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Research Article

A STUDY TO EXAMINE ANKLE FLEXIBILITY AND ITS CORRELATION TO FUNCTIONAL MOBILITY IN COMMUNITY DWELLING ELDERLY PEOPLE

Khyati Shah and Joseley Sunderaj Pandian T

Srinivas College of Physiotherapy and Research Centre

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ABSTRACT

Background: Ageing is associated with reduced ankle flexibility and reduced ankle flexibility impairs functional mobility that increases the risk of falls. To explore this in more detail, this study was conducted with the aim:

- To find out correlation between ankle flexibility and functional mobility in community dwelling elderly people.

Methodology: Fifty subjects (25 men and 25 women, mean age 73.24 ±7.05 years) residing in community were screened for inclusion and exclusion criteria and underwent Mini mental state examination. After explaining the procedures and gaining informed consent, tests for functional mobility and ankle flexibility were applied. Functional mobility was measured with Timed Up and Go Test. Ankle flexibility was measured with Universal Goniometer. Ankle flexibility data was correlated with functional mobility data using Pearson Product Moment Correlation coefficient.

Results: Correlation between passive ankle dorsiflexion range of motion and Timed Up and Go test was -0.675.

Conclusion: Significant Correlation exists between ankle flexibility and functional mobility in community dwelling elderly people.

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INTRODUCTION

In older adults, falls are the seventh leading cause of death in people over 75 years of age¹ and fall rates in persons 65 years of age and older are at least 33% per year in community dwelling older adults.^{2,3}

The three primary peripheral sensory inputs contributing to postural control are the bilateral receptors of the somatosensory, visual and vestibular systems.^{4,5} Although most falls involve multiple factors, causes of falling are often categorized into intrinsic and extrinsic factors.^{6,7}

Research shows that preservation of balance in elderly is fundamental to maintain functional mobility.⁸ Balance impairment is a major contributor to falling in elderly people.⁹⁻¹³ With aging, we lose muscle strength, proprioception and balance, resulting in increased falls.¹⁴ Amongst them, decreased force production in lower extremities has been identified as potential risk factor in those who fall when compared with those who did not,¹⁵⁻¹⁷ with the greatest compromise in ankle dorsiflexion force.¹⁵

Loss of joint range is considered to be part of the normal aging process¹⁸ and restriction of ankle range impacts many aspects of function. There is decrease ankle flexibility due to aging in mechanical properties and morphology of joint structures¹⁹⁻²¹ muscles and bones which contributes to an increased risk of fall. TUG is useful for predicting level of functional mobility²² with inter-rater reliability (ICC=0.98-0.99).²²⁻²⁴

Decreased flexibility in elderly also decreases their ability to recover quickly from perturbations. Lack of necessary range of motion would decrease the effectiveness of hip and ankle strategies. Moreover in previous studies concentration is given on assessing vision, vestibular function, peripheral sensation, strength and reaction time to examine the relative contribution of sensory motor factors functional mobility and risk of falling. It is likely that ankle flexibility have a detrimental effect on functional mobility that is independent of the influence of these factors. Hence, this study draws the attention towards the association of ankle flexibility with functional mobility.

Objective of the Study

To find out correlation between ankle flexibility and functional mobility in community dwelling elderly people.

*Corresponding author: **Khyati Shah**
Srinivas College of Physiotherapy and Research Centre

Ethical clearance: Ethical clearance was taken from the Ethical Committee of Srinivas College of physiotherapy and research centre, Mangalore.

METHODOLOGY

It is a Co-relational study with purposive sampling. Fifty Participants were taken. Community dwelling people (60 to 85 years) who can ambulate independently with and without walking aids and having minimum score of 23 on Mini Mental State Examination (MMSE) were included. Participants with Neurological problems, Musculoskeletal problems related to ankle, Visual problems, Uncontrolled hypertension, Severe ankle edema, Abnormal sensation in lower extremity, All foot abnormalities, Limb length discrepancy, Grade of less than 3 (Fair) on MMT were excluded. Materials used were Stop watch, Standard arm chair, Cone, Universal goniometer, paper, pen.

Procedure Participants included were explained details and purpose of the study and a verbal and written consent was obtained. The Cognition level of the subjects was assessed with Mini Mental State Examination (MMSE) which included Orientation, Registration, Attention, Calculation, Recall and Language and the minimum score for the inclusion in the study was 23 out of 30. Following MMSE, Functional Mobility Test i.e., Timed Up and Go Test was administered. Ankle flexibility i.e., passive ankle ROM was then checked in two positions, i.e., with knee flexed and extended both with the help of universal goniometer. Ankle flexibility was hence examined and correlated functional mobility.

