

# Comparison of Two Different Assistive Devices on Balance in Adults with Knee Osteoarthritis - An Observational Study

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## ABSTRACT

Osteoarthritis (OA) is most common joint disorder worldwide. It is second most common frequent joint disease with a prevalence rate of 22% to 39% in India. It affects women more than men. Knee OA is affect balance, muscle power, gait parameters. Main function of cane are to increase the support base, improve balance, and share the body weight load with the upper limb, which is achieved by directly applying force to the handle of the cane. Knee brace is give joint stability, less ending muscle co-contraction, improving proprioception, decreasing the magnitude of load on the knee through improvement in Malalignment and distribution of load across the knee. Aim is to compare the effect of no assistive device, cane and knee brace on balance in adults with knee OA by using time up and go test. Study included 52 patients individual with case of OA of knee between the age of 40 to 60 years. Patients were observed 3 days by randomly selected groups. Balance was measured by TUG in Group A (no device), Group B (cane) and Group C (brace) then statistical analysis was done. In statistical analysis, analysis of outcome measure of TUG was done by nonparametric test. So between groups Kruskal Wallis test was done. There was statistically significant difference found in TUG in between Groups analysis and it is concluded the knee brace is effectiveness in balance and gait velocity with knee OA patients.

**Keywords:** knee OA, cane, knee brace, TUG

## 1. INTRODUCTION

Osteoarthritis (OA) is progressive disease characterized by degeneration of articular cartilage and alteration of joint tissues resulting in pain, disability and stiffness. <sup>[1]</sup>

The pathological definition is characterized by focal areas of loss of articular cartilage within synovial joint, associated with hypertrophy of bone & thickening of the capsule. <sup>[2]</sup>

Histologically, disease is characterized early by fragmentation of the cartilage surface, cloning of chondrocytes

and vertical cleft in the cartilage, variable crystal deposition, remodeling & eventual violation of the tidemark by blood vessels. This phenomenon can present in any joint but is most common in knee, hip, spine & foot. <sup>[3]</sup>

Clinically, the condition is characterized by joint pain, bony or soft tissue swelling, tenderness, bony crepitus, peri - articular muscle atrophy, bony hypertrophy, deformity and marked loss of joint motion. <sup>[4]</sup>

There are two kind of osteoarthritis primary and secondary. Primary

osteoarthritis is not only related to aging but also to uncoupling of balance between cartilage degeneration and regeneration whereas, secondary osteoarthritis of knee is caused by another condition and disease. [4]

Osteoarthritis is most common degenerative disease affecting thousands of Indian citizens. [5] In Indian population, the prevalence of knee OA is 22% to 39%. [6] The prevalence of knee osteoarthritis increases with advancing age with estimates of 7.2% in those aged 40 or older, [7] 12.5% in those aged over 45 [8] and 14.8% in those aged 50 or older. [9]

When OA affects weight bearing joint, mainly the knee, it leads to a marked decline of muscle function and consequently to a reduction in balance and specially while performing sit to stand task and even gait alterations resulting in functional limitation and loss of independence, therefore, knee osteoarthritis is considered to be an intrinsic risk factor for the occurrence of fall. [10]

A report by the centers for disease control and prevention indicated that patients with arthritis have substantially worse health related quality of life than those without it. 80% of patients develop medial compartment OA of knee resulting in varus or “bow legged” deformity & 5 to 10% develop lateral compartment OA of knee resulting in valgus or “knock knee” deformity. [11]

Balance is an integral component of these and many other activity of daily living. Balance is a complex function involving numerous neuromuscular process. Control of balance is dependent upon sensory input from the visual, vestibular and somatosensory system. Central processing of this information results in coordinated neuromuscular response that ensure the center of mass remains within the base of support in situations when the balance is disturbed and effective control of balance thus relies not only on accurate sensory input but also on a timely response of strong muscle. Balance impairment is associated with an increased risk of fall and poorer mobility. [12]

This study intend to consider the problems of adults with knee osteoarthritis using assistive device by measuring their balance with time up and go test.

