MEASUREMENT OF SKELETAL MUSCLE CROSS-SECTIONAL AREA WITH ULTRASONOGRAPHY
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Introduction
Magnetic resonance imaging (MRI) has been a commonly used method when assessing the cross-sectional area (CSA) of skeletal muscle. However MRI is expensive and its accessibility is often low and therefore cheaper and more accessible alternative method is needed. B-mode ultrasonography (US) can be used to produce high quality cross-sectional pictures and it has been shown to be comparable to MRI when measuring muscle CSA in vivo (Reeves et al. 2004). Moreover, the modern US apparatus can create panoramic ready to analyze 2D images making the measurement and analysis of large muscle CSA easy and quick. The purpose of this study was to investigate the reliability of US panoramic method when measuring the CSA of vastus lateralis (VL) muscle.

Methods
34 untrained young men volunteered as subjects. After 20 min of rest in a supine position the B-mode ultrasound (GE Logic e, USA) with panoramic software (Logic view) was used to create full CSA images of VL. An especially crafted probe support which assured the angle of probe and divided pressure even to the skin was used. The MRI (GE Signa CV/i 1.5T, USA) measurement was performed within 30 min after the US measurement. During both the US and MRI measurements the subject was laying relaxed in an identical position with legs 15 cm apart and firm cushion (10 cm) under the knees. The US and MRI images were taken from the midpoint of lateral knee joint surface and spina iliaca anterior superior (PROX) as well as 2 cm (MID) and 4 cm distally (DIST) along the quadriceps muscle. Image-J (National institute of health, USA, version 1.37) software was used for analyzing both US and MRI images. Three US images from each position were collected and the mean was taken as the CSA result.

Results
Coefficient of variation between three consecutive measurements of CSA with US was 2.7 ±1.61%. The CSA were at PROX 30.2 ±1.61 cm² and 27.2 ±1.61 cm², at MID 30.7 ±1.61 cm² and 27.5 ±1.61 cm² and at DIST 29.4 ±1.61 cm² and 26.8 ±1.61 cm² in MRI and US, respectively. The correlations between the US and MRI measurements were r=0.88 (p<0.01), r=0.91 (p<0.01) and r=0.84 (p<0.01) at PROX, MID and DIST, respectively.

Discussion
In the present study a new panoramic technology was used in joining the US images received from VL. The results indicate that the present US method is reliable when measuring the CSA of thigh muscle. The differences in CSA between the US and MRI methods can in part be explained with the differently aligned scanning axis since MRI was measured vertically to table surface and US vertically to skin surface. However, the data suggest that the present US method may be a practical alternative tool for assessing muscle CSA. In future the capability of the US panoramic method to detect changes in locomotor muscles due to training, disuse and aging should be studied.

References

Keywords: Muscle, Hypertrophy, Reproducibility