How easy is it to perform a tendon Shear-Wave Elastography examination?

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Ultrasound represents an excellent imaging method for exploring the musculoskeletal system, with great accessibility and being widely spread in the clinical world. Musculoskeletal ultrasound (MSUS) has high sensitivity and specificity in detecting pathological changes.

In terms of tendons, as specified in the last EFSUMB Guidelines and Recommendations, MSUS represents the first imaging method to identify structural changes, being more sensitive than clinical examination and MRI, even if it does not always correlate with pain or dysfunction [1].

On the other hand, ultrasound elastography has become, in the last years, one of the most important additions to the armamentarium of sonographic techniques. The examination of musculoskeletal structures is one of the first clinical applications of elastography. Basically, two main approaches for elastography of the musculoskeletal system are used in clinical practice: strain and shear-wave elastography. Strain elastography (SE) analyzes tissue strain, which represents tissue deformation parallel to the direction of the exploratory force, deformation being induced by ultrasound or by a pure mechanical force. Shear-wave elastography (SWE) analyzes the displacement of shear waves perpendicular to the direction of the exploratory force, information obtained represents in the instance, the shear wave speed [2].

The idea of this editorial started from one of the articles published in the current issue, which refers to the factors that influence SWE in the assessment of the patellar tendon.

In recent years there have been several studies that have tried to demonstrate the usefulness of elastography in the evaluation of tendons. Studies on elastography in tendon-related disorders suggest that this technique can provide important information on the mechanical properties of the tendons and can detect particular changes in different pathologies. In addition to the morphological information obtained using B-mode ultrasound, elastography can quantify alterations related to inflammation, degeneration, injury, healing, and response to treatment.

Until now, many manufacturers have developed elastography techniques for their ultrasound machines, but no consensus concerning measurements and cut-offs exists.

Some studies have tried to establish ranges of normal values of shear wave velocities, so that the normal-pathological difference can be fixed. Achilles tendon, patellar and quadriceps tendon, supraspinatus and elbow tendons were the most studied tendons, but despite the multiple studies published until now, a great range of normal SWE values are reported with no consensus on the values being considered normal. One of the explanations for these wide variations would be the fact that tendons, like other structures of the musculoskeletal system, are made up of heterogeneous, anisotropic tissues, which lead to such differences in the values of shear wave speed.

Some authors tried to study the best examination technique, identify the limits, the artefacts, and the pitfalls for SWE evaluation on tendons.

There are many factors to consider when performing a SWE examination of the normal tendons, some are included in the EFSUMB recommendations:

- Longitudinal orientation of the transducer to the tendon fibers in order to achieve values that are as accurate and confident as possible.
- In the state of relaxation or contraction, the shear waves propagate faster in contracted tendons. Some studies show that speed values could also be influenced by the flexion degree of the tendon.
- Regarding the transducer pressure on the skin, the SWE examination is recommended to be performed with the lightest pressure.
- The size of the region of interest (ROI) does not seem to have an influence on the SWE speed measurements.
- The amount of gel applied between the skin and the transducer, or the placement of a gel pad could also influence shear wave velocity values.
- The moment when the measurements are calculated, after performing physical exercises or for a certain period of time after stopping them could be a pitfall in the interpretation of values. Some papers suggest that SWE could be used to study the effects of physical exercises on healthy athletes, as well as on patients under rehabilitation treatment [2-4].

As can be seen from the list above, there are many challenges for SWE imaging on the normal tendons which must be taken into account for an optimal examination.

In this issue of Medical Ultrasonography, Pelea et al [5] evaluated the reliability of SWE in the assessment of the patellar tendon and to establish which are the factors that influence the values of shear wave speed values. They analyzed several factors: the examiner experience, the probe frequency, degree of knee flexion, ROI diameter in two different regions of the tendon, the use of coupling gel as standoff, the position of the color box in relation with the probe footprint, and the influence of physical exercise prior to examination. They found that highest interobserver (p<0.001) and intraobserver agreement (k=0.92, respectively k=0.891) was obtained with the knee in the neutral position, in the proximal and middle area of the tendons, with the transducer placed directly on the skin with light pressure. Another interesting finding was that the best results were obtained after 10 minutes of relaxation. The position of SWE and the size of ROI did not have a significant influence on the SWE examination of the patellar tendon. The authors draw attention to the fact that the type of transducer could distort the elasticity measurements, recommending the use of the linear transducer.

As many ultrasound systems have incorporated the SWE module, it is important to examine the musculoskeletal structures in order to standardize imaging protocols and positions, as well as to clarify the causes and solutions for imaging pitfalls and artefacts.

References