

Does Eccentric Quadriceps Strengthening Increase Balance Control and Reduce Risk of Falls in the Elderly? A Pilot study

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Introduction

- Falls are a serious health concern for the elderly population – anyone aged 65 years or more. They are prevalent enough that 25% of older adults fall every year.¹
- Of those who fall, one in five suffer a serious injury such as a fracture or head injury.^{2,3} These injuries may lead to decreased strength and balance from sedentary behaviors during healing and recovery.
- The older adult may also be afraid of falling again and self-limit his/her activity resulting in increased weakness and subsequent risk of falls.⁴ Therefore, there is strong motivation to reduce risk of falls given this increased likelihood.
- Someone who has fallen at least once is twice as likely to fall again than someone who has never fallen.⁵
- Falls are linked to both public and personal health costs. Medicare costs associated with falls in 2015 were \$31 billion.⁶
- Eccentric exercise allows for high-force generation by muscles with lower oxygen consumption than in concentric exercise. These populations can perform eccentric exercise to achieve the strength gains required for safe ambulation that would be otherwise be too strenuous with concentric exercise.
- Research question: Is there an association between eccentric quadriceps strength and fall risk in a cohort of adults aged 65 and older? Null hypothesis: There is no association between eccentric quadriceps strength and fall risk in a cohort of adults aged 65 and older.

Methods

- A randomized control study examined the effectiveness of eccentric quadriceps strengthening on balance control and reducing risk of falls in the elderly population.
- Between 30 and 24 community dwelling adults will be recruited from the existing patient population at FYZICAL® Therapy and Balance Centers in Fort Myers and North Fort Myers, FL.
- The selection criteria includes community dwelling adults aged 65+ years, cognitively intact, able to provide informed consent, and self-referred or referred by a health care provider for physical therapy treatment for balance impairments as defined by a score of < 45/56 on the Berg Balance Scale and/or > 13.5 seconds on the Timed Up and Go (TUG) test.
- Participants will be randomly assigned to an intervention group (N=12) and a control group (N=12).

Methods

- Each participant will receive an orientation to the BTE™ Eccentron™ machine lasting roughly 15-minutes by a licensed physical therapist.
- The intervention group will train on the Eccentron™ for ten minutes each session following 30-minutes of standard balance training.
- The control group will complete 40-minutes of standard balance training.
- Voluntary balance control will be measured with the Limits of Stability (LOS) test to determine ability to reach outside base of support. Reactive balance control will be measured with the Motor Control Test (MCT) to determine the participants' ability to react to unexpected external disturbances. The Sensory Organization Test (SOT) will be used to determine if improvements were the result of eccentric strength training or concurrent physical therapy treatment.
- Functional outcome measures will be used to determine improvements using tools available in all clinical settings. The Berg Balance Scale (BBS), Timed Up and Go Test (TUG) and, Activities-Specific Balance Confidence Scale (ABC) will assess balance control, risk of falls, and fear of falling, respectively. All functional outcome measures will be assessed prior to beginning the study protocol, at completion of week 2, and at one week post-intervention.
- All functional outcome measures will be assessed prior to beginning the study protocol, at completion of week two, and at one week post-intervention.
- Participants will adhere to the following study schedule:

	Appointment 1	Appointment 2	Appointment 3
Week 1	TESTING 40 min	Treatment 40 min	Treatment 40 min
Week 2	Treatment 40 min	Treatment 40 min	TESTING 40 min
Week 3	Treatment 40 min	Treatment 40 min	(off)
Week 4	Treatment 40 min	Treatment 40 min	(off)
Week 5	(off)	(off)	TESTING 40 min

Results

- Currently in subject recruitment.



Data Analysis

- Data will be analyzed using a paired t-test to analyze pre- and post-training effect within a group, a one-way repeated measures ANOVA to analyze pre- and mid-training effect and mid- and post-training effect, and a two-way repeated measures ANOVA to analyze pre- and post-training effects between groups. Significance will be set at p<0.05.
- Changes will be examined in pre vs. post intervention balance control measures (Limits of Stability [LOS] and Motor Control Test [MCT]) and functional outcome measures (Berg Balance Scale [BBS], Timed Up and Go Test [TUG] and, Activities-Specific Balance Confidence Scale [ABC]) in the intervention group. Eccentric quadriceps strength will be examined between the intervention group and the control group.

Discussion

- If the hypothesis is correct, eccentric quadriceps strength training can be incorporated into physical therapy interventions for older adults as well as community based programs to reduce the risk of falls.
- Information regarding comparative effectiveness of the interventions could benefit participants and/or society by providing support for interventions that result in improved clinical outcomes.

Conclusions

- To be determined.
- Falls continue to be a significant health and safety concern for the elderly population.
- Future research should examine varying training protocols, different eccentric strength training times, and longer retention periods to determine effectiveness of eccentric strengthening.
- Future studies may also choose to focus on specific patient diagnoses instead.