Utilizing One-Repetition Maximum Testing to Guide Dosing and Measure Strength Changes During an Intensive Strength Training Program
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Background
In pediatric physical therapy, it is often difficult to objectively quantify muscle strength using manual muscle testing or hand held dynamometry due to decreased participation, impaired cognition, compensatory movement, or availability of dynamometry equipment. One repetition maximum (1-RM) testing is an alternative method to objectively quantify strength and set intensity for strengthening interventions. 1-RM testing is defined as the maximal amount of weight that can be lifted at one time through a subject’s complete range of motion. This poster highlights the clinical implementation of a standard method to determine the 1-RM of hip and knee musculature in order to optimize training intensity and objectively measure strength changes during a six week intensive strengthening program for children with neurological impairments.

Methods
The 1-RM for three specific exercises was identified during observational gait and movement analysis. The weight for each exercise was gradually increased until the child could only complete one isolated repetition, without compensation, through the available joint range of motion. Participants completed an intensive therapy program consisting of three 2 hour sessions per week for a total of six weeks. Strength training intensity was set at 60-80% of the 1-RM based on recommendations by the NSCA and ACSM. The training volume was set at three sets of ten repetitions for each of the three exercises. The training weight was evaluated throughout the treatment program and increased systematically based on the patient’s ability to perform the maximum number of repetitions and sets without compensation. 1-RM was re-evaluated upon completion of the program to assess strength changes.

Results
Determination of the 1-RM allowed therapists to objectively determine an appropriate strength training intensity for single plane lower extremity exercises when initiating an intensive strengthening program. In addition, re-assessment of the 1-RM following intensive training indicated participants gained strength in the specific muscle groups targeted throughout the program.

Results are reported in tables and charts above.

Significance
Isolated strengthening allowed participants to focus on simple movements to gain basic strength as suggested by a critical review of strength training by Verschuren and colleagues. The 1-RM also provided an effective means of objectively measuring strength changes following training by decreasing the risk of examiner bias or equipment error that may influence hand held dynamometry and manual muscle testing. Furthermore, the 1-RM test allowed strength to be measured on participants who are unable to conceptualize isometric muscle contraction required for manual muscle testing due to impaired cognition.

References: