

contains ten items of which the last three concerns tasks that some patients cannot and some do not perform. No manual for the use of ATRS has been developed. The purpose was to investigate how ATRS responds at 4, 6 and 12 months after rupture and develop a manual for the use of ATRS.

**Materials and methods** This study was performed as a retrospective registry study analysing prospectively gathered data from the Danish Achilles tendon Database. The data was gathered 4, 6 and 12 months after rupture. The original score based on 10 items was compared with a score based on the first 7 items adjusted to the same scale as the original score. Density- and scatterplots were made and differences between the scores were tested by t-test or Mann–Whitney U test.

**Results** 2790 completed ATRS scores were included. The 7-item score statistically significantly overestimated the value of the 10 items score at all time points ( $p < 0.001$ ) but only at 4 months the difference was clinical relevant (9.7points).

**Conclusion** The ATRS cannot be recommended for use at 4 months past rupture, as the last 3 items skew the score. If the ATRS is used before 6 months the last three items could be omitted. A manual for the use of the ATRS will be developed defining how and when the score should be applied.

## 21 VALIDATION OF ACHILLES TENDON LENGTH MEASURE AND ACHILLES TENDON RESTING ANGLE IN RELATION TO COPENHAGEN ACHILLES LENGTH MEASURE

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**Introduction** Elongation of the Achilles tendon after rupture is a frequent and overlooked complication. The Achilles Tendon Length Measure (ATLM) and the Achilles Tendon Resting Angle (ATRA) are indirect length measures using the resting angle of the ankle. Copenhagen Achilles Length Measure (CALM) is a direct ultrasound measure. Examination of the association of elongation to valid clinical measures of the length of the Achilles tendon are needed. The purpose was to examine the concurrent validity of ATLM and ATRA in relation to CALM within one year of rupture.

**Materials and methods** The study was performed as a validity study. Data were collected from patients included in a randomized controlled trial. Mixed linear regression, controlling for time after injury, age and gender, was performed investigating the three models (dependent-independent): CALM-ATRA, CALM-ATLM and ATRA-ATLM.

**Results** 130 patients were included (23 women, 107 men) mean age 41.8 years (SD 10.5). All three regression models demonstrated a statistical significant ( $p < 0.01$ ) linear relationship. For each degree ATRA increased, CALM increased with 0.39 mm. For each cm ATLM increased, CALM increased with 1.7 mm. For each cm ATLM increase, ATRA increase with 1,6 degrees.

**Conclusion** ATRA and ATLM were found to have a linear relationship to CALM and seems valid as surrogate measurements for the assessment of tendon elongation after an Achilles tendon rupture.

## 22 RUNNING A MARATHON – THE EFFECT ON ACHILLES TENDON STRUCTURE

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**Introduction** More than half a million athletes were enrolled in a marathon run during the last years. During running the Achilles tendon is submitted to high loads, and multiple tensile strain cycles. There are no studies investigating the effect of a marathon in the structure of the Achilles tendon. Thus, the aim of this study was to investigate the short-term response of the Achilles tendon structure after running a marathon.

**Materials and methods** Ten male non-elite runners who participated in a marathon were included. Tendon structure was assessed before, 2 days and 7 days after a marathon using the ultrasound tissue characterization (UTC), an imaging tool which quantifies tendon organization dividing the structure into four different echo types (I–IV).

**Results** Two days after a marathon, no significant changes in tendon structure were observed. However, after 7 days both insertional and midportion structure changed significantly. At the insertion of the tendon there was a significant decrease in the percentage of echo types I, III and IV and a significant increase in the percentage of echo type II. The midportion of the tendon showed a significant decrease in the percentage of echo types III and IV and a significant increase in the percentage of echo type II.

**Conclusion** We observed that the effects of running a marathon on the Achilles tendon structure occurred 7 days after the event. In a population of runners without tendon injuries, there seems to be a positive adaptation of the tendon to the load after running a marathon.

## 23 EVALUATION OF IN-EAR SENSOR SYSTEMS FOR QUANTIFYING HEAD IMPACT EXPOSURE IN YOUTH FOOTBALL

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**Introduction** Wearable sensor systems may be useful for measuring head-impact exposure. Here, we tested the validity of in-ear sensors developed to improve head coupling.

**Methods** First, the sensor was mounted to a Hybrid III head-form (HIII) and impacted with a linear impactor or football. Peak linear acceleration (PLA), peak rotational acceleration (PRA) and peak rotational velocity (PRV) were obtained from both systems; random and systematic error were calculated using HIII as reference. Then, six youth football players wore sensors and performed a structured training protocol