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The Reliability of Carpenter's Tri square Measure for Assessment of Postural Impairments in Geriatric individuals with Symptomatic Osteoarthritis of Knee- an Observational Study

Sneha Laxmanbhai Chauhan*Nootan College of Physiotherapy,
Sankalchand Patel University, Gujarat,
India

Abstract

Context: Knee osteoarthritis (OA) is one of the most prevalent musculoskeletal complaints worldwide. Age-related impairments in balance and postural stability are well documented. Ageing is associated with a decline in the integrity of the physiological systems that contribute to the control of balance. Improve postural alignment may also have a positive impact on balance reactions, thus decreasing the risk of hip fracture from falling.

Aim: The aim of the study was to find out reliability of carpenter's tri square measure for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee.

Study settings and design: An observation study was carried out in hospitals and societies.

Method and material: For measure Intra and Inter rater reliability of carpenter's tri square (CT) for 24 geriatric individuals with symptomatic osteoarthritis of knee should be taken. All measurements were taken for 3 times by both rater and the mean values of 3 tests were calculated. The CTM tool was used twice by same rater (Rater A 1 and Rater A 2) at different time (after 24 hours of duration) and at first day used for once by rater B.

Statistical analysis: Data was analysed by using SPSS Version 20. Intra and Inter rater reliability of CT were assessed by Pearson's correlation coefficient.

Results: Pearson's correlation coefficient value for Inter and Intra rater reliability is show good to moderately positive correlation of carpenter's tri square measures.

Conclusion: Carpenter's tri square measure appears to be reliable tool for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee. carpenter's tri square tool for measuring postural impairments in less time, easy to access with periodically at clinic with more precisely.

Keywords: Carpenter's tri square measure (CTM); Osteoarthritis (OA) knee; Forward head position (FH); CT Ear (CTE); CT Shoulder (CT Sh); CT Hip (CTH); CT Knee (CTK); CT Ankle (CT An); Postural impairments

***Corresponding author:**

Sneha Laxmanbhai Chauhan

✉ chauhansneha73@gmail.com

Tel: 8128983554

Nootan College of Physiotherapy,
Sankalchand Patel University, Gujarat, India

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Introduction

Knee osteoarthritis (OA) is one of the most prevalent musculoskeletal complaints worldwide, affecting 30–40% of the population by the age of 65 yr. It is a major cause of impairment and disability among the elderly and poses a significant economic burden on the community. Individuals with knee OA suffer progressive loss of function, displaying increasing dependency in

walking, stair climbing and other lower extremity tasks [1].

Osteoarthritis is a common progressive health problem among adults. Is it estimated that 80% of all adults at or over the age of 65 years exhibit radiographic evidence of OA [2].

Global statistics reveal over 100 million people worldwide suffer from OA, which is one of the most common causes of disability [3].



Figure 1 Material (Carpenter's Tri-square) used in the study.



Fig (2a): CT Ear



Fig (2b): CT Shoulder

Figure 2a and 2b CT Ear and CT Shoulder assess with the carpenter's tri-square.

Epidemiological profile of this disease in India is not clear but it is estimated that osteoarthritis (OA) is the second most common rheumatological problem and is most frequent joint disease with prevalence of 22% to 39% in India [3]. Osteoarthritis is a chronic degenerative disorder primarily affecting the articular cartilage of synovial joints, with eventual bony re-modelling and overgrowth at the marginal of the joints. There is also progression of synovial and capsular thickening and joint effusion [4]. Age-related impairments in balance and postural stability are well documented. Ageing is associated with a decline in the integrity of the physiological systems that contribute to the control of balance [1].

Measuring postural deviation and determining its relevance to the client's condition is a challenge for physical therapist. There is some support for a relationship between postural deviation to spinal pain, functional loss, risk of falling and decreased risk of fracture in women [5]. Improve postural alignment may also have a positive impact on balance reactions, thus decreasing the risk of hip fracture from falling. Approximately 90% of hip fractures in older adults occur as a result of a fall and current trends suggest that the incidence of hip fractures will increase sixfold by the year 2050 [4].

Physical therapists generally rely on subjective observations or less frequently, tools such as the flexi curve ruler, plumb line, kypho meter, goniometer or ruler to evaluate postural deviation. C.M.