The time up and go test can modified from the get up & go test. The TUG test is a combined measure that involves power, velocity, agility and dynamic balance, with objective of evaluating functional mobility. The TUG test is easy to administer and no training is required. [13]

Knee brace give more joint stability, reducing pain, less ending muscle co-contraction, improving proprioception, decreasing the magnitude of load on the knee through improvement in Malalignment and distribution of load across the knee. Brace is effectiveness combated by disease progression and speculated as source for diminish treatment effect with prolonged use. [14]

Knee brace come in a variety of designs, but most are constructed with a combination of rigid and flexible materials like plastic, metal or other composite material for basic structure and support, and synthetic rubber or moldable foam for padding and positioning.

Bracing is often employment as a treatment strategy for knee arthritis involving primarily one compartment to relive pain , to maintain function and activity level and in case of younger active patient to delay an eventual knee arthroplasty procedure. [15]

Main function of cane are to increase the support base, improve balance, and share the body weight load with the upper limb, which is achieved by directly applying force to the handle of the cane. Cane also increases patient’s confidence in the performance of daily activities. [16]

Regular exercise and weight reduction are not only important for maintaining general health; they are also strongly recommended conservative modalities for managing knee osteoarthritis. [17]

**Shih Hung Chuang et al.** effect of knee sleeve on static and dynamic balance in patients with knee osteoarthritis, 50

patients were divided into Group A (without wear sleeve) & Group B (with wear sleeve) and concluded improvement might prevent knee OA patients from falling down and increase their sense of security during physical activities. [18]

Thus, need of the study is to know that which one is beneficial and comfortable amongst cane, knee brace and no assistive device in adults with knee osteoarthritis. In daily routine physiotherapist advice to use any assistive devices & orthosis to improve balance.

## 2. Need of study

Regular exercise and weight reduction are not only important for knee OA, they are also strongly recommended conservative treatment for managing knee OA.

In daily routine physiotherapist advice to use any assistive devices & orthosis to improve balance. However, physiotherapist are unaware of which is more beneficial than the other in term of balance.

To know that which one is beneficial and comfortable amongst no assistive device, cane and knee brace in adults with knee OA, the need of this study arise.

Secondary, There are many studies done showing the effect of assistive devices and different orthosis on balance but very few studies has actually gave comparison between different assistive devices.

## 3. Aim and objectives

To compare the effect of no assistive device, cane & knee brace on balance in adults with knee OA by using time up and go test.

## 4. Hypothesis

### 4.1 Null hypothesis [Ho]

[Ho<sup>1</sup>]- There is no significant difference between no assistive device, cane and knee brace on balance in adults with knee OA by using time up and go test.

### 4.2 Alternative hypothesis [H1]

[H1<sup>1</sup>] -There is significant difference between no assistive device, cane and knee brace on balance in adults with knee OA by using time up and go test.

## 5. MATERIALS AND METHODOLOGY

The study was started after taking approval from Institutional Ethical Committee. Sample size was estimated on the base of data from pilot study. From pilot study, estimated sample size was 52 and it provides 95% power assuming a significance level of 0.05. This study was conducted in different government & different private physiotherapy centers of Ahmedabad.

In this study both male & female were included in the study with 40-60 years of age. According to Inclusion criteria subject who were diagnosed as having primary & idiopathic OA by an orthopedic surgeon, subject with unilateral OA, individuals who was easily comprehend command, individuals who was willing to participate and who were diagnosed by OA of knee with Kellgren Lawrence grade 2 & 3 were included in this study

Subject who have the history of dizziness, subject who were already using any assistive device, individual having any other neurological problem; any other associated severe musculoskeletal & cardiovascular problems were excluded.

### 5.1 Outcome measures

#### • Time up & go test for balance: [13]

The TUG test was modified from the get up and go test. Both tests are based on a functional task of rising from a standard armchair, walking 3 m, and returning to chair. The TUG test is combined measure that involves power, velocity, agility, and dynamic balance, with the objective of evaluating functional mobility in activities which included standing up, walking, turning 180 and sitting down, such as getting off a bus or standing up in time to go to toilet or answering the telephone.

