

Shear wave elastography for cervical disc characterization: a feasibility study

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Background

Intervertebral disc (IVD) plays an important role in spine biomechanics. Magnetic resonance is currently the reference technique to assess cervical IVD [1]; it allows the evaluation of disc's morphology, but it currently gives no information on IVD stiffness *in vivo*. Shear wave elastography is a recent ultrasound-based technique to determine biomechanical properties of soft tissues [2]. Preliminary *in-vitro* measurements in oxtail samples [3] showed good repeatability and correlations between shear wave speed (SWS) and disc's stiffness.

Aim

The aim of this study was to assess feasibility and reliability of shear wave elastography in cervical discs of healthy subjects.

Material and methods

Forty-seven healthy subjects (26 males and 21 females, 36.5 ± 12.6 years old, range 22-73, free of spinal pathologies and of neck or back pain) volunteered in this study. SWS was measured in C6-C7 or C7-T1 IVD with an Aixplorer (SuperSonic Imagine, Aix en Provence, France); three series of six measurements were acquired. On a subset of 6 subjects, measurements were repeated by 3 operators to assess reproducibility according to ISO 5725 standard. Correlations were analysed with Spearman's rank correlation coefficient (significance: 0.05).

Results

Average SWS was 3.0 ± 0.4 m/s (ranging from 2.2 to 3.9 m/s). Measurement repeatability and inter-user reproducibility were 0.2 and 0.3 m/s, respectively, corresponding to 7 and 10 % of average SWS. A correlation was observed between age and SWS (Spearman's $\rho = -0.68$, $p \ll 0.05$).

Conclusions and clinical implications

These results are preliminary, and the subject cohort will have to broaden to include disc diseases and spine deformities. However, results show good reproducibility and sensitivity to age-effect, thus opening the way for routine non-invasive characterisation of cervical IVD mechanical properties.

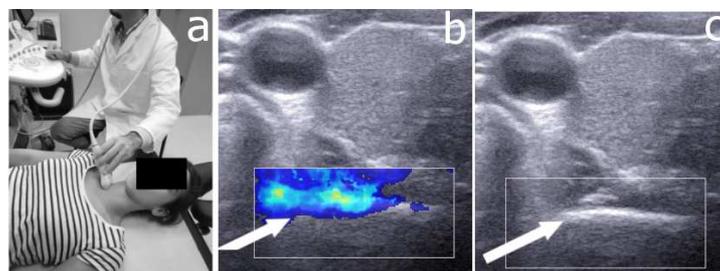


Figure 1. (a) Elastographic exploration of cervical intervertebral disc; (b) elastographic image and (c) standard B-mode.

Acknowledgements

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References:

1. Gibson MJ et al. J Bone Joint Surg Br (1986).
2. Tanter M et al. Ultrasound Med Biol (2008).
3. Vergari et al., (Submitted)