## Preliminary results of a clinical trial for the assessment of elastic properties of pathological Achilles' tendons based on measurement of the speed of sound

Dujardin PA<sup>1</sup>, Ossant F<sup>1,2</sup>, Plag C<sup>2</sup>, Brault A<sup>1</sup>, Defontaine M<sup>3</sup>, Canon F<sup>4</sup>, Fournier J<sup>2</sup>, Patat F<sup>1,2</sup>, <sup>1</sup>CIC 1415, CHU Tours, Inserm, Tours Cedex, France, <sup>2</sup>UMR 1253, iBrain, Université de Tours, Inserm, Tours, France, <sup>3</sup>Rheawave, Tours, France, <sup>4</sup>CNRS UMR6600, UTC, Compiègne, France

## Background, Motivation and Objective:

Musculoskeletal disorders are among the main causes of pain and disability in adults. These disorders are often associated with professional or sports activities and linked to hyper-solicitation. Achilles tendinopathy is particularly common in the population aged from 30 to 50. The incidence of this disease has been estimated at 2 per thousand. Achilles tendon (AT) ruptures generally occur on pathological tendons, but there is currently no simple method that can be used in clinics to assess the physiopathological state of a tendon through its mechanical properties. We propose to evaluate the diagnosis potential of a device based on the measurement of the acoustic speed of sound (SOS) with an axial transmission technique in AT of 15 subjects with a risk of tendon rupture (patients with a history of tendon rupture in the contralateral foot).

## **Statement of Contribution/Methods:**

A dedicated US device, consisting in 1 emitter and 20 receivers, was fixed parallel to the AT. Short US impulses were emitted; the SOS was calculated from the time shift between the 20 received signals during an isometric contraction of the sural triceps (see figure below). Each subject initially performed its strongest isometric contraction; the corresponding torque, called maximum voluntary contraction (MVC), was recorded. Then, each subject had to make another isometric contraction following the pattern: 20% of the MVC and contracting up to 80% of the MVC. Mean SOS values were measured for each isometric contraction (SOS<sub>20</sub> and SOS<sub>80</sub>). . For each subject, 3 measurements were performed without dismantling the device. SOS values of these 15 subjects were compared to those of the 40 healthy subjects included in the trial described in [1].

## **Results/Discussion:**

 $SOS_{20}$  and  $SOS_{80}$  values (Median [Q1;Q3]) of the patient group were significantly lower than those of the control group (p=0.047 and p=0.027, respectively): 1929 [1875; 2008] and 1969 [1886; 2034] against 1994 [1945; 2028] and 2035 [1978; 2062], respectively. These preliminary results show the potential of this device to detect patients with a risk of tendon rupture.

[1] Reproducibility of a non-invasive ultrasound technique for the assessment of elastic properties of Achilles' tendon, on healthy volunteers: preliminary results, IEEE Int. Ultr. Symp. 2019



Photography of the foot restraint system allowing an isometric contraction of the sural triceps