

Thompson calf squeezing test: clinical and ultrasound correlations in the follow up of Achille's tenorrhaphy

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Abstract. In the follow up of Achille's tenorrhaphy, negativization of Thompson calf squeezing test is not always omogeneous and absolute. Aim of the paper is to correlate Thompson test to different anatomical-ultrasound and functional parameters. We investigated clinically and by ultrasound 61 patients operated on of Achille's tenorrhaphy at Novara Hospital with follow-up of 10 to 46 months. Negative controls were contralateral tendons. We excluded patients with previous and/or contralateral Achille's tendon ruptures, those operated after 7 days, diabetics or with autoimmune diseases, if used topic steroids, < 18 years, those rejecting the study. Measured parameters were: age, gender, height, weight, side, open vs percutaneous approach, time from operation, neutral angle and range of motion of the ankle, maximal circumference of the leg, Single Heel Rise Test, Visual-Analogue-Scale Foot and Ankle (VAS FA) score; with ultrasound: length of tendons, mio-tendinous U.S.-structure, dynamic diastasis of tendon scar, tendon sliding. Thompson test is positive if no plantar-flexion of the foot occurs at calf squeezing, negative if plantar-flexion is normal (75% patients) and intermediate if reduced or slight reactive (25%). We found correlation of Thompson test with age ($p < 0,05$) and with tendon length ($p > 0,05$), being intermediate tests more represented in older patients and in those with longer healed tendons. In conclusion post-operative negativization of Thompson test can be incomplete as observed in older patients and in those healed with elongated tendon. (www.actabiomedica.it)

Key words: Achilles tendon, Thompson test, Ligadon, Krakow, ultrasound, tenorrhaphy

Introduction and rationale

Anamnesis and clinical examination are essential in diagnosis of Achille's tendon ruptures.

Lack of plantar-flexion of the foot at calf squeezing is the most sensitive and specific sign, as described by Thompson in 1962 (1, 2). According to our observations, even at medium-long follow-up time after surgical repair of the Achille's tendon, negativization of Thompson calf squeezing test is not always omogeneous and absolute. This led us to investigate on its meaning and mechanism.

Aim of the paper is to correlate Thompson test to different anatomical-ultrasound and functional parameters.

Materials and Methods

In this retrospective study, we investigated 61 patients sequentially operated, from 01/01/2008 to 12/31/2010 of Achille's tenorrhaphy at Novara Hospital with follow-up of 10 to 46 months.

Standard post-operative rehabilitation protocol was the same for all patients and made of three

stages: 1) 30 days of loadless plantar-flexion immobilization cast; 2) 30 days of full weight bearing with a 90°-locked brace and active-passive loadless mobilizations against gravity. 3) 30 days of free ankle walking (full weight bearing) with a decreasing heel from 4 to 1 cm weekly.

We excluded patients with previous and/or contralateral Achille's tendon ruptures, insertional or mid-tendinous junction ruptures, all surgical procedures but Krakow technique (open approach, in spinal anesthesia) and percutaneous Ligadon® technique (in local anesthesia) (Fig. 1), those operated after 7 days from rupture, diabetics, patients with autoimmune diseases, if used topic steroids, those under 18 years of age and who rejected to participate to the study.

At respective follow-up, all included patients underwent three orthopaedists independent evaluation with Thompson calf squeezing test. Contralateral tendons were considered as negative controls. On the basis of unanimous opinion, patients were divided into three groups: 0) negative if plantar-flexion was normal at calf squeezing, 1) intermediate if reduced or slight reactive, 2) positive if no plantar-flexion of the foot occurred. Patients on whom orthopaedists opinion was discordant were excluded from the study.

Measured parameters reported on individual Case Report Form (CRF) were: weight (Kg), age at surgery (years), neutral angle and range of motion of the ankle (degrees) established with a goniometer (Fig. 2), maximal circumference of the lower leg (cm) (Fig. 3)



Figure 1. Percutaneous suture under UltraSound control



Figure 2. Measuring Tibio-Talar joint angles with goniometer



Figure 3. Measuring maximal lower leg circumference with a flexible measuring tape

and minimal circumference of the ankle (cm) in the operated limb established with a flexible measuring tape, minimal external width of operated tendon (mm) measured with a calliper (Fig. 4), Single Heel Rise Test (3-7) on operated leg (number of repetitions). Ultra-sound parameters were acquired and measured with the following echographer: Esaote S.p.A. (Genova – Italia), MyLab 70 XVG with linear transducer LA 523 using 8 to 12 MHz frequencies (Fig. 5, 6). In particular we measured and registered: length (mm) of tendon from Soleus mio-tendinous junction to most proximal tendon-calcaneus contact, thickness at mio-tendinous junction (mm), width of mio-tendinous junction, tendon maximal thickness, tendon maximal