The TUG test is easy to administer and no training is required. The results from this test provide information related to mobility.

## 5.2 Procedure:

52 patients with knee OA were assessed as per inclusion and exclusion criteria recruited from physiotherapy department of Ahmedabad.

After screening of inclusion & exclusion criteria, the whole procedure of the study was explained. A written informed consent form was taken from the all subjects.

Randomization order was concealed from the subject to eliminate ceiling effect & then enrollment order was changed for same subject. Each of the subject were assessed for balance by using TUG. Verbal commands were given to subject according to test. Moreover washout period was kept for 1 day in between.

Each and every participant was asked to carry out TUG to evaluate balance without using any assistive device. then same participants were given 1 day washout period and then asked to carry out same test by using T shaped Adjustable Aluminum single Cane. Now, again after 1 day washout period, participants were asked to repeat the test by wearing Hinged open patella type of Knee Brace.

Three different sized knee brace (small, medium, large) and cane was sponsored by institute to avoid therapist bias.

### ❖ Verbal commands for time up and go test:

For this test, do the best you can and walk at your regular pace.

1. Start by sitting in the chair with your back resting on the back rest and your hands on the arm rest.
2. On start, stand up, walk to the mark, turn around, return and sit back into the chair with your back resting on the back of the chair.
3. Walk at your regular pace.
4. Get ready and START. [19]



Figure 1: participant performing TUG without assistive device



Figure 2: participant performing TUG with cane



Figure 3: participant performing TUG with knee brace



## RESULT

The present study was analyzed the comparison of two different assistive device on balance in adults with knee osteoarthritis.

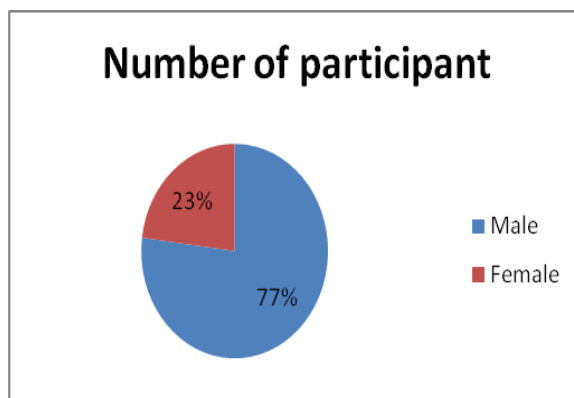
Data were collected from various physiotherapy department of Ahmedabad. Total 52 patients were selected on the basis of inclusion criteria and data were taken.

In this study 52 subjects (male & female ) with age group of 40 to 60 years and was divided in to three groups namely Group A (no assistive device), Group B (cane) and Group C ( knee brace).

SPSS software version 20 was used to perform statistical analysis prior to performing the statistical test data was a screen for normal distribution study. In this study power was kept at 95% and level of significant was kept at 5%. All the outcome measures were analyzed.

TABLE 1: Gender distribution of the subjects

	Male	Female
No. of participants	12	40
percentage	23%	77%

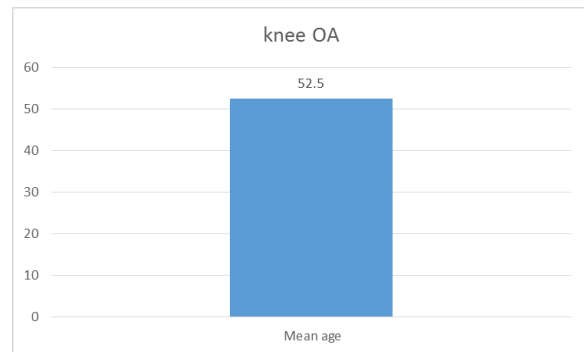


GRAPH 1: Gender distribution of the subjects

TABLE 2: Mean age of participants

No. of participants	Mean age
52	52.5

Here, the mean age of the participants was 52.5 respectively. The SD was  $\pm 6.1468$  respectively.

