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Validity and Reliability of the Achilles Tendon Total Rupture Score

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ABSTRACT

The best treatment of acute Achilles tendon rupture remains debated. Patient-reported outcome measures have become cornerstones in treatment evaluations. The Achilles tendon total rupture score (ATRS) has been developed for this purpose but requires additional validation. The purpose of the present study was to validate a Danish translation of the ATRS. The ATRS was translated into Danish according to internationally adopted standards. Of 142 patients, 90 with previous rupture of the Achilles tendon participated in the validity study and 52 in the reliability study. The ATRS showed moderately strong correlations with the physical subscores of the Medical Outcomes Study 36-item Short-Form Health Survey (r = .70 to .75; $p < .0001$) and Victorian Institute of Sports Assessment-Achilles questionnaire (r = .71; $p < .0001$). Test-retest of the ATRS showed no significant difference in the mean (2.41; $p = .07$). The limits of agreement were ±18.53. A strong correlation was found between test and retest (intercorrelation coefficient .908); the standard error of measurement was 6.7, and the minimal detectable change was 18.5. The Danish version of the ATRS showed moderately strong criterion validity. For study and follow-up purposes, the ATRS seems reliable for comparisons of groups of patients. Its usability is limited for repeated assessment of individual patients. The development of analysis guidelines would be desirable.

Rupture of the Achilles tendon is a very frequent injury (1–3). However, no consensus has been reached regarding the best treatment for acute Achilles tendon rupture. The treatment can be surgical or nonsurgical, it can be immobilizing or dynamic, and it can be weightbearing or non-weightbearing. In the pursuit of the optimal treatment protocol, studies have focused on repeat rupture, functional assessment, duration of sick leave, wound healing, infection, and nerve damage, to mention some of the assessed outcomes (4–11). In line with contemporary outcome evaluation, a patient-reported outcome measure (PROM) is needed to evaluate the patient-perceived outcomes after acute Achilles tendon rupture (12–15).

Patient-derived questionnaires have added a new dimension to clinical outcomes evaluation. PROMs are important for assessing individual patients in the clinic, quality monitoring, and research purposes (14,15). In 2007, a new PROM for the assessment of the outcome of Achilles tendon rupture treatment was developed (12). The Achilles tendon total rupture score (ATRS) consists of 10 items reflecting symptoms and physical activity. The ATRS is currently the only validated PROM specifically for use in Achilles tendon rupture management (12,13,16). However, it requires additional validation and, to use it in a Danish context, requires translation into Danish. Thus, we undertook to validate a Danish translation of the ATRS using a cross-sectional survey.

Patients and Methods

The aim of the present study was to validate the criterion validity and reliability of a Danish translation of the ATRS. The study was conducted as a questionnaire-based cross-sectional survey of patients with previous rupture of the Achilles tendon. Patients who presented with acute Achilles tendon rupture in our department from January 1, 2009 to January 30, 2012 were eligible for inclusion in the study. The "International Classification of Diseases, 10th revision" (17), code for Achilles tendon rupture (DS860) was used to identify a cohort of 189 patients. Of these, 110 (58.2%) responded to our invitation to participate in the present study. The study consisted of 2 parts, the validity study and the reliability study. Patients were excluded from both studies if all questionnaires were not completed correctly. For the reliability study, 2 additional exclusion criteria were used: stating a change in the condition of the Achilles tendon between measurements and not completing the second ATRS questionnaire within the predetermined period of 1 to 3 weeks after completing the first ATRS questionnaire. The study cohort was contacted by mail and asked to return the ATRS, the Medical Outcomes Study 36-item Short-Form Health Survey (SF-36) (18–20), and the Victorian Institute of Sports Assessment-Achilles (VISA-A) (21,22) questionnaires in a stamped envelope. After 10 days, an ATRS repeat test was sent as a separate mailing.