Table 1 Age distribution of older adults (years).

| Age Group (Years) | No of Subjects |
|-------------------|----------------|
| 65-70 | 17 |
| 71-75 | 6 |
| 75-85 | 1 |
| Total | 24 |

Table 2 Mean value and Standard Deviation of Carpenter's tri-square measures (CTM).

| CTM | RaterA1 | RaterA2 | RaterB1 | |
|------|---------|---------|---------|-------|
| FH | Mean | 7.62 | 7.8 | 7.63 |
| | SD | 1.47 | 1.40 | 1.47 |
| CTE | Mean | 14.37 | 14.54 | 14.37 |
| | SD | 1.88 | 1.81 | 1.88 |
| CTSh | Mean | 14.58 | 16.56 | 20.58 |
| | SD | 1.71 | 1.72 | 2.71 |
| CTH | Mean | 15.38 | 17.45 | 16.38 |
| | SD | 1.97 | 2.88 | 1.97 |
| CTK | Mean | 20.37 | 19.08 | 17.33 |
| | SD | 2.24 | 1.50 | 1.23 |
| CTAn | Mean | 13.20 | 13.16 | 13.16 |
| | SD | 1.38 | 1.48 | 1.28 |

Table 3 Pearson's correlation coefficient shows Intra rater and Inter-rater reliability of CTM.

| CTM | Intra rater | Inter rater | |
|------|-------------|-------------|-------|
| FH | r value | 0.959 | 0.97 |
| | p value | 0.000 | 0.000 |
| CTE | r value | 0.87 | 0.86 |
| | p value | 0.000 | 0.000 |
| CTSh | r value | 0.84 | 0.73 |
| | p value | 0.000 | 0.000 |
| CTH | r value | 0.65 | 0.84 |
| | p value | 0.000 | 0.000 |
| CTK | r value | 0.937 | 0.987 |
| | p value | 0.000 | 0.000 |
| CTAn | r value | 0.86 | 0.948 |
| | p value | 0.000 | 0.000 |

Arnold did study on reliability of five clinical postural alignment measures for women with osteoporosis and concluded that standard measurement tools such as flexi curve ruler, carpenter's tri square, posture rating scale, height and forward head position and posture classification are reliable tool for measuring postural alignment in osteoporosis women [5].

Carpenter's tri-square measure a similar procedure as described by Harrison Barry-Greb & Wojowicz was used. To ensure that the back board was level. Distance measurements were taken from 6 standard points on the back board to a plumb line suspended from the ceiling or following surface landmarks were located and marked on the right side of the body: The most posterior aspect of occiput for forward head position (FH), the most posterior aspects of the tragus of the ear (CTE), two centimeters below the tip of the acromion (CTSh.), the most superior aspect of the greater trochanter (CTH), the midpoint of the lateral aspect of the

knee joint line (CTK) and 1.5 cm anterior to the most posterior aspect of the lateral malleolus (CTAn) [5].

Need for the study

There are less study on tool for measuring postural impairments in less time, easy to access with periodically at clinic with more precisely. So this carpenter tri-square tool may use for measuring postural impairments in symptomatic OA of knee. Study interpretation may helpful for making treatment protocol in this population.

There are no studies which find reliability of Carpenter's Tri-square for postural impairments in Geriatrics individuals with symptomatic OA of knee. The purpose of this study is to find reliability of carpenter's tri square measure for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee.

Aim of the study

The aim of the study was to find out reliability of carpenter's tri square measure for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee.

Objectives of the study

- To assess intra-rater reliability of carpenter's tri square measure for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee.
- To assess inter-rater reliability of carpenter's tri square measure for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee.

Material and Methods

Study setting

Orthopedic hospitals, Societies.

Study design

An Observational study.

Method of collection of data

Study population: Geriatric individuals with symptomatic osteoarthritis of knee

Sampling method: Purposive sampling

Sample size: 24 subjects

Materials to be used:

- Consent form, paper Pencil and Pen
- Back Board
- Carpenter's Tri-square tool

Criteria for selection

Inclusion Criteria:

- Age: ≥ 65 years (Geriatric population).¹³
- Gender: both males and females.

