Clinical and Lab Based Measures of Physical Status Following Rehabilitation for Ankle Fractures

Jeffrey Houck, PT, PhD, Michaela Bailey, Maya Bernadett-Peters, Alexandra DeAvila, Melissa Law, Mariah Murchison, Paulina Shackelford

Introduction

Ankle fractures are one of the most common injuries of the lower extremity. A recent study shows that rapid functional gains over the first 6 months after an ankle fracture are common, but there are little to no gains 18-24 months into the recovery cycle (Beckenkamp, 2014). When looking at how well patients recovered after surgery, patients are categorized as having good recovery yet are still unable to return to their previous level of sport (Hong, 2013). This brings up the issue of whether there are performance based tests that would be appropriate for ankle fracture patients to determine return to sport or higher level activity. The purpose of our study was twofold: first, to determine if ankle fracture patients demonstrate functional strength and ROM deficits after completing typical rehabilitation following an ankle fracture. Second, if there are superior clinical tests to capture these deficits that they may exhibit.

Hypothesis

We hypothesize that there will be differences in biomechanical force data and clinical test data of control subjects vs. ankle fracture patients. Clinical tests will correlate with biomechanical force data when determining if a patient is ready to return to sport after an ankle fracture.

Methods

Clinical tests and biomechanical lab data were performed on controls and patients who suffered from an ankle fracture. Ankle fracture patient subjects were required to have completed physical therapy. Control subjects were required to have no history of an ankle fracture and at least one year without any ankle injury.

- There were two ankle fracture subjects, both female with left unimalleolar fractures (44 years old and 66 years old).
- There were 10 total control subjects, 5 in “younger” population group (ages 27-31), and 5 in an “older” population group (ages 43-62).

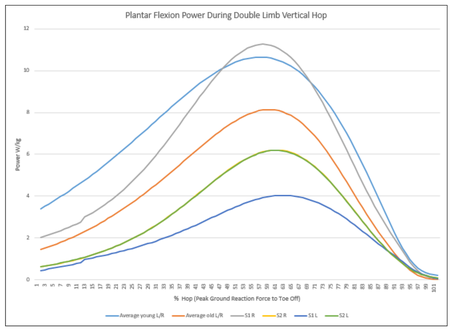
All subjects completed self report functional outcome measures: Lower Extremity Functional Index (LEFI), and the Foot and Ankle Ability Measure (FAAM).

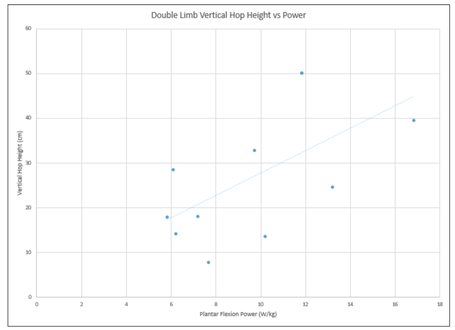
All participants completed the following clinical and biomechanical lab tests:

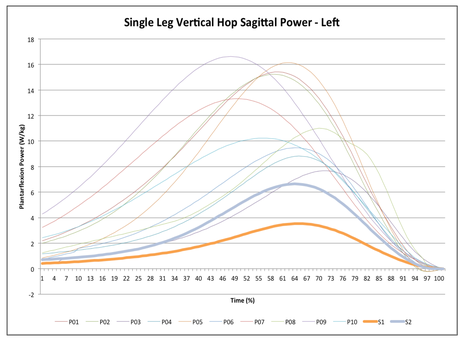
Clinical Tests:	Motion Analysis Tests:
Ankle DF wall test (bent and straight knee)	Subtalar Joint Neutral
Navicular Drop	Hindfoot Eversion
Heel Raise	Ankle DF (bent and straight knee)
Double Leg Vertical Jump Height	Double Leg Vertical Hop Test
Single Leg Vertical Jump Height	Single Leg Vertical Hop
Double Leg Lateral Hop over single line	Single Leg Lateral Hop
Double Leg Lateral Hop over 30 cm	Single Leg Medial Hop
Single Leg Lateral Hop over single line	
Single Leg Lateral Hop over 30 cm	

