Muscle Recruitment Strategy for Musculoskeletal Modeling of the Shoulder

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Abstract: Musculoskeletal modeling software has the potential to open new pathways in biomechanics and human factors analysis and research. However, the output of these models is only as good as the model itself. Decisions made when setting up the model can drastically alter the results and output of the model. Musculoskeletal models rely on optimization algorithms, called muscle recruitment strategies, to determine muscle activity required to perform the modeled task. In this research, five participants were recruited to perform a static and dynamic task at 3 weight levels (2.5, 5, and 10 lbs) while upper body motion capture data and electromyography data of muscles driving the shoulder were collected. Each trial was modeled in AnyBody Musculoskeletal Modeling System with each of the six available recruitment strategies. Correlation analysis was performed between the electromyography data for each muscle and the corresponding muscle activity output of the musculoskeletal model to determine which muscle recruitment strategy resulted in the most accurate reproduction of the muscle activity of the participants. Poly4 and Min/Max had the highest correlations for dynamic and static tasks, respectively.

Keywords: Musculoskeletal Modeling, Recruitment Strategies, Shoulder