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Intra – Rater Reliability of Goniometer to Measure Weight Bearing Lunge Angle of Ankle Dorsiflexion

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Abstract

Introduction: Ankle dorsiflexion is an important movement during gait and if not present, harmful compensation mechanisms can occur. Goniometers have been used extensively for measurement of ranges of various body segments but there is paucity of research into reliability of measuring dorsiflexion in weight bearing position using goniometer and hence this study is intended to find the reliability of goniometer to measure the dorsiflexion in weight bearing position.

Method: Ankle dorsiflexion lunge angle of fifty healthy individuals was recorded using inclinometer and goniometer.

Results: Both the techniques demonstrated high intra rater reliability for weight bearing dorsiflexion angle measurements. Intraclass Correlation Coefficient (ICC) values, for inclinometer found were 0.89 and that for goniometer was 0.92 indicating an excellent reliability.

Conclusion: The study demonstrated that goniometer is reliable to measure dorsiflexion lunge angle in weight bearing position and also it suggested that goniometer is as reliable as inclinometer to measure weight bearing lunge angle.

Keywords: Ankle dorsiflexion lunge test; Goniometer; Inclinometer

Introduction

Ankle dorsiflexion is an important movement during gait and if not present, harmful compensation mechanisms can occur. Adequate range of ankle dorsiflexion is necessary for normal performance of functional activities such as walking, running, stair climbing, squatting, and etc [1]. Clinically, restrictions of these movements are often seen post injury or following immobilization. Restricted dorsiflexion has also been implicated as a contributing factor in overuse injury of lower limb [2,3] and foot and hence assessment of dorsiflexion is important for physiotherapists. In order to justify interventions and judge its effectiveness, physiotherapists need to incorporate objective measures in their clinical practice. Several methods have been reported in literature for measuring ankle dorsiflexion. This includes electric goniometer [4], rulers [5], inclinometer, roentgen sterophotogrammetry [6], visual estimation [7], etc. Use of most of these devices is impractical in clinical settings.

Physiotherapists commonly use weight bearing lunge test to assess dorsiflexion. Few studies have investigated the reliability of measurement of a dorsiflexion lunge test using modified lunge position and measured dorsiflexion using gravity affected flexometer [8]. Other studies have examined the reliability of measuring dorsiflexion in a non weight bearing position [9-13]. These studies have shown significant inter and intra rater reliability.

Comment on Goniometer

Studies have been done to examine inter and intra rater reliability of measuring dorsiflexion lunge using different methods. Goniometers have been used extensively for measurement of ranges of various body segments but there is paucity of research into reliability of measuring dorsiflexion in weight bearing position using goniometer and hence this study is intended to find the reliability of goniometer to measure the weight bearing position.

Method

50 Healthy participants were selected. All were under graduates, interns and post graduates students from College Of Physiotherapy. All participants were within the age group of 21 – 26 years. Participants with any neurological disorders and any orthopedic disorders affecting lower extremities were excluded from the study. Written informed consent was taken from each participant. This study was approved by the Ethical Committee of Pravara Institute of Medical sciences (DU), Loni.

Procedure

As there is no significant difference in mean lunge angle between left and right sides in normal individuals, only the right leg was measured [14]. Two tools were used to assess the dorsiflexion lunge angle.

1. Goniometer (fulcrum fixed at lateral malleolus and angle measured between lateral border of tibia and lateral border of foot)

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2. Inclinometer (the angle measured between the anterior border of tibia and vertical) (isomed ,Portland USA)

Measurement by Inclinometer

Figure 1 showing measurement of ankle dorsiflexion by inclinometer. The procedure involved the rater marking a point on the anterior border of the right tibia 15cm below the middle of the tibial tuberosity using a non- permanent felt – tipped pen. This was the point of application of middle of inclinometer. A line was drawn on right heel bisecting the calcaneus to enable consistent foot position on the tape on the floor. The test procedure was demonstrated to participants prior to commencement and standardized instructions were given. Participants positioned their right foot so their heel line and big toe were aligned on the tape measure on the floor. They lunged forward so that their knee touched a vertical line drawn on the wall. Participants were allowed to hold onto the wall for balance during the test and were free to rest the untested leg in a comfortable position on the floor. During the lunge the participant's heel was held by rater to prevent lifting from the floor. No attempt was made to limit pronation and supination in the foot. At the maximum lunge point, the rater placed the inclinometer on tibial mark and recorded the achieved angle i.e., the first reading. Mean of three readings were taken to achieve reading on first day. Similarily, second and the third readings were taken on the consecutive days.

Measurement by Goniometer

Figure 2 showing measurement of ankle dorsiflexion by Goniometer. The position of the patient was same as above. Only the fulcrum of the goniometer was placed on the lateral malleolus of the right foot with stationary arm parallel to lateral border of right foot and movable arm parallel to right lateral border of tibia. The readings were recorded with goniometer after a gap of one week of the measurement taken with inclinometer. Three mean readings were taken on three consecutive days.