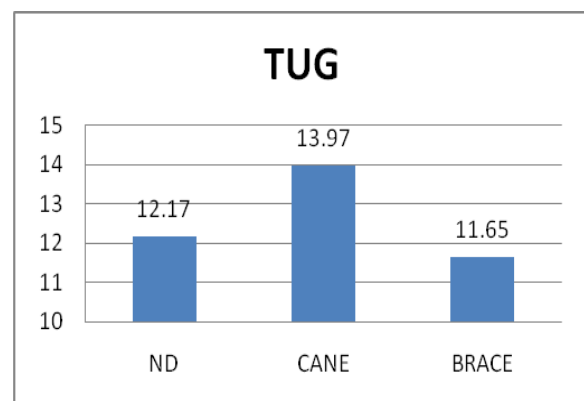


GRAPH 2: Mean age of participants

TABLE 3: Mean difference in TUG between groups

GROUP	MEAN	$\pm$ SD	P VALUE	CHI SQUARE VALUE
A	12.17	$\pm 1.65$	<0.001	29.084
B	13.97	$\pm 2.25$		
C	11.65	$\pm 1.58$		

Here, the between groups comparison of TUG was done by using kruskal Wallis test and p value was <0.001 which showed statistically significant difference in TUG for between groups



GRAPH 3: Mean difference in TUG between groups

TABLE 4: Pair wise comparison of TUG (Kruskal Wallis)

OUTCOME MEASURE	COMPARISON	P VALUE
TUG	Between group A and B	<0.01
TUG	Between group A and C	>0.05
TUG	Between group B and C	<0.01

Here, the multiple comparison of TUG was done by using pair wise comparison and the p value for comparison between Group A and B, Group B and C was < 0.01. So, there was statistical difference between Group A and B, Group B and C.

But Group A and C the p value was >0.05. So, there was no statistical significant difference in TUG between Group A and C.

## 6. DISCUSSION

The present study was conducted to compare the effect of no assistive device, cane & knee brace on balance in adults with knee osteoarthritis.

The comparative study was conducted on 52 subjects (male & female) with age group of 40 to 60 years and was divided in to three Groups namely Group A (No device), Group B (Cane) and Group C (knee Brace).

The result of this study shows that there is statistically significant difference in TUG in adults with knee Osteoarthritis in between three groups.

Time Up and Go test is found to have significant difference in between groups where P value  $\leq 0.001$ . However, while comparing mean values of no device (12.17), cane (13.97), and brace (11.65) it was found that the Group having no device take lesser time compare to cane, to cover an appropriate distance, but Brace takes much lesser time than no device to cover an appropriate distance. Hence, brace was more effective in improving balance than other two groups.

This is may be due to, the vital function of cane are increase the support base, improve balance, and share the body weight load with upper limb which is achieved by directly applying force to handle of the cane. But, most of the individual rarely use a cane during outdoor activities as they believe that usage of cane implies fragility and disability comprising their quality of life and making them feel more dependent and ill health.

However, improvement in balance is found in groups having Brace as well as no assistive device for TUG test may be due to varied reasons.

The most coral part is Proprioception. Proprioception is the sense of the position and movement of the limbs and is the result of sensory inputs arising from muscle, skin and joint structure, different type of knee orthoses has been improved kinesthesia.

Bracing for prolong period involves the combination of several underlying mechanism including changes in various neuromuscular factor such as proprioception, muscular strength and atrophy along with the mechanical factor such as altered movement about knee and compressive joint load. [20]

This is supported by T.B. Birmingham et al (2001) who evaluate the effect of functional knee brace specifically designed for patient with varus gonarthrosis on measured of proprioception and postural control and concluded improvement with the use of brace. [20]

## 7. CONCLUSION

In this study, between group A, B and C null hypothesis [Ho1] is rejected for balance. The result showed that cane as well as brace was effective in improvement of balance in adults with knee OA. The mean difference of knee brace was more for TUG compared to cane and no assistive device. So, brace is more effective in improvement in balance.

Hence, it concluded the brace was effectiveness in balance in adults with Knee OA.

### Clinical implication

The study showed Brace have been showing clinically significant improvement on balance in adults with knee OA. Although a brace intended to reduce the load indicates a small additional beneficial effect in conservative treatment of knee OA.

