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# TEST-RETEST RELIABILITY OF REAL-TIME ELASTOGRAPHY USING AN EXTERNAL REFERENCE MATERIAL: PRELIMINARY RESULTS

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## BACKGROUND AND AIM

Real-time elastography is a recent ultrasound-based technique which allows a qualitative assessment of tissue elasticity. Light and transverse tissue compression with an ultrasound probe is applied to a surface producing a displacement within the tissue, which is less pronounced in harder than in softer materials. Tissue displacement is calculated by comparing b-mode image pairs before and after the compression. Elasticity pattern are represented on the ultrasound monitor as a colour scale superimposed on a B-mode image. The aim of this study was to examine test-retest reliability of real-time elastography (RTE) using an external reference material.

## MATERIALS AND METHODS

Thirteen healthy subjects were recruited. Longitudinal RTE ultrasound (MyLab™ ClassC) images of the left and right Achilles tendon area were acquired in a test-retest session. An external reference material (Zerdine®, CIRS, Inc., Norfolk), with known elastic properties (first layer 93 kPa, second layer 10.5 kPa), was placed on the subject's Achilles tendon and included in the b-mode scans (Fig. 1). The reference material was used to normalize color scale among subjects. Different region of interest (ROI), including different human tissue (skin, Achilles tendon, Kager fat pad), were drawn in the images. The range between soft and hard (from red to blue) was divided in 256 steps (0-255), according to the ultrasound image color depth. The median and interquartile range of colors was computed. Test-retest reliability were calculated for the different tissues using ICC $_{2;1}$ (Intraclass Correlation Coefficent) and Bland Altman plots.

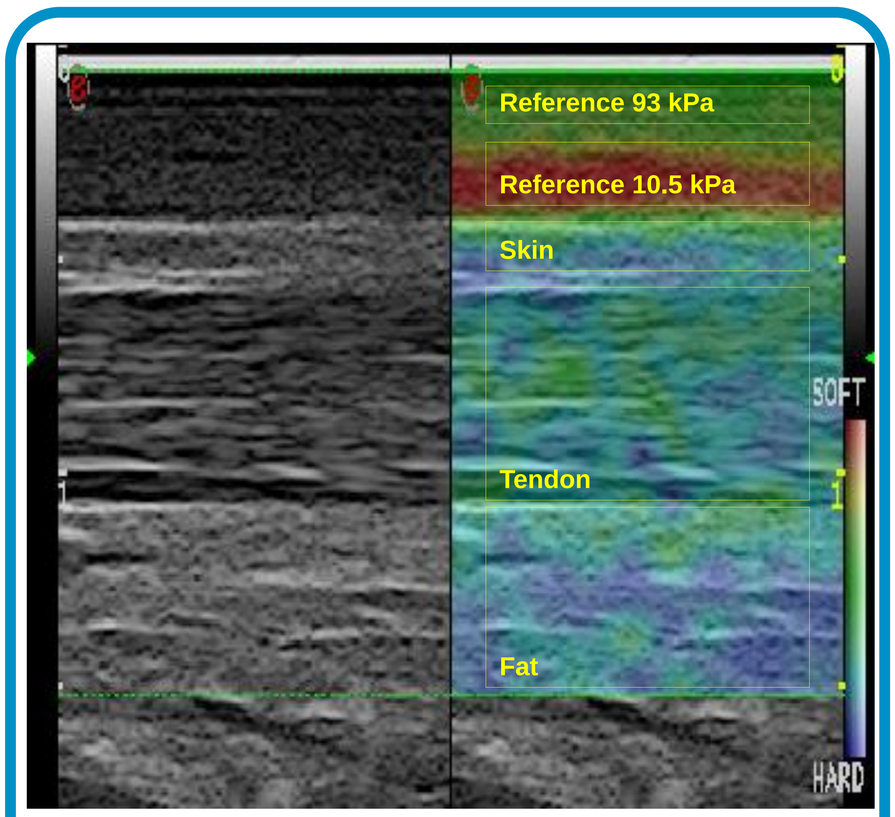


**Figure 1** Elasto-Dual image, yellow boxex show the different tissues examined.

| | ICC $_{2:1}$ | 95% CI | Mean difference (95%CI) |
|---|---|---|---|
| Reference 93kPa | 0.67 | 0.40-0.84 | 2.7 (-22.0 – 27.4) |
| Reference 10.5kPa | 0.76 | 0.54-0.89 | -4.48 (-28.3 – 19.3) |
| Skin | 0.51 | 0.17-0.74 | -2.96 (-23.1 – 17.2) |
| Tendon | 0.74 | 0.51-0.88 | -0.15 (-12.5 – 12.2) |
| Fat | 0.76 | 0.53-0.89 | -4.23 (-24.9 – 16.5) |

