Examensarbete 30 hp i Medicinsk Teknik

Development of image processing methods to study the fascia in muscles

Medicinsk teknik FoU är en forsknings- och utvecklingsavdelning vid Centrum för Informationsteknik och Medicinsk teknik på Norrlands universitetssjukhus, Region Västerbotten. Avdelningen bedriver internationell forskning, utveckling och utbildning inom det medicintekniska området, med kompetens inom exempelvis sensorer och mätsystem, bild- och signalanalys och biomekaniska modeller. MT-FoU står också bakom kompetenscentret AI for Medicine in Northern Sweden, AIM North, som stöttar kliniska forskningsprojekt med teknisk metodkompetens inom maskininlärning och AI.

Background

Up to 50% of the body's mass comprise muscle tissue. Musculoskeletal conditions affect 1.7 billion people world-wide, and is rapidly increasing with the shift in growing elderly population (WHO). Skeletal muscle tissue comprises two main components – the muscle fibres and the fascia – both with individual physiology and pathology. However, there are no methods for in-vivo study of the micro fascia and its dynamics. The skeletal muscle fascia (about 10% of muscle mass) is a mesh of connective tissue. A key challenge to image these structures is that the thickness of the fascial structures range from 1-5µm on the finest level, 5-20µm on the intermediate level, and 0.5-1mm on the thickest structures. And the resolution of most imaging systems is ~0.1-0.5 mm. In our research group we have developed an initial method – Vibration Localization Microscopy (VLM) that shows promising resolute, but we need to explore more methods for this task. If methods to study the fascia were available it could be used for several important applications including the study of muscle fall trauma treatment, monitoring treatment, pre-surgery planning, sports science applications, and muscle disuse during space flight.

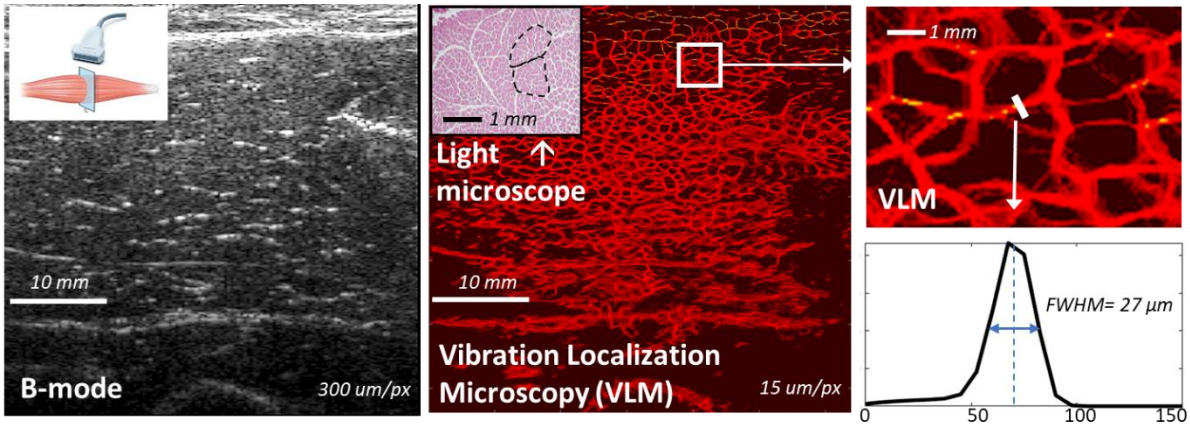

***Fig 1** – Left: anatomical ultrasound image of a muscle. Middle: Vibration Localization Microscopy image (VLM). Right: Cropped VLM image show a potential perimysium fascia of about 1mm diameter which is similar to those seen in light microscopy (middle) of typical skeletal muscle tissue (pink=muscle fibres, white=fascia).*

Aim

Develop/implement and evaluate methods to image the fascial structures (e.g super-resolution techniques).

Work description

Details will be decided together with the master student.

References

Rohlén et al., Scientific Reports, Nature Publishing Group, 2020
Ali et al., Biomedical engineering Online, 2022

Handledare vid Medicinsk teknik FoU
Christer Grönlund
CIMT, Medicinsk teknik – FoU, Region Västerbotten
E-post: christer.gronlund@regionvasterbotten.se, Web: https://www.regionvasterbotten.se/medicinsk-teknik-forskning-och-utveckling