

Guidelines for Submission - Innovative Practice Award

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- Practice Setting: Hospital Based Outpatient Physical Therapy
- Innovation Name: Reliable Ankle Plantar Flexion Dynamometry

Practice Innovation Description:

Within the Innovation Description section of your application, please outline the following components:

- **Description of Practice Innovation:** In recent years Manual Muscle Testing (MMT) has received scrutiny due to lack of reliability. Use of Hand Held Dynamometry (HHD) has been promoted due to its increased inter rater and intra-rater reliability and objective data to assess progress. Use of ordinary HHD for the ankle plantar flexion strength measurement however is not precise due to several inherent problems, described here briefly.
 1. Examiner's strength: Average force production of the plantar flexion in a healthy individual exceeds 120 lbs. force. Applying this much force for many therapists is not feasible and ultimately the recorded value become a test of the examiner instead of the true ankle plantar flexion strength.
 2. Examiner's stance position: The style of examiner's stance (staggered versus square stance, etc.) adds another confounding variable that impacts the measurement. The height of the table in comparison to the height of the examiner during measurement will change the recorded data.
 3. Ankle position: When a HHD is used most of the time the ankle position moves from a neutral position (0-degree dorsiflexion) to a plantar flexion position which changes the direction of force and torque production. Variation in dorsiflexion angle changes the accuracy. Due to this change in position, the test is neither a make nor break test.
 4. Dynamometer specifications: Although HHD devices can record values higher than ankle plantar flexion, most of the time with the ankle motion they reach a cap (near 60 lbs.) and differentiation between the injured part and uninjured side becomes undetectable.
 5. Placement of HHD on the foot. The attachments of the HHD come in limited shapes and if the location changes proximally or distally, due to lever arm the final measurement varies.
 6. Current methods do not allow reliable measurement of the soleus strength test).
- Patient's position: When the HHD is used most practitioners use it in supine position or long sitting which results in new errors in measurement. Both positions have the potential for the treatment table to translate on the floor or the patient to slide on the treatment table.
- **Application of Practice Innovation:** Rehabilitation of complete Achilles tendon rupture, whether managed surgically or non-surgically, follows a stepwise protocol, which strength measurement is

a key assessment component of it. In a healthy individual, a single leg standing plantar flexion against gravity is used to assess the full strength. This test in a person who undergoes a full Achilles tendon rupture (repair or conservative) is contraindicated, however strength measurement is needed (progress assessment, patient education, insurance, etc.) before an individual is able to perform full weight bearing on one leg.

- **What makes it innovative?** The proposed method of Pull Dynamometry instead of MMT or Push Dynamometry will provide more accuracy in measurement of plantar flexion strength test (both soleus and gastrocnemius muscles).
- **Unique Attributes of the Innovation:** As a **prototype** we used the bars of a treatment table as an anchor and the patient are on the floor. This type of testing similar to quad and hamstring testing eliminates the need for the examiner to hold the dynamometer. It uses a strap foot attachment around the forefoot which can be used with shoes or without shoes. Because the patient is lying on the floor the likelihood of slippage is close to zero but can easily be controlled. If a grant is awarded, we plan to even design a measurement method to perform this test in standing which is closer to functional patterns. In the design of the final product, we plan to build in ways to measure ankle plantar flexion in neutral flexion, dorsiflexion and plantar flexion position to allow measurement of the strength in outer and ranges as well as mid-range, because patients often present with good strength in neutral but lack force production in inner ranges.
- **Impact on the Profession:** Physical therapy profession has always defined itself as science of healing and art of caring. In a data driven age when sports medicine physicians, insurance companies and quite frankly patients want objective data and decision about return to participation, play and performance are based on limb symmetry index and quantitative measures, instead of time-based protocols, we need reliable and valid assessment methods. Communicating with sports medicine physicians and all other stake holders is much more fluent and effective when accurate data is presented.
- **Impact/Relevance of Practice Innovation to Patient Care/Treatment:** We have used this method on a few patients who undergo rehabilitation for full Achilles tendon rupture, and it has been a tool to demonstrate the progress (or lack thereof) to the patient.
- **Outcomes of the Practice Innovation:** As mentioned above we have tested the new method on a few patients. In one patient MMT showed 5/5 ankle plantar flexion, a HHD showed 57 lbs. on both injured and uninjured ankle, the new method (**photo at the end of this document**) showed the injured ankle plantar flexion strength was 106 lbs. and the uninjured ankle strength was 126 lbs. This was tried multiple times and consistent results were produced. Obviously, we will perform a formal reliability pilot study in future.
- **Cost of Innovation:** One of the reasons providers do not use dynamometer is the cost. We should be able to design a system with the \$ 1500 grant allocation if awarded. In our final design, we would like to simplify the product so it can utilize the equipment in an ordinary outpatient clinic.
- **Training Required for Utilizing the Innovation:** Simple and can be accomplished in ½ hour.
- **Justify AOPT funding this Innovation:** Foot and ankle injuries are common in sports and recreational individuals, even in geriatric population. Invited speakers at AOPT promote the use of dynamometer in patient care, however the focus of these recommendations often is the knee

(ACLR) or shoulder (RCR). To the best of our knowledge, inexpensive and reliable ways of ankle plantar flexion has not been popularized in ortho and sports circles.

- Benefit(s)/Value to Clinical Practice: Better communication with patients, third party payers, referring physicians, a reliable method for assessing patient progress, and ultimately an easy method to be used in clinical setting and for potential research project.

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