301 - Excellence - 25 - Strength Tester- Executive Summary
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Lower Extremity Strength Testing Device

During and after pregnancy, it is common for women to experience a loss of strength and an increased laxity in the muscles and joints of the pelvic girdle. This can cause pain and discomfort. According to H.S Robinson et al., 2010, 52% of pregnant participants experienced pelvic girdle pain. In the study by Albert et al., 2003, 8.5% of women were experiencing consistent pelvic girdle pain even 2 years postpartum. Women who experience pelvic pain during their first pregnancy are also likely to observe a recurrence and worsening of symptoms with subsequent pregnancies. Previous research has shown that the force generated by the hip flexor muscles during the active straight leg raise correlates well with pelvic instability. Thus, one of the current methods that clinicians can use to assess pelvic strength, and diagnose pelvic instability, is the active straight leg raise (ASLR) test. In this test, a patient performs a straight leg raise and rates the difficulty of doing so on a scale of 0-5, with a 5 being the highest difficulty. If the patient does not give a rating of 0, the patient performs the leg raise again while the clinician compresses their hips. If this extra pressure makes the straight leg lift easier for the patient to perform, this is indicative of pelvic instability. While this test is useful, more quantitative data is needed to develop robust criteria for diagnosis, which will increase the reliability of diagnoses and assessment outcomes. To address this need, the team designed a device that can measure the maximal voluntary contraction (MVC) of the hip flexor (iliopsoas) and knee extensor (quadriceps, rectus femoris) muscles during a straight leg raise task.

The team designed a lower extremity strength testing (LEST) device that can accurately measure MVC, is comfortable and adjustable for the patient's height, and can be transported easily. Our final design includes a rectangular base plate, with one end attached to a metal frame that has load cells integrated into the vertical supports, and a push plate rigidly attached to the metal frame. During the test, the patient will lay in a supine position on the base plate, and the height of the metal frame will be adjusted so that the push plate rests above the anterior side of the patient's ankle. The patient will then perform an active straight leg raise against the push plate, and this force will be measured by the load cells. Force plate testing will be performed with known weights to compare with the LEST device. This will establish whether the LEST is a suitable alternative to the force plate within 0.2% accuracy.

Implementing the LEST device as a research tool for studying pelvic instability will allow clinicians to collect quantitative data that can be used to precisely monitor changes in strength over time and detect differences between subject groups. This information will be used to establish criteria for diagnosis and for investigating correlations between pain and hip flexor strength. Furthermore, the efficacy of various treatment and physical therapy options will be evaluated by collecting data using this device. In addition to pelvic instability, the LEST is able to be used for studying other conditions affecting the strength of other muscles, such as the ACL and lumbopelvic muscles.

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