Hence, bracing individual with knee OA is safe and effective and should be used as a mode of treatment, leading to meaningful functional changes.

### Limitations

- The study consisted small number of subject.
- Blinding was not done.

### Future recommendation

- Future studies should be done using different types of brace.
- Future study can be done using other outcome measures of knee OA.
- The future study can be done using different populations.

## REFERENCES

1. Adele Erin Connelly et al, Knee osteoarthritis: A clinical trial examining therapeutic effect of high rosmarinic acid spearmint tea and investigation into relationship of pain with modifiable lifestyle factors and biomarkers of joint metabolism and inflammation. University of Guelph, 2015.
2. Deborah Symmons, Colin Mathers, Bruce Pfleger. Global burden of Osteoarthritis in the year 2000. [https://www.who.int/healthinfo/statistics/bod\\_osteoarthritis.pdf](https://www.who.int/healthinfo/statistics/bod_osteoarthritis.pdf)
3. Prof. Dr. A.J. van der Linden et al, Histological, Pathological and Therapeutically aspect of osteoarthritis. 1992; 11-13.
4. Annil Mahajan, Sourabh Verma et al, Osteoarthritis and menopause; J Indian Rheumatol Assoc; 2005: 13: 21-25.
5. Manjusha vagal et al, Medial taping patella with dynamic thermotherapy – A combined treatment approach for osteoarthritis of knee joint; The Indian occupational therapy, 2004.
6. A Mahajan, S verma, V tendon. Osteoarthritis JAPI, vol. 53, July 2005.
7. Henry pollard et al, The effect of a manual therapy knee protocol on osteoarthritic knee pain: a randomized control trial. J Can Assoc 2008; 52.
8. Bedson J, Jordan K, croft P et al, The prevalence and history of knee osteoarthritis In general practice: a case control study. fam pract 2005; 22(1) : 103-108.
9. Kacar C, Gilgil E, Urhan S, et al, The prevalence of symptomatic knee and distal interphalangeal joint osteoarthritis in the urban population of Antalya, Turkey. Rheumatol Int 2005; 25(3): 201-204.
10. Afaf A.M.Shaheen and Khaled Ayad. Impact of chronic osteoarthritis of knee joint on postural stability and functional mobility of women. Bull. Fac. Ph. Th. Cairo Univ.: Vol. 13, No. (1) Jan. 2008
11. Brotzman S B, Wilk K E, Clinical orthopaedic rehabilitation : evidence based approach, 2nd edition, united states of America, 2003
12. R.S.Himman, K.L.Bennell et al, Balance impairment in individual with symptomatic knee osteoarthritis: a comparison with matched control using clinical tests. Rheumatology 2002; 41: 1388-1394.
13. Vanessa Noonam, Elizabeth Dean.et al, Submaximal exercise testing: clinical application and interpretation journal of the American physical therapy association and royal dutch society for physical therapy. Physther, 2002;80: 782-807.
14. R.F. Moyer, T.B. Birmingham et al, Biomechanical effect of valgus knee bracing: a systematic review and meta analysis;178-188 ; OARSI , 2014
15. Nicholas J. Giori et al, Load shifting brace treatment for osteoarthritis of the knee: a minimum 2 1/2 year follow up study; journal of rehabilitation research & development. Volume 41; 2004.
16. Anamaria Jones, Ana Claudia Monteiro Alves et al. Energy expenditure during cane assisted gait in patients with knee osteoarthritis. Clinics. 2008 Apr; 63(2): 197–200.
17. Kristin Briem, Daniel K. Ramesey et al, The role of bracing; sports medicine and arthroscopy review. 2013.
18. Shih Hung Chuang et al, Effect of knee sleeve on static and dynamic balance in patients with knee osteoarthritis; 2007.
19. T.B. Birmingham et al, Knee bracing for medial compartment osteoarthritis: effect on proprioception and postural control. BSR; 2001; 40: 285-289.
20. Fionaa Dobson, Kim L. Bennell Rana et al, Recommended performance based tested to assess Physical function in people diagnosed with Hip and Knee Osteoarthritis- OARSI 2012.

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