Comparison of Muscle Activation Patterns and Upper Extremity Kinematics during a Pull-up Exercise: Comparison of a Pronated Grip, Supinated Grip, and Perfect•Pull-up™ Twisting Handles

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ABSTRACT (Limited to 300 Words):

This project was approved by the Mayo IRB (# 09-006510). All subjects signed an approved consent form.

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PURPOSE: This study compares a conventional pull-up and chin-up with a combined pull-up/chin-up using Perfect • Pullup™ twisting handles to determine if kinesiological differences exist.

SUBJECTS: Twenty-five healthy subjects 21 men (24.9±2.4y) and 4 women (23.5±1.0y) volunteered to participate.

METHODS AND MATERIALS: Raw EMG signals from the dominant arm were collected with DE-3.1 double differential surface electrodes at a sampling frequency of 1000 Hz. Maximal voluntary isometric contraction (MVIC) of each muscle was performed. Subjects completed 3 consecutive repetitions of each pull-up exercise (pull-up, chin-up, Perfect • Pullup™) in random order, using a metronome for pacing. EMG signals were normalized to each muscle's respective peak activity in the MVIC trial and expressed as a percentage. Motion analysis data of the elbow was obtained using Vicon MX20+ cameras and interpreted with Vicon Nexus software version 1.4.116.

ANALYSES: A one-factor repeated measures ANOVA was used to examine the muscle activation patterns and kinematic differences that existed between the three pull-up exercises.

RESULTS: Average EMG muscle activation (%MVIC) were as follows: latissimus dorsi (122.2±47.1), biceps brachii (89.1±32.2), infraspinatus (75.0±54.2), lower trapezius (50.3±20.9), pectoralis major (49.9±29.8), erector spinae (40.1±26.6), external oblique (33.2±22.1). The arc of motion at the elbow joint was determined to be 44.7°±10.2° to 142.9°±10.1° of flexion. Muscle activity for the concentric and eccentric phases of the pull-up exercises was also determined through correlation of the EMG and motion analysis data. Significant differences were not found between the Perfect • Pullup™ and the pull-up or chin-up. However, significant differences do exist between the pull-up and chin up.

CONCLUSIONS: The manufacturer’s claim that the Perfect • Pullup™ is superior in muscle activation was not demonstrated according to the results of this study.

IMPLICATIONS: Based on EMG activation from the 7 muscles observed, the Perfect • Pullup™ does not appear to enhance muscular recruitment when compared to the conventional pull-up or chin-up.