Title:
Steady State Free Precession MRI Anatomical Analysis and Cartography of the Human Hand

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Conflicts of Interest:
The Authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Background:
The depth and location of neurovascular bundles in the hand has been recognized as useful in pre-surgical planning, improving patient understanding and satisfaction, reducing post-operative complications, administering neural blockades, calculating dosage for laser therapies, developing prosthetics, and in many other applications. However, live, human data regarding the average depth of neurovascular bundles in relation to body mass index is lacking. This study seeks to address the absence of quantified data concerning the depth and distribution of various tissues within the human hand by mapping the depth and relative location of the neurovascular bundles, tendons and bones. The data will identify morphological characteristics of nerve and hand tissue, correlating their spacial relationships with demographic variables and body mass index.

Methods:
30 subjects with no known hand injuries or chronic conditions were recruited. Height, weight, sex, and age were recorded. Patients were then subjected to a 3 tesla MRI scan of their right hand using a constructive interference in steady-state (CISS) MRI sequence. A template average of 10 randomly selected scans was generated. Segmentation of anatomical structures were performed on this template.

Results:
13 male and 17 female subjects were successfully scanned and interviewed. Average subject age was 28.7 (range 20-51), and average BMI was 23.8 (range 19.0-32.0). Template segmentations were successfully extrapolated to all 30 individual scans.

Discussion:

Further segmentation of the hand template is required to include all structures of interest. Once segmentation of the template is complete, computational extrapolation will be employed to autonomously segment each individual scan from the study population. Heat maps will be generated using this data to show the mean distances between designated structures of the human hand, exposing any variation due to age, sex, and BMI.