Figure 1:

Figure 2:

MEAN	DAY 1	DAY2	DAY3
INCLINOMETER (degrees)	30.3	32.22	34.38

Table 1:

MEAN	DAY 1	DAY2	DAY3
GONIOMETER (degrees)	30.58	32.72	34.5

Table 2:

	MEAN(degree)
INCLINOMETER	32.3634
GONIOMETER	32.59

Table 3:

Statistical Analysis

The design used was a cross over design. The mean of the three test results was calculated and considered for analysis. The results were processed using Graph Pad InStat3®. Coefficient of Variation was used to find out the reliability of the two measurement tools.

Results

The day wise mean values of inclinometer and goniometer is shown in (Table 1 and 2) respectively. Table 3 shows total mean values taken from inclinometer and goniometer. The results showed that there is no significant difference between the two methods used to measure the weight bearing dorsiflexion lunge angle. Both the technique demonstrated high intra rater reliability for angle measurements.ICC values for inclinometer was 0.89 and that for goniometer was 0.92 indicating an excellent reliability.

Discussion

The study presented here showed that goniometer is reliable to measure dorsiflexion lunge angle in weight bearing position. And it has also proved its reliability over inclinometer.

Most Researchers have assessed dorsiflexion in non weight bearing position and have used a variety of measurement techniques. However our intra rater results compare favorably with previous reports where ICC values have ranged from 0.74-0.98 [7,9-12,15]. Goniometer is an important tool used by physiotherapist universally to measure the range of motion of joints and is easily accessible. Not much evidence has been found about goniometer to measure dorsiflexion lunge angle in weight bearing position so this study illustrates the use of it.

High reliability in the study may be due to several factors. The readings were taken with appropriate gap in between the measurements, to decrease the effect of probable stretch on TA due lunge position. Secondly, the average of 3 readings was taken which is more reliable than taking a single reading. Also lateral malleolus is a reliable anatomical landmark to place the goniometer. Any physiotherapist with the

knowledge of the anatomy can easily use goniometer as measurement tool unlike the inclinometer which has to be placed without the fixed reference point with chances of error in readings being more. Hence only, qualified and experienced physiotherapist can use inclinometer. Thirdly, in India, a goniometer measurement is a part of teaching curriculum for all undergraduate students. So they are more confident in using goniometer for measurement purposes and not inclinometer. All physiotherapists have their personal goniometers, hence it can be used easily on large population and hence it is not time consuming. The same is not possible with an inclinometer because not all setups have one. Hence this study is a preliminary effort to project the reliability of goniometer on a small healthy sample size within a particular age group.

Conclusion

The result of this study demonstrated that goniometer is reliable to measure dorsiflexion lunge angle in weight bearing position and also it suggested that goniometer is as reliable as inclinometer to measure weight bearing lunge angle.

References

1. Bohannon RW, Tiberio D, Zito M (1989) Selected measures of ankle dorsiflexion range of motion: differences and intercorrelations. Foot Ankle 10: 99-103.
2. Hughes LY (1985) Biomechanical analysis of the foot and ankle for predisposition to developing stress fractures. J Orthop Sports Phys Ther 7: 96-101.
3. Warren BL, Jones CJ (1987) Predicting plantar fasciitis in runners. Med Sci Sports Exerc 19: 71-73.
4. Clapper MP, Wolf SL (1988) Comparison of the reliability of the orthoranger and the standard goniometer for assessing active lower extremity range of motion. Phys Ther 68: 214-218.
5. Montgomery LC, Nelson FR, Norton JP, Deuster PA (1989) Orthopedic history and examination in the etiology of overuse injuries. Med Sci Sports Exerc 21: 237-243.
6. Lundberg A, Goldie I, Kalin B, Selvik G (1989) Kinematics of the ankle/foot complex:Plantarflexion and Dorsiflexion. Foot ankle 9: 194-200.
7. Youdas JW, Bogard CL, Suman VJ (1993) Reliability of goniometric measurements and visual estimates of ankle joint active range of motion obtained in a clinical setting. Arch Phys Med Rehabil 74: 1113-1118.
8. Ekstrand J, Wiktorsson M, Oberg B, Gillquist J (1982) Lower extremity goniometric measurements: A study to determine their reliability. Arch Phys Med Rehabil 63: 171-175.
9. Elveru R, Rothstein JM, Lamb RL (1998) Goniometric reliability in a clinical setting. Subtalar and ankle joint measurements. Phys Ther 68: 672-677.
10. Grimston SK, Nigg BM, Hanley DA, Engsberg JR (1993) Differences in ankle joint complex range of motion as a fuction of age. Foot Ankle 14: 215-222.
11. Jonson SR, Gross MT (1997) Intraexaminer reliability, interexaminer reliability , and mean values for nine lower extremity skeletal measures in healthy naval midshipmen. J Orthop Sports Phys Ther 25: 253-263.
12. Moseley A and Adams R (1991) Measurements of passive ankle dorsiflexion: Procedure and reliability. Aust J Physiother 37: 175-181.
13. Rome K, Cowieson F (1996) A reliability study of the universal goniometer, fluid goniometer, and electrogoniometer for the measurement of ankle dorsiflexion. Foot Ankle Int 17: 28-32.
14. Stefanyshyn DJ, Engsberg JR (1994) Right to left differences in the ankle joint complex range of motion. Med Sci Sports Exerc 26: 551-555.
15. Mayerson NH, Milano RA (1984) Goniometric measurement reliability in physical medicine. Arch Phys Med Rehabil 65: 92-94.