**Table 1** ICC, 95%CI and mean difference of the different tissues examined

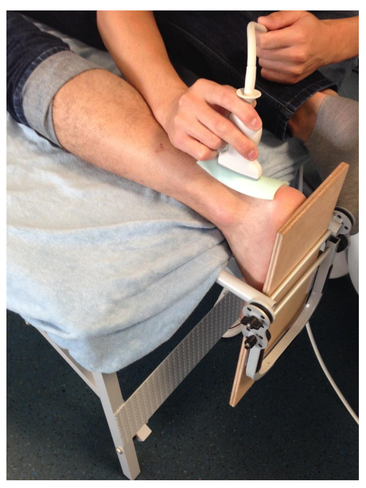

**Figure 2** Experimental Set-Up

## RESULTS

Test-retest reliability for the different tissues show an ICC $_{2;1}$ of 0.67 (95%CI: 0.40-0.84) for the reference 93kPa; 0.76 (95%CI: 0.54-0.89) for the reference 10.5 kPa; 0.51 (95%CI: 0.17-0.74) for the skin; 0.74 (95%CI: 0.51-0.88) for the tendon and 0.76 (95%CI: 0.53-0.89) for the fat. (Table 1)
Bland Altman plots (Figure 3) show a mean difference of 2.7 (95%CI: -22 to 27.4) for the reference 93kPa; -4.48 (95%CI: -28.3 to 19.3) for the reference 10.5kPa -2.96 (95%CI: -23.1 to 17.2) for the skin; -0.15 (95%CI: -12.5 to 12.2) for the tendon and -4.23 (95%CI: -24.9 to 16.5) for the Kager fat pad.

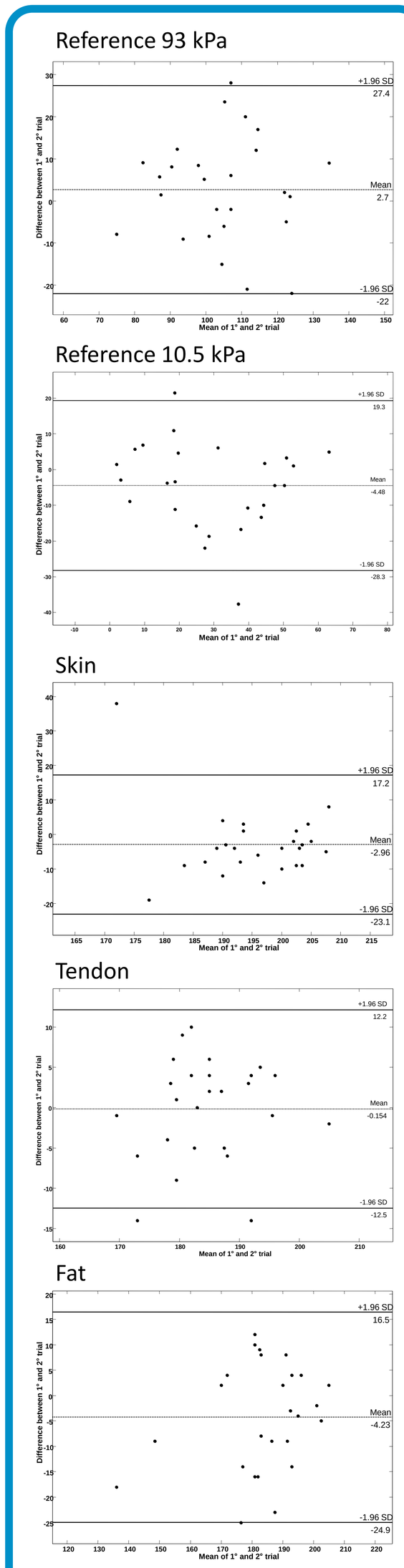


**Figure 3** Bland Altman plot for reliability of different tissues.

## CONCLUSIONS

Preliminary results shows good reliability of RTE using an external reference material especially on Achilles tendon. Due to the high color scale Dynamic Range, tissues seems to have very little color difference between each others. The high reliability might be influenced by this color homogeneity.

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