LEST
(Lower Extremity Strength Tester)

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Overview

- Problem Statement
- Background Information
- Design Specifications / Testing Procedure
- Design Alternatives
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- Future Work
- Acknowledgements / References

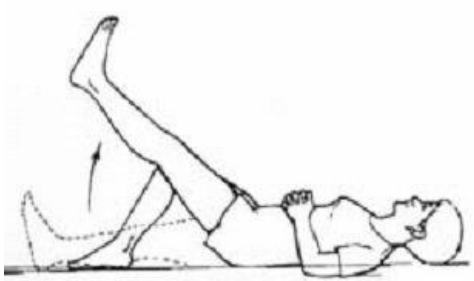
Problem Statement

Provided-

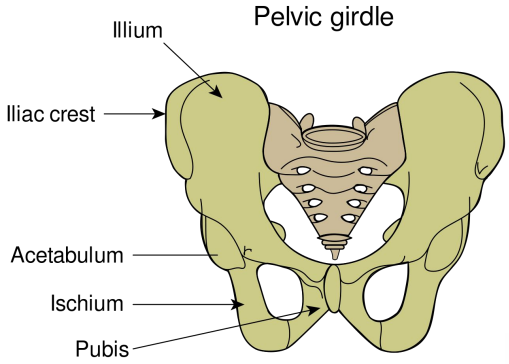
- A device is needed that can assess a maximal voluntary contraction (MVC) of the hip flexor/knee extensor muscles of an adult female during a straight leg raise task.

Added -

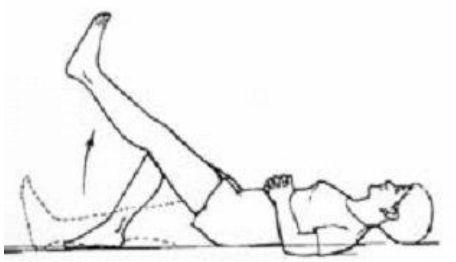
- Measurement of this MVC will occur at the ankle.
- The device must operate in accordance with a strict testing procedure.



Background



1. Pelvic bones -Illium and Sacrum
2. Effects of childbirth on pelvic floor muscles
3. Straight leg raise
    a. Hip flexor (iliopsoas) contracts to raise the leg
    b. Knee extensors (quadriceps, rectus femoris) stabilizes the leg
    c. Tests pelvic instability



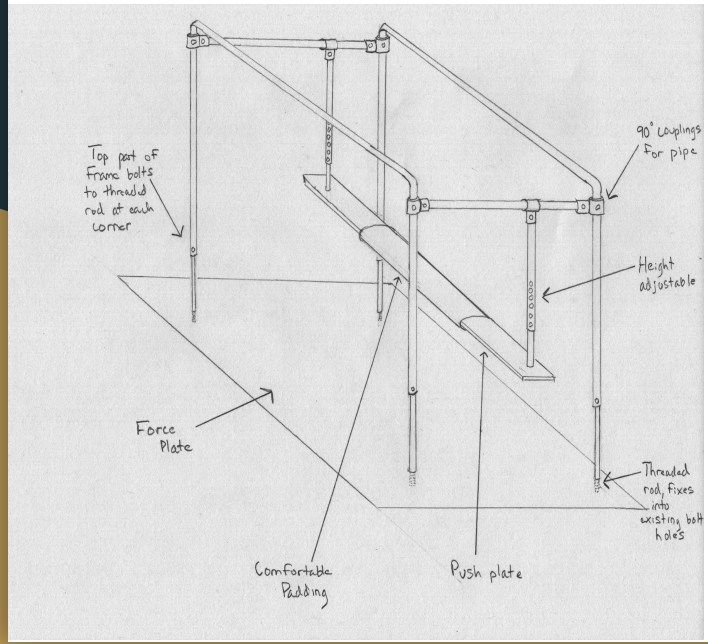
4. The straight leg raise can be used to determine the muscle strength associated with pelvic pains postpartum.
    a. Client would like to quantitatively measure the effects.
5. Testing Procedure