A total of 110 patients were eligible for inclusion in the validity study, and 20 patients (18.18%) were excluded because of incorrect (e.g., writing an answer instead of ticking a box or ticking more than 1 box) or incomplete questionnaires, leaving a study population of 90 patients (81.82%) (Fig. 1). A total of 75 patients (68.18%) were eligible for inclusion in the reliability study, because 35 patients did not return the second ATRS. Overall, 23 patients (20.91%) were excluded: 7 because of incorrectly completed questionnaires, 8 because they stated a change in the condition of the Achilles tendon, and 8 because they failed to answer the first and second ATRS within the predetermined period. A study population of 52 patients (47.27%) remained (Fig. 2). The demographic data of the cohort are listed in Table 1.

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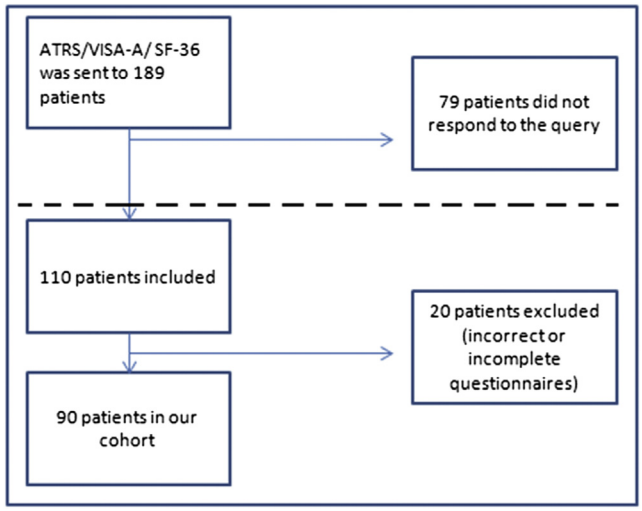

Fig. 1. Inclusion diagram for the validity study. The diagram shows the number of patients (n = 189) who received the 3 questionnaires, the Achilles tendon total rupture score (ATRS), Victorian Institute of Sports Assessment-Achilles (VISA-A) and Medical Outcomes Study 36-item Short-Form Health Survey (SF-36), and the events, such as a lack of response (n = 79) and meeting the exclusion criteria (n = 20), that led to the final cohort (n = 90) used to measure validity.

Translation

The translation was performed according to internationally adopted methods. These included forward translation, back translation, examination of the translation quality, and confirmation by bilingual speakers (18,23,24). The forward translation was provided by 3 independent translators from Swedish to Danish. A test version was agreed on and translated back to Swedish by an independent translator. The back translation was approved by the Swedish inventor of the questionnaire (12).