- BMI: - 18-30
- Knee pain on most days of the previous month (average pain ≥ 3 cm on a 10 cm visual analogue scale)
- Patients diagnosed with unilateral and bilateral OA knee.
- Stages 3 osteoarthritis of knee on radiographs finding. (The Kellgren and Lawrence system)
- Subjects will be taking non-steroidal anti-inflammatory drugs on a stable dosage over the previous fortnight.
- Subjects with normal cognitive function (MMSE >23)
- Independent in ADL and Ambulatory older without use of assistance device

Exclusion Criteria:

- Subjects with history of any recent surgeries in low back and lower limbs.
- Subjects with history of any recent musculoskeletal injuries like fractures, dislocation, joint instability or any soft tissue injuries no with other form of neurological impairments.
- Consultation of a physiotherapist for treatment of the knee (previous 12 months)
- Hemodynamically unstable subjects.
- Uncooperative subjects or who is not willing to participate.

Measurement procedure:

- The subjects have been selected on the basis of inclusion and exclusion criteria.
- Before starting the study, brief assessment has been done by Mini Mental State Examination and written consent was taken from the subjects. Patients were then explained about the CTM tool and procedure to be conducted to check postural impairments in geriatric individuals with symptomatic osteoarthritis of knee.
- Ask to subjects for proper position on back board was level and distance measurements were taken from 6 standard points to the back board.

Postural impairments assess with the carpenter's tri-square (Parameters) were:

- Forward head position (FH)- Distance from backboard to surface mark (most posterior aspect of the occiput)
- CT ear- Distance from backboard to surface mark (tragus) of ear
- CT Shoulder- Distance from backboard to surface mark (tip of the acromion) of shoulder
- CT hip- Distance from backboard to surface mark (greater trochanter) of hip
- CT knee- Distance from backboard to surface mark (midpoint of the lateral aspect) of knee
- CT ankle- Distance from backboard to surface mark (lateral malleolus) of ankle

- All measurements were taken for 3 times by both rater and the mean values of 3 tests were calculated.
- The CTM tool was used twice by same rater (Rater A 1 and Rater A 2) at different time (after 24 hours of duration) and at first day used for once by rater B.

Results

All the statistical analysis was done by Statistical Package for the Social Sciences (SPSS) statistical software version 20.0 for windows. Intra rater and Inter rater reliability of CTM were assessed by Pearson's correlation coefficient. Level of significance (p value) was set to 0.01 level. Total 24 participants included in study and 4 subjects excluded due to they had not completed in criteria.

Discussion

This study was conducted to check Inter and Intra rater reliability of carpenter's tri square measure for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee.

In the above study the results for intra and inter rater reliability suggested moderate positive correlation with Rater A 1, Rater A 2 and rater B which suggest that assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee by carpenter's tri square tool.

Result of present study suggested that CTM tool is reliable tool to assess postural impairments in geriatric individuals with symptomatic osteoarthritis of knee and this is supported by a study done by C.M. Arnold on reliability of five clinical postural alignment measures for women with osteoporosis and concluded that standard measurement tools such as flexi curve ruler, carpenter's tri square, posture rating scale, height and forward head position and posture classification are reliable tool for measuring postural alignment in osteoporosis women [4].

Correlations between all measures FH (forward head position), CTE, CTSh, CTH, CTK and CTAn were good to moderate positive

correlations. That suggesting that this is simple method for measure forward head position, protracted shoulder, flexion of knee and outward foot position in geriatric individuals with symptomatic osteoarthritis of knee.

In additional findings were difficulty noted that both raters got little variations in identification of surface mark in body and Postural changes noticeable at level of head, shoulder and knee. In this study intra rater measures had more variations may due to measure at next day and participants more active due to previous experience.

The present study finding suggests that carpenter's tri square tool is reliable tool for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee.

Conclusion

Carpenter's tri square measure appears to be reliable tool for assessment of postural impairments in geriatric individuals with symptomatic osteoarthritis of knee. carpenter's tri square tool for measuring postural impairments in less time, easy to access with periodically at clinic with more precisely.

Limitation of the study

Small sample size, specific age criteria for geriatric individuals with symptomatic osteoarthritis of knee.

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Conflict of Interest

Nil.

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