Validation and cross-cultural adaptation of Greek version of Achilles tendon Total Rupture Score

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ABSTRACT

Background: The purpose of this study was the translation, cross-cultural adaptation and validation of the Achilles Tendon Total Rupture Score (ATRS) in Greek population.
Methods: The translation and cross-cultural adaptation of the original version of ATRS in Greek language was performed according to the methodology described by Beaton et al. Validation and test–retest reliability were evaluated in forty-six patients, treated surgically for acute Achilles tendon rupture. Validity was evaluated by correlation of total and all subscale scores of Greek version of Manchester Foot Pain and Disability Index (MFPDI). Test–retest reliability evaluated with interclass correlation coefficient and Crombach's α coefficient was used for internal consistency.
Results: The internal consistency ($\alpha = 0.96$) and test–retest reliability (ICC = 0.97) were excellent. There were no ceiling and floor effects during test–retest assessment. The Greek version of ATRS showed strong correlation with all subscales and overall score of MFPDI (pain subscale: R = −0.954, p < 0.01, function subscale: R = −0.811, p < 0.01, appearance subscale: R = −0.763, p < 0.01, overall: R = −0.914, p < 0.01).
Conclusions: Greek version of ATRS was successfully adapted in Greek population and it appears to be a valid and reliable instrument to evaluate outcomes in Greek speaking patients after Achilles tendon rupture.
Level of evidence: Level III.

1. Introduction

Achilles Tendon (AT) is the most commonly ruptured tendon in middle aged men during sports and the incidence of acute ruptures is rising [1]. Treatment options include operative tendon suturing and nonoperative; but there is no general consensus regarding the indications for each one [2]. Self-reported scores or questionnaires are frequently used in clinical studies in order to evaluate the functional status before or after treatment of a disease or an injury.

Although there are several validated scores for ankle joint [3,4] and for Achilles Tendinopathy (Victorian Institute of Sports Assessment for Achilles Tendinopathy, VISA-A) [5], only Achilles tendon Total Rupture Score (ATRS) is validated for tendon ruptures [6,7]. The main advantage of this score is that it is a patient-reported outcome measure evaluating the symptoms and physical activity after Achilles tendon rupture (Fig. 1). It has been shown to have excellent reliability, good validity and responsiveness in different languages [7–12].

The methodology concerning the process of translation, cross-cultural adaptation and validation of a questionnaire in different speaking language population is already described by Beaton et al. [13]. The process consists of 6 stages. Firstly, is the forward translation by two individuals from original language to target language. In the second stage the two translations merge in one and any misinterpretations solved by the translators and the developer. A back translation in original language consists in stage three and the new questionnaire compared with the original by an expert committee during forth stage. In fifth step, the pre-adapted questionnaire is pretested in a number of subjects, who interviewed about understanding the meaning of each question. Then, in final stage, all written reports are analyzed by the committee and a final version of adapted questionnaire approved for further testing and validation in patients.

The aim of this study was the translation, cross-cultural adaptation and validation of the ATRS in Greek language, in order to provide a good clinical instrument for patient's evaluation after Achilles tendon rupture, in patients with Greek native language.

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Achilles tendon Total Rupture Score (ATRS)

Hospital Number: **Date:**
Date of rupture: **Date of repair:**

Please rate your current limitations; 0 is no limitation, 10 is severe limitation, circle your answer to the following questions

1. Are you limited due to decreased strength in the calf/Achilles tendon/foot?

    0   1   2   3   4   5   6   7   8   9   10

2. Are you limited due to progressive tiredness in the calf/Achilles tendon/foot?

    0   1   2   3   4   5   6   7   8   9   10

3. Are you limited due to stiffness in the calf/Achilles tendon/foot?

    0   1   2   3   4   5   6   7   8   9   10

4. Are you limited due to pain in the calf/Achilles tendon/foot?

    0   1   2   3   4   5   6   7   8   9   10

5. Are you limited during activities of daily living?

    0   1   2   3   4   5   6   7   8   9   10

6. Are you limited when walking on uneven ground?

    0   1   2   3   4   5   6   7   8   9   10

7. Are you limited when walking quickly up stairs or up a hill?

    0   1   2   3   4   5   6   7   8   9   10

8. Are you limited during activities that include running?

    0   1   2   3   4   5   6   7   8   9   10

9. Are limited during activities that include jumping?

    0   1   2   3   4   5   6   7   8   9   10

10. Are you limited in performing heavy physical work?

    0   1   2   3   4   5   6   7   8   9   10

Fig. 1. English version of Achilles tendon Total Rupture Score.

