Static MRI Measurements and Analysis of the Healthy Levator Muscle in the Soft Palate

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Abstract: Cleft palate deformity is one of the most common birth defects in the US and 25% of cleft palate repair surgeries fail for unknown reasons. Computational modeling of muscles in the soft palate would allow for better insight and a physiological explanation to further improve the outcome of cleft palate repair surgery. A previously developed MATLAB line segment model of a healthy levator veli palatini muscle in the soft palate was created to predict muscle shortening. This geometric model's predictions are based on input lengths from static MRI measurements of six healthy subjects. The first aim of this research project was to validate the static MRI measurement accuracy between multiple users. I performed four sets of measurements for each subject and I had four separate volunteers perform the same measurements on Subject 1. The variances between my measurements and the volunteers' measurements were minimal and the most sensitive measurement parameters only altered the MATLAB muscle shortening predictions by up to 4%. The second aim of this research project was to compare the MATLAB model predictions to the newer, more accurate dynamic MRI measurements taken by graduate student Katie Pelland. The difference in percentage of muscle shortening between the static and dynamic data ranged from 6% to around 16%. The data collected from this second aim shows room for improvement in the MATLAB model. In conclusion, the current MATLAB model does a good job of explaining the theoretical reason of the levator muscle involvement but there's still areas of improvement. As we work towards improving the model, the static data and the dynamic data will only become more accurate and closer to one another.

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