ULTRASOUND ELASTOGRAPHY FOR THE EVALUATION OF THE ELASTIC PROPERTIES OF THE THORACO-LUMBAR FASCIA AND BACK MUSCLES IN IDIOPATHIC LOW BACK PAIN

Bauermeister W.[1], Rassmann P.[2]
[1, 2] Schmerzinstitut, Munich, Germany

Introduction

The manual assessment of of fascia and muscle stiffness in low back pain is an integral part of the physical exam. Unfortunately, palpation is limited to superficial structures with a high stiffness contrast leaving out subtler or deep lying changes which affect the mechanical and pain generating properties of the myofascial system. Indirect clinical tests like joint range of motion, strength, function or muscle tone provide information about the functional system as a whole but no specific information about the pathology of one muscle and the fascia. One major pathology which changes the mechanical properties, causes low back (LBP) and pelvic girdle pain are Myofascial trigger- points (MTrPs) or trigger - areas. Since they cause only hardness but no obvious structural changes they do not appear on X-Ray, MRI, CT-Scan or Ultrasound and therefore are not even considered as a differential diagnosis. Unlike these inappropriate techniques Ultrasound Elastography (UE) shows the hardness of the fascia and the muscles and is emerging as a new diagnostic tool in musculoskeletal medicine. With UE it is possible to image the mechanical changes which affect the joint range of motion, force generation, muscle function, posture and pain. UE allows to differentiate between healthy and diseased myofascia, it can help to evaluate treatment approaches and to develop new rehabilitation strategies.

Purpose/Aim

To evaluate the ability to visualize hardening of the fascia and muscles. To compare the advantages and limitations of Shearwave (SUE) - and Compression (CUE) – Elastography and to test the Interrater-reliability.

Materials and Methods

Population: n=40; 28 f, 12 m -, age $\bar{x}$=54 years, with a history of LBP. Examination of the Trapezius, TLF, Hips and legs. The CUE with Ultrasonix-Tablet (Analogic, USA) and Aplio 500 (Toshiba, Japan) tested the reliability to pick up a difference of the yellow–red pixel count $\geqslant$ 20% comparing corresponding body sites. SUE with Aixplorer (Supersonic, France), and Aplio 500 (Toshiba, Japan) tested the hardness in kPa. Prior to the in vivo exams the CUE and SUE was done on a gel phantom with fascia and muscle inclusions (Ulm University, H. Jäger) and on a Elasticity QA Phantom Model 049A (CIRS, USA).

Results

SUE: Gel-phantom and in vivo testing showed a significant number of artifacts and inconsistent finding. The depth of penetration of the shearwaves was limited to 2,5–3,0 cm. The Interrater-reliability showed no agreement with K=0,2. CUE showed a substantial agreement with K=0,8.

Discussion

SUE claims to be operator independent, a notion which cannot be upheld for musculoskeletal applications at the present time. The limited depth of penetration makes it more usable in superficial but not in deeper areas. The measurements have to be done after the acquisition of the images which is time consuming. CUE is real time, is operator dependent but shows a good Interrater-reliability when only the differences between corresponding body sites are evaluated.

Conclusion(s)

Idiopathic LBP requires a complex evaluation of the musculoskeletal system to locate the cause of the pain like MTrPs, which can be located well above or below the pain site. They present as focal or areal hardening of the facia (TLF) and muscles and can therefore be visualized only with UE but not with conventional imaging techniques. Often they are located deeper than 3,0 cm where SUE has reached its limits. Therefore, at the present time CUS appears to be the best approach since it can reach into deeper tissue areas, it is real time and has an excellent Interrater reliability.

Keywords

Ultrasound Elastography, Sonoelastography, Fascia, Muscle, Trigger points, Low Back Pain

Disclosure of Conflict of Interest:
W.B. disclosed no relevant relationships. P.R. disclosed no relevant relationships.