308522807
3. Lyman S, Fleisig GS, Andrews JR, Osinski ED: Effect of pitch type, pitch count, and pitching mechanics on risk of elbow and shoulder pain in youth baseball pitchers. Am J Sports Med. 2002, 30:463-468. 10.1177/03635465020300040201
4. Fleisig GS, Andrews JR, Cutter GR, et al.: Risk of serious injury for young baseball pitchers: a 10-year prospective study. Am J Sports Med. 2011, 39:253-7. 10.1177/0363546510384224
5. George A, Saltzman MD, Hsu WK: The effect of an arthroscopic orthopaedic procedure on a professional tennis player's career. Cureus. 2019, 11:e5654. 10.7759/cureus.5654
6. Wilk KE, Macrina LC, Fleisig GS, et al.: Correlation of glenohumeral internal rotation deficit and total rotational motion to shoulder injuries in professional baseball pitchers. Am J Sports Med. 2011, 39:329-335. 10.1177/0363546510384223
7. Shitara H, Kobayashi T, Yamamoto A, et al.: Prospective multifactorial analysis of preseason risk factors for shoulder and elbow injuries in high school baseball pitchers. Knee Surg Sports Traumatol Arthrosc. 2017, 25:3303-3310. 10.1007/s00167-015-3731-4
8. Kibler WB, Ludewig PM, McClure PW, Michener LA, Bak K, Sciascia AD: Clinical implications of scapular dyskinesis in shoulder injury: the 2013 consensus statement from the 'Scapular Summit'. Br J Sports Med. 2013, 47:877-885. 10.1136/bjsports-2013-092425
9. Tooth C, Gofflot A, Schwartz C, Croisier JL, Beaudart C, Bruyère O, Forthomme B: Risk factors of overuse shoulder injuries in overhead athletes: a systematic review. Sports Health. 2020, 12:478-487. 10.1177/1941738120931764
10. Wilk KE, Macrina LC, Fleisig GS, et al.: Deficits in glenohumeral passive range of motion increase risk of shoulder injury in professional baseball pitchers: a prospective study. Am J Sports Med. 2015, 43:2379-2385. 10.1177/0363546515594380
11. Hjelm N, Werner S, Renstrom P: Injury risk factors in junior tennis players: a prospective 2-year study . Scand J Med Sci Sports. 2012, 22:40-48. 10.1111/j.1600-0838.2010.01129.x
12. Wilk KE, Obma P, Simpson CD, Cain EL, Dugas JR, Andrews JR: Shoulder injuries in the overhead athlete . J Orthop Sports Phys Ther. 2009, 39:38-54. 10.2519/jospt.2009.2929
13. Uematsu D, Suzuki H, Sasaki S, Nagano Y, Shinozuka N, Sunagawa N, Fukubayashi T: Evidence of validity for the Japanese version of the foot and ankle ability measure. J Athl Train. 2015, 50:65-70. 10.4085/1062-6050-49.3.42
14. Hudak PL, Amadio PC, Bombardier C: Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) [corrected]. The Upper Extremity Collaborative Group (UECG). Am J Ind Med. 1996, 29:602-608. 10.1002/(SICI)1097-0274(199606)29:6
15. Beaton DE, Wright JG, Katz JN: Development of the QuickDASH: comparison of three item-reduction approaches. J Bone Joint Surg Am. 2005, 87:1038-1046. 10.2106/JBJS.D.02060
16. Alberta FG, ElAttrache NS, Bissell S, Mohr K, Browdy J, Yocum L, Jobe F: The development and validation of a functional assessment tool for the upper extremity in the overhead athlete. Am J Sports Med. 2010, 38:903-911. 10.1177/0363546509355642
17. O'Brien DF, O'Hagan T, Stewart R, Atanda AW Jr, Hammoud S, Cohen SB, Ciccotti MG: Outcomes for ulnar collateral ligament reconstruction: a retrospective review using the KJOC assessment score with two-year follow-up in an overhead throwing population. J Shoulder Elbow Surg. 2015, 24:934-940. 10.1016/j.jse.2015.01.020
18. Tsuruike M, Ellenbecker TS, Hirose N: Kerlan-Jobe Orthopaedic Clinic (KJOC) score and scapular dyskinesis test in collegiate baseball players. J Shoulder Elbow Surg. 2018, 27:1830-1836. 10.1016/j.jse.2018.06.033
19. Kraeutler MJ, Ciccotti MG, Dodson CC, Frederick RW, Cammarota B, Cohen SB: Kerlan-Jobe Orthopaedic Clinic overhead athlete scores in asymptomatic professional baseball pitchers. J Shoulder Elbow Surg. 2013, 22:329-332. 10.1016/j.jse.2012.02.010
20. Wymore L, Fronek J: Shoulder functional performance status of National Collegiate Athletic Association swimmers: baseline Kerlan-Jobe Orthopedic Clinic scores. Am J Sports Med. 2015, 43:1513-1517. 10.1177/0363546515574058
21. Oh JH, Kim JY, Limpisvasti O, Lee TQ, Song SH, Kwon KB: Cross-cultural adaptation, validity and reliability of the Korean version of the Kerlan-Jobe Orthopedic Clinic shoulder and elbow score. JSES Open Access. 2017, 1:39-44. 10.1016/j.jses.2017.03.001
22. Fredriksen H, Myklebust G: Norwegian translation, cross-cultural adaptation and validation of the Kerlan-Jobe Orthopaedic Clinic shoulder and elbow questionnaire. BMJ Open Sport Exerc Med. 2019, 5:e000611. 10.1136/bmjsem-2019-000611
23. Matsuura T, Suzue N, Kashiwaguchi S, Arisawa K, Yasui N: Elbow injuries in youth baseball players without prior elbow pain: a 1-year prospective study. Orthop J Sports Med. 2013, 1: 10.1177/2325967113509948
24. Beaton DE, Bombardier C, Guillemin F, Ferraz MB: Guidelines for the process of cross-cultural adaptation of self-report measures. Spine (Phila Pa 1976). 2000, 25:3186-3191. 10.1097/00007632-200012150-00014
25. Kang H: Sample size determination and power analysis using the G*Power software . J Educ Eval Health Prof. 2021, 18:17. 10.3352/jeehp.2021.18.17
26. Terwee CB, Bot SD, de Boer MR, et al.: Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol. 2007, 60:34-42. 10.1016/j.jclinepi.2006.03.012
27. Shrout PE, Fleiss JL: Intraclass correlations: uses in assessing rater reliability . Psychol Bull. 1979, 86:420-428. 10.1037//0033-2909.86.2.420
28. de Vet HCW, Terwee CB, Mokkink LB, Knol DL: Measurement in Medicine: A Practical Guide . Cambridge University Press, Cambridge; 2011. 10.1017/CBO9780511996214
29. Bland JM, Altman DG: Statistical methods for assessing agreement between two methods of clinical measurement. Lancet. 1986, 1:307-310. 10.1016/S0140-6736(86)90837-8
30. Kanda Y: Investigation of the freely available easy-to-use software 'EZR' for medical statistics . Bone Marrow Transplant. 2013, 48:452-458. 10.1038/bmt.2012.244