2. Material and methods

2.1. Translation and cultural adaptation

Two native Greek individuals with excellent knowledge of English language translated the English version of ATRS in Greek language. An expert committee (two doctors, a physiotherapist and an English language professor), with the translation team analyzed the translation and synthesized the Greek initial draft version of ATRS. This draft version has been back translated in English and any inconsistency with the original version was resolved. The final Greek version of ATRS (Appendix A) was approved by the committee and it was tested in 10 patients suffered ankle and foot problems and ten healthy volunteers. There were no reported difficulties in answering the questionnaire because of the language.

2.2. Participants and ethics approval

Participants were patients suffered from acute Achilles tendon Total Rupture, treated surgically in University General Hospital of Alexandroupolis. A total number of 46 patients participated in the study. All patients gave their written informed consent prior to inclusion and completed the questionnaires in an outpatient office of the hospital. Chronic ruptures, under 18 years old patients and traumatic bisections of Achilles tendon were excluded.

The cross-cultural adaptation and prospective cohort study of Greek version of ATRS was approved by the Ethics Committee of Department of Physical Education and Sport Science of University of Thessaly.

2.3. Collection of data

The Greek version of ATRS administered 2 times in patients with two weeks interval to evaluate the test–retest reliability of the questionnaire. Patients completed the ATRS-Greek and the only validated score in Greeks language, which concerns problems of foot and ankle, the Manchester Foot Pain and Disability Index (MFPDI) [14] to evaluate the validity of the ATRS. Acceptance of measurements estimated by the number of items left blank. Patients were also clinically evaluated by an orthopaedic surgeon during their follow-up.

2.4. Statistical analysis

Statistical analysis was performed using PSPP software (Free Software Foundation, Inc) for Windows and $p < 0.05$ was consisted as statistically significant. Normality of sample assessed by the Kolmogorov–Smirnov test. Patient demographics reported as means and standard deviation (SD). Reliability of the Greek version of ATRS was tested by the interclass correlation coefficient r (ICC), and internal consistency was tested with Cronbach coefficient α. Reproducibility of scores considered to be poor if $r < 0.40$, good if r was between 0.40 and 0.75 and excellent if $r > 0.75$ [15]. Values of $\alpha > 0.7$ considered as reliable. The Crombach's α was also calculated for elimination of one of ten questions.

Validation of the questionnaire was assessed using the Spearman's rank correlation coefficient r to find the association of Greek version of ATRS and the Greek version of MFPDI. MFPDI has 3 subscales. Validation was tested with all subscale scores and the overall score of MFPDI. Spearman's coefficient >0.50 considered to be a strong correlation. Values between 0.35 and 0.50 considered as moderate and values <0.35 as poor correlation [16]. The Greek version of ATRS had to be strong correlated with the Greek version of MFPDI with r > 0.75 to be considered as good [17].

Content validity was also tested by the occurrence of ceiling and floor effects. During both tests, ceiling and floor effects calculated by the proportion of patients, who achieved minimum (0) or maximal (100) score relative to the total number of subjects. This considered to be relevant if there were >30% of patients [21].

3. Results

Translation process successfully conducted with no major problems in back translation step. Cross-cultural adaptation did not reveal any problems in answering of questionnaires. Final Greek version of Achilles tendon Total Rupture Score is shown in Appendix A. All patients completed the questionnaires and there was no missing data or items left blank. Demographics of patients are listed in Table 1. Absolute value of ATRS was mean 84.1 (range 34–100) with maximum scale of 100, and absolute values of the MFPDI were 1.7 (range 0–10) in pain subscale, 2.2 (range 0–13) in function subscale, 0.8 (range 0–4) in appearance subscale and 4.7 in overall score (range 0–25) with maximum scales of 12, 22, 4, and 38 respectively. 11 patients of the first participation and 10 patients in the second participation achieved maximum score of 100 and none of the patients in both times achieved the minimum score of 0.