Statistical analysis

To find out correlation between Ankle flexibility and Functional mobility, Pearson Product Moment Correlation Coefficient was used. Statistical software SPSS 11.5 was used analysis. Microsoft office excel 2007 was used for graphs, tables.

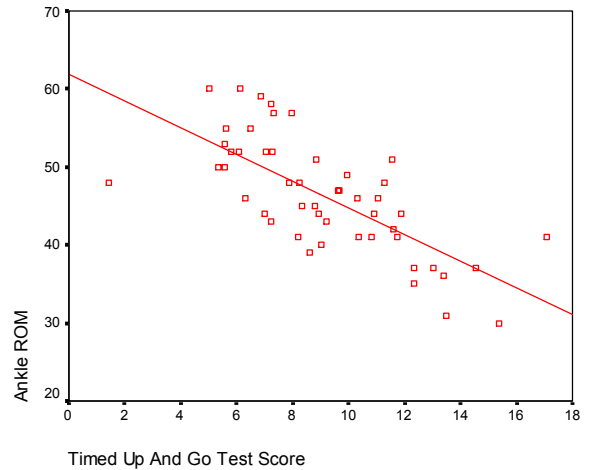
RESULTS

Correlation between TUG and ankle flexibility with knee flexed and extended.

Timed Up and Go Test	Knee flexed right	Knee flexed left	Knee extended right	Knee extended left	Knee flexed right & left	Knee extended right & left
R	-0.675	-0.688	-0.481	-0.583	-0.714	-0.579
P	0.000	0.000	0.000	0.000	0.000	0.000

Above table shows good correlation i.e., -0.714 between TUG and ankle flexibility with knee flexed position and low correlation i.e., -0.579 with knee extended position.

Following graph shows SCATTER GRAPH for correlation between TUG and Ankle DF ROM with knee flexed.



r = -0.714

DISCUSSION

The results showed a statistically significant reduction of passive ankle dorsiflexion range of motion in participants with increasing age. Decreased range of motion may be due to: Increased stiffness of the peri-articular connective tissue (due to changes in their mechanical properties with age), decreased movement about the ankle joint produced by a lower muscle force and decreased activity level.²⁵

There is significant reduction in functional mobility scores (TUG).²⁶⁻²⁸ These results may be due to normal age related variability because only asymptomatic healthy participants were included in the study.

It was also found that ankle dorsiflexion (passive) in sitting and lying had a negative correlation with scores on Timed Up and Go Test (knee flexed- -0.675, knee extended- -0.481). This implies that people with more passive ankle dorsiflexion range takes lesser time on the Timed Up and Go Test. This finding may indicate that decreased performance associated with restricted motion of passive ankle dorsiflexion may be due to non-contractile tissues such as capsule, ligaments, etc. rather than a short gastronemius muscle length.

Study done by Jason Buono *et al.* (2007) showed that in elderly adult (65 years) ankle dorsiflexion range of motion had a moderate to good correlation to performance and balance assessment that was ranging from 0.01 to 0.52 and therefore may be a predictor of falling.²⁷ In this study passive dorsiflexion range of motion was measured and functional mobility was assesed.

Study done by Hylton B. Menz *et al.* (2005), concluded that in older people aged 62 to 96 years foot and ankle characteristics, particularly ankle flexibility are significant independent predictors of balance and functional ability.²⁶ On contrary the results of study by Michael Chiacchiero *et al.*(2010) stated that in older people range of motion score was statistically significant in the faller group than in the non-faller group (p<0.05) there was no significance found between balance and flexibility/ range of motion (nonfaller: R² = 0.0407, fallers: R² = 0.0378).²⁹

A study done by Evans *et al.* (2007) also contradicted that in older adults neither muscle flexibility nor ankle dorsiflexion range of motion were correlated with balance, balance confidence or falls.³⁰ Thus on the basis of our study, when assessing the functional mobility of elderly we should not confine to the assessment of the nervous system alone. We should also take into consideration the changes in the musculoskeletal system as well.

Future Recommendations

Instruments like force platform and electronic goniometer can be used for better accuracy. Intervention studies including Joint mobilizations, stretching and strengthening exercises for foot and ankle that may improve ankle flexibility and hence improve functional mobility thus reducing the risk of falls.

Limitations of the Study

1. Sample size was small.
2. Discrimination of fallers and non-fallers was not done.
3. Factors -chair height, different types of footwear could have influenced study results.

CONCLUSION

There is significant correlation between ankle flexibility and functional mobility in community dwelling elderly people. Timed Up and Go Test resulted in higher correlation with passive ankle dorsiflexion range of motion with knee flexed position rather than knee extended position.

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