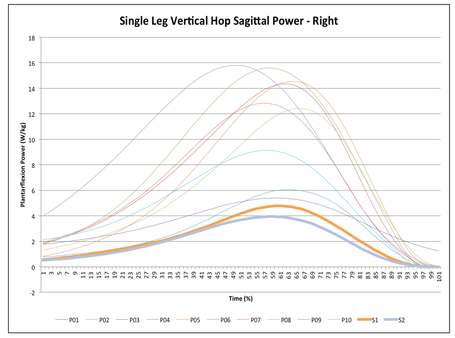
Results

- DF moment and power decreased bilaterally for all vertical and lateral/medial hops (see graphs).
- There was less change in range of motion bilaterally during all hops. (ankle fracture patients start in average DF angle but end in less PF for vertical hops. For lateral/medial hops ankle fracture patients start in decreased DF ROM and end in less PF ROM (lower change overall), and demonstrate less eversion range than inversion.
- Jumping height in clinical tests do correlate with ankle power graphs for single leg vertical hops.
- Heel rise test: younger population controls were able to do more (R: 32.6, L: 28.6) than older population controls (R: 20.25, L: 16.5), ankle fracture patients (R: 12.2, L: 10.0) were lower than older population (aged matched norm).
- Correlation for DLVH power vs. height was r=0.63, where 0.5 shows moderate correlation. The p value is 0.051



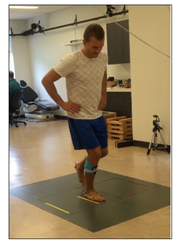






Discussion

- Bilateral changes in ROM and power generation seen in ankle fracture patients due to being overall weaker and deconditioned.
- The heel rise test is not a good predictor of return to function after ankle fracture because it does not expose lasting deficits.
- A “floor effect” was seen in both lateral and vertical hops
- Jumping height involves a combination of ankle, knee and hip movement. Knee and hip movement can compensate for the ankle and contribute to height.
- Single leg hop tests aren’t the best indicator for return to function for those in the older population since many don’t have to do tasks that involve the same type of skill. Younger patients that are returning to sports would benefit more from these types of tests since they often have to do movements that require the same skills.
- A test is needed that is easier than a lateral hop and harder than the heel rise test in order to get a true picture of the deficits and functional ability of those recovering from ankle fractures.
- A shuttle jump may be more advantageous since you would be able to decrease resistance to less than body weight and it would be simple to implement clinically.
- We’re unable to come to a conclusion when comparing biomechanical and clinical lateral/medial hops due to variability in patients and controls being able to complete the tasks.



Declarative Statement

Ankle fracture patients are able to generate less power for double and single leg vertical hops compared to controls, and demonstrated decreased range of motion, bilaterally, after completing rehab.

References

Beckenkamp, Paula R., et al. "Prognosis of Physical Function Following Ankle Fracture: A Systematic Review With Meta-analysis." journal of orthopaedic & sports physical therapy 44.11 (2014): 841-851.

Hong, et al. Functional Outcome and Limitation of Sporting Activities After Bimalleolar and Trimalleolar Ankle. Fractures. Foot & Ankle International. 34(6): 805-810.

Lin, C. “Effects of Rehabilitation after Ankle Fracture: A Cochrane Systematic Review”. (2009)

Psatha, Maria, et al. "A longitudinal MRI study of muscle atrophy during lower leg immobilization following ankle fracture." Journal of Magnetic Resonance Imaging 35.3 (2012): 686-695. 2000.

Schaffer, M., et al. Effects of Immobilization on Plantar-Flexion Torque, Fatigue Resistance, and Functional Ability Following an Ankle Fracture. Physical Therapy. 80(8): 769-780.