The Greek version of ATRS showed strong correlation with all subscales and overall score of MFPDI (Pain subscale: $R = -0.954$, $p < 0.01$, Function subscale: $R = -0.811$, $p < 0.01$, Appearance subscale: $R = -0.763$, $p < 0.01$, Overall: $R = -0.914$, $p < 0.01$).

Table 1
Demographics of study cohorts.

Variable	
Patients (n)	46
Gender	
Male	42
Female	4
Affected side	
Right	29
Left	25
Age (years)	
Mean (SD)	41 (10.0)
Range	24–39
BMI	
Mean (SD)	26.6 (2.15)
Range	23.2–33.95
Time from injury (months)	
Mean (SD)	27 (51.8)
Range	3–228

Internal consistency considered as high (Crombach's α, 0.96) for all items and between 0.94 and 0.96 after elimination of one question at a time. In test–retest evaluation, the interclass correlation coefficient considered as excellent ($r = 0.97$, $p < 0.01$).

4. Discussion

The ATRS is an instrument developed for evaluation of patients suffered from Achilles tendon rupture [7]. In fact, it is the only validated measurement of this specific injury [6]. It is a patient-reported outcome measurement, consisted of ten items considering symptoms and patient function. Score ranges from 0 to 100, with maximal score indicating no symptoms and full function [7]. ATRS validated and culturally adapted in Swedish [7], English [9], Danish [10], Turkish [11], Persian [12], and Italian [18]. Greek version of ATRS shown good acceptance by patients and healthy volunteers reflected by the absence of items left blank.

Although the optimum sample size required in order to evaluate the validity of a patient-reported outcome measurement is not well defined, it has been suggested that minimum requirement must be 50 patients [8]. Considering the incidence of this injury, and the existing literature concerning the evaluation of ATRS in other languages, we believe that 46 participants is a capable size to enroll our study, providing good statistical power.

Several scores have been used to determine the validity of this instrument. ATRS showed high correlation with subscales of SF-36, VISA-A, Foot Functional Index (FFI), Lower Extremity Functional Scale (LEFS), Foot and Ankle Outcome Score (FAOS) in different languages [7–12,18]. In Greek language, the only validated measurement considering problems of foot and ankle is the Manchester Foot Pain and Disability Index (MFPDI) [14]. MFPDI is a 19-item questionnaire for evaluation of the severity and the impact of foot pain. It has 3 subclasses with items considering functional limitation (10 items), pain intensity (5 items) and personal appearance (2 items + 2 items of difficulty at work) [19]. Every item has 3 options, which scores from 0 (never) to 2 (most of the time) with overall score ranging from 0 to 38 and maximal score indicates severe pain and functional limitation. The Greek ATRS shown high correlation with all subscales of MFPDI and overall score.

Test–retest evaluation indicated excellent reliability of the instrument and was equal with the other published versions of ATRS (Table 2) [7–12,18]. The recommended interval time between the two tests varies from 2 days to 2 weeks [7].

The interval time of two weeks was considered as a proper one as it was enough time for the participants not to remember the items and on the other hand any rehabilitation program had no significant impact on patient's functional status.

The Greek version of ATRS, also assessed for its internal consistency tested with Cronbach's coefficient α, which considered as high. In addition, when an item was deleted, Crombach's α did not change, indicated that all items of the questionnaire had homogeneity and all affected in overall score. The internal consistency was found in this study similar to the other reported results of the adapted versions (Table 2). Internal consistency measured only in the first assessment of Greek version of ATRS.

Ceiling and floor effects were also calculated during test and re-test assessment. None of the patients achieved minimum score, so there was no floor effect. Eleven of 46 patients achieved maximum score in first attempt (23,9%) and 10 patients (21,7%) in second assessment. Both were below 30% cut, suggesting that there was no ceiling effect.