Design Specifications

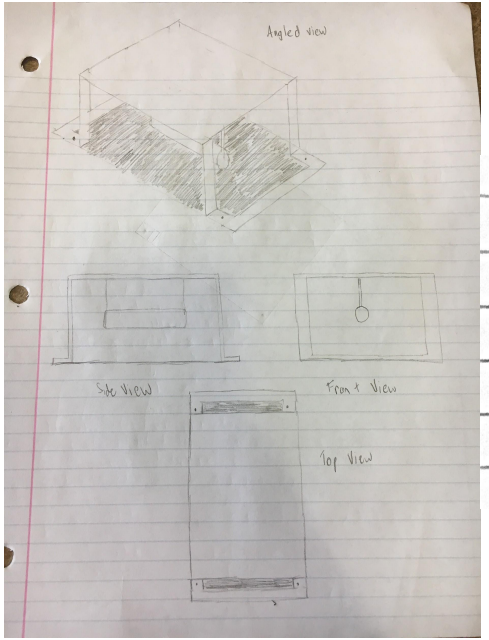
- Portability - move between locations, easy to assemble.
- Strength requirement - withstand MVC from lower body of adult female performing leg lift.
- Must be in place and ready to use within 60 seconds of fatiguing task.
- A budget of $1000 must be kept.
- Has to accommodate a supine test subject.
- Subject should not have to hold onto device and device must be fully fixed in place.
- Must be compatible with provided force plates.
- The surface in contact with subject must not be uncomfortable to the point of causing pain, but must also not be too soft as to absorb the force of the MVC.
- Must be compatible with intended testing procedure.

Design Alternatives

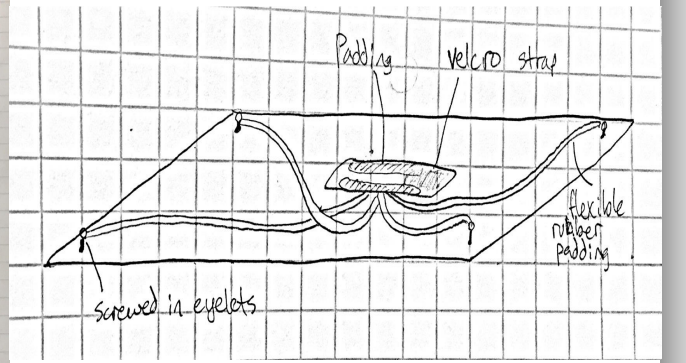
The Jungle Jym



The Box



The Rubber Hose



Design Matrix

Design Criteria	Design One - Jungle Gym	Design Two - The Box	Design 3 - Rubber Hose
Ability to Accurately Measure MVC (30)	5/5 30	4/5 24	2/ 5 12
Quickness of data collection after fatiguing task (25)	4/ 5 20	4/ 5 20	5/5 25
User Comfort (15)	4/ 5 12	4/ 5 12	4/5 12
Ease of Fabrication/Assembly (15)	3/ 5 9	3/ 5 9	5/5 15
Aesthetics (5)	5/5 5	4/ 5 4	1/ 5 1
Cost (5)	3/ 5 3	3/ 5 3	5/5 5
Safety (5)	5/5 5	5/5 5	3/ 5 3
Total (100)	84	77	73

Future Work

- Revise The Jungle Gym Design
  - Add feature to allow push plate to swing upwards
  - Add rest bars on each side for foot not being tested so it doesn't come into contact with force plate.

- Maintain collaboration with client on design as it develops to ensure the final product has all of the necessary features.

- Begin ordering of parts and fabrication.

References and Acknowledgements

Advisor: Dr. Wan-Ju Li

Client: Dr. Bryan Heiderscheit

Dr. Rita Deering

References:

Deering, RE et al (2018). Fatigability of the lumbopelvic stabilizing muscles of women 8 and 26 weeks postpartum. Journal of Women's Health Physical Therapy. In press.