00355 A Novel Segmentation Method for Anatomically-challenging Scapholunate Interosseous Ligament From Magnetic Resonance Images

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Aims: Medical image segmentation is a process of dividing medical images into regions. For segmenting small tissues such as scapholunate interosseous ligament (SLIL), the challenges are anatomical size, variability, soft tissue heterogeneity and closeness in grayscale intensity of surrounding soft tissues. This study aims to develop an opensource MATLAB program to accurately segment the SLIL and validate it using commercially available image segmentation software.

Methodology: Magnetic resonance images of 0.5 mm resolution were acquired for one cadaveric rightwrist. We developed a MATLAB (MathWorks, Inc., Natick, Massachusetts, United States) program based on Chan-Vese active contour algorithms to segment and reconstruct a 3D SLIL model. Firstly, a total of 6 models were obtained by a single operator and then compared with corresponding models segmented using Mimics (Materialise NV, Leuven, Belgium) based on median absolute volume. Secondly, Dice similarity coefficient (DSC), a ratio representing the degree of volumetric overlap between two segmentations ranging from 0 (no overlap) to 1 (perfect overlap), and Hausdorff distance (HD), a measure of distance between surfaces of two segmentations, were calculated and analyzed for each model.

Result: The median volumes of SLIL segmented using MATLAB and Mimics are 182.4 mm3 and 183.8 mm3, respectively. Non-parametric Mann-Whitney U test indicated that there was no statistically significant difference in volumes between segmented models using MATLAB and Mimics ($p = 0.47$). The mean DSC and HD were calculated to be 0.78 (± 0.06) and 0.3 mm (± 0.04 mm), respectively.

Conclusion: Our results show that SLIL segmentation using our MATLAB program produces similar absolute volumes, relatively high volumetric overlap and small surface-to-surface distance between the two segmentations of interest, as compared with that of using Mimic. The developed segmentation method could potentially be a low-cost alternative for segmentation of small ligaments to model various pathomechanics of ligament injury and joint instability.