A factor affected the importance of an instrument is responsiveness. It is the ability of a measurement to determine whether a change in a score indicates real clinical change. Although there are several methods available for evaluation the responsiveness [20], it has not been assessed in this study. This is the major limitation and

Table 2
Psychometric properties of the original version and published adapted versions of ATRS.

	Internal consistency	Test–retest reliability	Responsiveness
Swedish [7]	0.96	0.98	ES: 0.87 and 2.21
English [8]	0.89–0.95	NE	No floor/ceiling effects
English [9]	NE	0.99	ES: 0.93
Danish [10]	0.96	0.99	No floor/ceiling effects
Turkish [11]	0.95	0.98	No floor/ceiling effects
Persian [12]	0.95	0.98	No floor/ceiling effects
Italian [18]	0.97	0.96	No floor/ceiling effects
Greek (*this study*)	0.96	0.97	No floor/ceiling effects

NE: not established.

future evaluation is needed. Responsiveness is also not evaluated in other evaluation studies [8,11,12,18]. Time from injury, varied from 3 to 228 months, constituting also a limitation because patients were in different stages of rehabilitation.

5. Conclusion

Achilles tendon Total Rupture Score (ATRS) has been successfully translated, validated and cross-culturally adapted in Greek language. It has shown excellent reliability, equal to original questionnaire, and other adapted versions. ATRS appeared a good self-reported instrument to assess symptoms and functional limitations in patients suffered from Achilles tendon rupture.

Conflict of interest

The authors declare that they have no competing interests.

Appendix A. Greek version of Achilles Tendon Rupture Score

Κλίμακα Ολικής Ρήξης Αχίλλειου Τένοντα

Όλες οι ερωτήσεις αναφέρονται σε περιορισμούς/δυσκολίες σε δραστηριότητες που σχετίζονται με τον τραυματισμένο Αχίλλειο τένοντα σας.
Σημειώστε με ένα Χ στο νούμερο που ταιριάζει το επίπεδο περιορισμού!

1. Έχετε κάποιο περιορισμό λόγω μειωμένης δύναμης στο γαστροκνήμιο (γάμπα)/Αχίλλειο τένοντα/πόδι ;

    0   1   2   3   4   5   6   7   8   9   10

2. Έχετε κάποιο περιορισμό λόγω κούρασης στο γαστροκνήμιο (γάμπα)/Αχίλλειο τένοντα/πόδι ;

    0   1   2   3   4   5   6   7   8   9   10

3. Έχετε κάποιο περιορισμό λόγω δυσκαμψίας στο γαστροκνήμιο (γάμπα)/Αχίλλειο τένοντα/πόδι;

    0   1   2   3   4   5   6   7   8   9   10

4. Έχετε κάποιο περιορισμό λόγω πόνου στο γαστροκνήμιο (γάμπα)/Αχίλλειο τένοντα/πόδι;

    0   1   2   3   4   5   6   7   8   9   10

5. Έχετε κάποιο περιορισμό κατά τη διάρκεια δραστηριοτήτων της καθημερινής ζωής;

    0   1   2   3   4   5   6   7   8   9   10

6. Έχετε κάποιο περιορισμό όταν βαδίζετε σε ανώμαλες επιφάνειες ;

    0   1   2   3   4   5   6   7   8   9   10

7. Έχετε κάποιο περιορισμό όταν περπατάτε γρήγορα όταν ανεβαίνετε τις σκάλες ή ένα λόφο ;

    0   1   2   3   4   5   6   7   8   9   10

8. Έχετε κάποιο περιορισμό κατά τη διάρκεια δραστηριοτήτων που περιλαμβάνουν τρέξιμο ;

    0   1   2   3   4   5   6   7   8   9   10

9. Έχετε κάποιο περιορισμό κατά τη διάρκεια δραστηριοτήτων που περιλαμβάνουν άλμα ;

    0   1   2   3   4   5   6   7   8   9   10

10. Έχετε κάποιο περιορισμό σε βαριά (χειρωνακτική) δουλειά ;

    0   1   2   3   4   5   6   7   8   9   10

Συνολική Βαθμολογία: ....

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