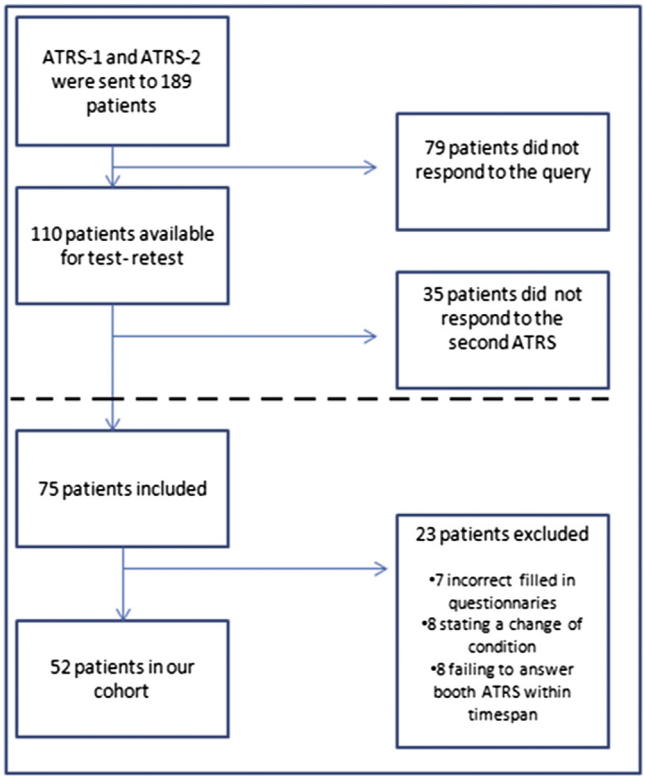

Fig. 2. Inclusion diagram for the reliability study. The diagram shows the number of patients (n = 189) who completed the Achilles tendon total rupture score (ATRS) questionnaire 2 times (n = 189), and the events, such as a lack of response to the first ATRS (n = 79), a lack of response to the second ATRS (n = 35), and meeting the exclusion criteria (n = 23), that led to the final cohort (n = 52) used to measure reliability. ATRS-1, first ATRS; ATRS-2, second ATRS.

Table 1
Demographics of study cohorts

Variable	Validity Study	Reliability Study
Patients (n)	90	52
Gender		
Male	63	36
Female	27	16
Age (y)		
Mean	47 ± 13	50 ± 14
Range	15 to 83	27 to 81

Validity

The ATRS questionnaire was compared with the SF-36, version 1 (18–20), and the VISA-A (21,22) questionnaires. The SF-36 is considered the reference standard for assessment of health-related quality of life, and VISA-A is an Achilles tendon, disease-specific questionnaire. The SF-36 includes 36 questions and 1 multi-item scale measuring each of 8 health concepts summarized in 2 main scores: the physical component score and mental component score (19,20). In our study, we focused primarily on physical functioning and the physical and mental component scores. The VISA-A questionnaire is a PROM valid for Achilles tendinopathy that evaluates symptoms. It consists of 8 questions that measure the domains of pain and function in daily living and sporting activity. The results range from 0 to 100, where 100 represents the ideal score (21,22). The VISA-A has been used in previous validations of the ATRS (12,16). Standard procedures were used for descriptive statistics. Correlation coefficients for correlation between the outcome measures of the questionnaires were calculated using Spearman's rank correlation.

Reliability

The test and retest were done within a period of 7 to 21 days between answers. The data were evaluated using the Bland-Altman method (25). Differences in the mean and standard error of measurement [SEM = standard deviation × √(1 − intercorrelation coefficient [ICC])] were calculated to assess the agreement between groups of data (26). The limits of agreement and minimal detectable change were calculated to assess agreement between data of the individual patients (minimal detectable change = 1.96 × √2 × SEM) (26). Also, the ICC was calculated. A paired Student's *t* test was used for a comparison of the mean values, because the data showed a normal distribution and the scale was considered to be continuous.

Internal Consistency

Cronbach's α was calculated for the intercorrelation among the items in the ATRS (internal consistency). Cronbach's α indirectly measures the extent to which each of the 10 items of the ATRS questionnaire measure the same construct. A low Cronbach's α indicates a lack of correlation between the items in a scale, making summarizing them unjustified. If the items constituting the score are all identical and so perfectly correlated, α will equal 1. A Cronbach's α greater than .7 should be the minimum expected, with an α greater than .9 considered more desirable (27–29).

Responsiveness

Floor or ceiling effects were considered present if more than 15% of the respondents achieved the lowest or highest score, respectively (27). The study was developed by the first, second, and last authors. Data collection was performed by the first author. An analysis of the data was conducted by all authors, and statistical analyses were performed by the second author. All statistical analyses were performed using the Statistical Package for Social Sciences, version 20.0, for Windows (SPSS, Chicago, IL). A probability of the null hypothesis of 5% or less ($p \leq .05$) was considered statistically significant.

Results

Translation

Danish and Swedish are similar languages, and the cultural differences between the 2 countries are minor. Only a few words were changed to reflect the written and spoken Danish language better; for example, "lower leg" was used instead of the "calf."