Figure 4. Width of Achille's tendon measured with a calliper

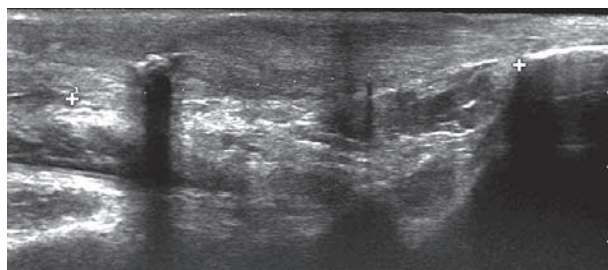


Figure 5. Panoramic longitudinal ultrasound scan of an operated Achille's tendon with particular on calcaneal insertion. Shadow cones of stitches can be noted

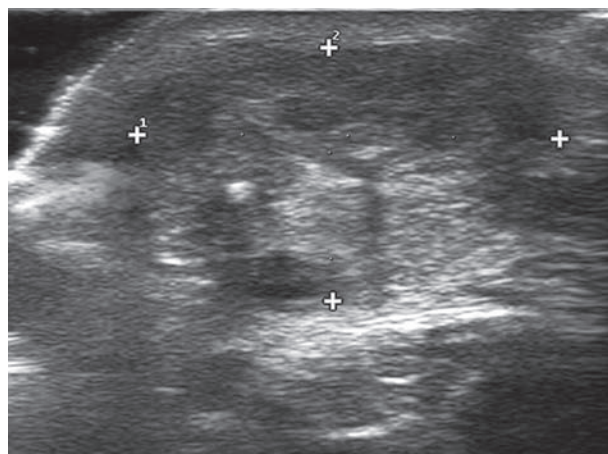


Figure 6. Transversal ultrasound scan of an operated Achille's tendon looking thicker and disomogeneous

width. Visual-Analogue-Scale Foot and Ankle (VAS FA) (8) was administered to patients (maximum total = 100 x 20 = 2000). Gender, height, weight, side, open

vs percutaneous approach, time from operation, ankle ROM in dorsal-flexion and in extension, difference rate of maximal circumference between the operated and non operated leg, mio-tendinous U.S.-structure of the Achilles tendon and Triceps Surae muscles, dynamic diastasis of tendon scar and tendon sliding (by dynamic ultrasound) were also noted.

Means of different parameters reported on a DataBase were correlated to the three Thompson test categories using Student t-test.

Results

From the retrospective evaluation of the 61 patients, 40 fell within the exclusion criteria. Remaining 21 patients underwent clinical and ultrasonographic evaluation obtaining results reported in Table 1.

At check up from 10 to 46 months after surgery, 15 out of 21 patients (75%) showed a negative Thompson test (group 0) for all three evaluators and 6 out of 21 (25%) an intermediate Thompson test (group 1). All the 21 contralateral Achille's tendons (negative controls) had a negative Thompson test (21/21 = 100%).

In particular, 4/16 (25%) of the tendons operated with open Krakow technique resulted in intermediate Thompson test versus 1/5 (20%) of the tendons operated with percutaneous Ligadon® technique.

In table 1 are also reported results concerning the comparison of different variables (mean with standard deviation and p value) among Group 0 and Group 1.

Tendon mean length seems to be 23% higher in Group 1 than in Group 0 (p=0.2).

The mean age at surgery was higher in Group 1 (59 years) compared to Group 0 (44 years), (p=0.01).

Discussion

Among the published articles talking about the Achille's tendon and the Thompson test, is never explicitly considered the possibility of having a non completely positive or negative (intermediate) result, probably because such results are ipso facto considered as positive, as emerged from a survey we conducted on orthopaedic surgeons.

Table 1. t-test of comparison between the means of the parameters for the two groups of negative (0) and intermediate (1) Thompson Test

| | Mean Thomp. 0 | Mean Thomp. 1 | t | gl | p | N Krakow | N Ligadon | Std. Dev | Std. Dev | F ratio | p |
|---|---------------------|---------------------|-------|----|------|-------------|--------------|----------|----------|---------|------|
| Weight (Kg) | 80,9 | 81,2 | -0,05 | 19 | 0,96 | 16 | 5 | 10,3 | 9,3 | 1,22 | 0,94 |
| Age (years) | 43,5 | 59,2 | -2,72 | 19 | 0,01 | 16 | 5 | 10,9 | 12,5 | 1,32 | 0,62 |
| Neutral Angle Op (°) | 110,6 | 107,8 | 0,97 | 19 | 0,34 | 16 | 5 | 5,8 | 4,6 | 1,62 | 0,69 |
| Tot. ROM Op (°) | 109,8 | 109,6 | 0,05 | 19 | 0,96 | 16 | 5 | 5,7 | 5,2 | 1,18 | 0,96 |
| Max circumf. Op (cm) | 37,4 | 36,4 | 0,73 | 19 | 0,48 | 16 | 5 | 2,4 | 3,8 | 2,47 | 0,18 |
| Min circumf. Op (cm) | 23,3 | 23,0 | 0,30 | 19 | 0,77 | 16 | 5 | 1,4 | 1,9 | 1,75 | 0,38 |
| Min Ext.Width Op (mm) | 20,2 | 21,2 | -0,50 | 19 | 0,63 | 16 | 5 | 3,8 | 4,7 | 1,50 | 0,50 |
| Single Heel Rise Test Op (N) | 25,3 | 28,8 | -0,41 | 19 | 0,69 | 16 | 5 | 9,2 | 32,2 | 12,34 | 0,00 |
| Op tendon Length (mm) | 87,1 | 107,4 | -1,23 | 19 | 0,23 | 16 | 5 | 34,4 | 22,3 | 2,38 | 0,42 |
| Thickness at Miotend. Junction Op (mm) | 10,0 | 10,6 | -0,61 | 19 | 0,55 | 16 | 5 | 1,5 | 3,2 | 4,30 | 0,03 |
| Width at Miotend Junction Op (mm) | 23,9 | 26,4 | -1,23 | 19 | 0,23 | 16 | 5 | 4,2 | 2,6 | 2,60 | 0,37 |
| Max Thickness Op (mm) | 13,4 | 14,2 | -0,67 | 19 | 0,51 | 16 | 5 | 2,5 | 2,1 | 1,44 | 0,79 |
| Max Width Op (mm) | 34,5 | 25,8 | 0,43 | 19 | 0,67 | 16 | 5 | 44,3 | 2,4 | 344,12 | 0,00 |
| Tot. VAS | 1628,0 | 1773,6 | -0,80 | 19 | 0,43 | 16 | 5 | 381,6 | 216,5 | 3,11 | 0,28 |

Novelty of this study is to investigate on this particular intermediate response.

Thompson test can be useful not only for diagnosing Achille's tendon ruptures, but also for evaluating the function of Triceps Surae mio-tendinous complex, in order to monitor the functional recover.

We have been very meticulous setting the inclusion/exclusion criteria in order to get the most homogeneous sample group as possible, without too many variables that could affect the result. This choice, however, determined a great reduction of the sample size and, consequently, the statistical significance.

Could be interesting to continue the study in order to reach a more appropriate statistical significance also on other variables that have larger difference among the two groups. In particular, it would be good to increase the sample size having the tendon length as main outcome.

Tendon measurement has proved to be difficult to achieve in clinical as well as under ultrasonographic

evaluation, so we focused on developing a reproducible method to reduce inter and intra observer differences.

ROM in flexo-extension as well turned out to be laborious to obtain: goniometer measurement is inaccurate because of the lack of absolute anatomical reference points.

The fact that Thompson test can give intermediate results in same proportion (20-25%) both in open suture (4/16 cases) and percutaneous suture (1/5 cases) could demonstrate that surgical procedure is not influential. In particular, the closed approach gives more difficulty to reduce the two tendinous stumps, with higher risk of post-cicatrizacion tendon lenght discrepancy from the healthy contralateral, but our results contradict this theory.

Checking with ultrasounds the tendinous stumps juxtaposition during percutaneous suture (Fig. 1), we also noted that the best length result is obtained knotting Ligadon® wire with fully plantar-flexed/equinus ankle.

Beyond surgical technique, the tendon healing most conditioning factor consists probably in the post-surgical treatment.

Conclusions

All data considered, it can be asserted that Thompson calf squeezing test can not only be positive or negative but also intermediate (partially positive or partially negative); post-surgical negativization of the test is due to the age at surgery: in particular, patients with incomplete negativization have a higher mean age.

It is interesting to note that Achilles's tendons with intermediate results at medium-long term were 23% longer than tendons with a completely negative test, even if these data have a too much variability (high standard deviation) and are not statistically significant ($p > 0.05$).

It's reasonable to suppose that incomplete calf squeezing test negativization, which is prevalent in the elders, could be correlated to a worse tendon healing, even though there are no statistically significant differences in the mio-tendinous U.S. structure.

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