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Comparison of functional mobility with and without the use of assistive device [knee brace] in patients with knee osteoarthritis

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Abstract

Background: Osteoarthritis is a progressive disease characterized by degeneration of articular cartilage and alteration of joint tissue resulting in pain, disability, and stiffness. When it affects the weight-bearing joint it leads to a marked decline in muscle function due to reduction in quadriceps muscle strength as well as impairments in knee joint proprioception and consequent reduction in balance resulting in functional limitations. Knee sleeves provide warmth and compression that may enhance knee joint proprioception, thus improving static and dynamic balance.

Aim: The aim was to assess functional mobility with and without the use of assistive device [knee brace] in patients with knee osteoarthritis.

Method: An observational study was carried out and using purposive sampling 80 subjects were diagnosed with knee osteoarthritis. Functional mobility was assessed by using a timed up and go test. The data was analyzed.

Result: There were 66.3% females and 33.7% males between the age group of 40 to 60 years among which 41.25% patients diagnosed with grade 2 and 58.75% patients with grade 3 osteoarthritis. The results revealed a significant difference between the timed up and go test without a knee brace and with a knee brace [P .000].

Conclusion: The knee brace, a less cumbersome and less costly alternative, has been accepted based on subjective performance. The findings of this study suggest that patients with knee osteoarthritis wearing knee braces showed improvement in functional mobility. Therefore, it is effective to wear a knee brace in patients with knee osteoarthritis while performing static and dynamic activities.

Keywords: Knee osteoarthritis, functional mobility, the knee brace

Introduction

Osteoarthritis is a progressive disease characterized by degeneration of articular cartilage and alteration of joint tissue resulting in pain, disability, and stiffness. The pathological definition is characterized by focal areas of loss of articular cartilage within the synovial joint, associated with hypertrophy of bone and thickening of the capsule. Knee osteoarthritis is one of the most prevalent musculoskeletal complaints worldwide, affecting 30%-40% population by the age of 65 years. It is the second most rheumatologic problem and most frequent joint disease with a prevalence of 22%-39% in India [1]. Clinically the condition is characterized by joint pain, soft tissue swelling, tenderness, bony crepitus, deformity, and marked loss of joint motion. When it affects the weight-bearing joint, it leads to a marked decline of muscle function and consequent reduction in balance resulting in functional limitations. 80% of patients develop medial compartment osteoarthritis resulting in varus or bow leg deformity and 5%-10% develop lateral compartment osteoarthritis resulting in valgus or knock knee deformity [1].

Balance is an integral component of walking and other lower extremity tasks. Control of balance is dependent upon sensory input from the visual, vestibular, and somatosensory systems [1]. Balance impairments are associated with an increased risk of falls and poorer mobility measures in the elderly population. Aging is associated with a decline in the integrity of visual, vestibular, and somatosensory systems that contribute to control of balance, and the presence of osteoarthritis may result in changes that accelerate the

deterioration of these systems. Individuals with knee osteoarthritis display reduction in quadriceps strength and activation as well as impairments in knee joint proprioception and these deficits in combination with the aging process may culminate in greater impairments in balance [2]. Loss of balance most commonly occurs during movement-related tasks such as walking and less frequently during static activities and therefore evaluation of balance must incorporate testing procedures that reflect the dynamic nature of such locomotor tasks [2].

Balance control is defined as the ability to control the body's center of gravity provided by the feet. The impact of knee osteoarthritis on balance may elucidate possible mechanisms of disability in these patients. Impairment in balance is associated with falls and poor mobility. Balance is a complex function of numerous neuromuscular processes which include sensory, motor, and integrated components. Structures around the knee joint are easily affected in patients with knee osteoarthritis. Loss of hyaline articular cartilage and impairment of bony remodeling can even result in capsular damage and muscle weakness [3].

Conservative treatment of knee osteoarthritis includes weight loss, physical therapy, assistive devices, exercises, and pharmacological treatment [3].

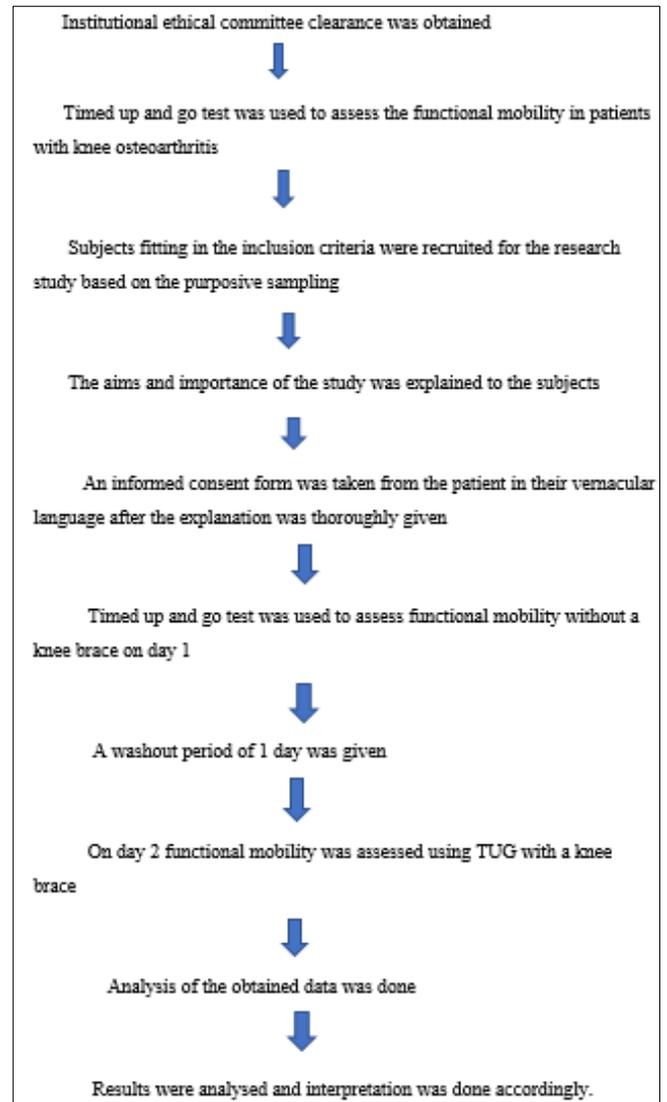
Wearing an orthosis for knee osteoarthritis is important for their balance. Braces for osteoarthritis are designed to alter the loads that the knee joint is subjected to during weight-bearing activities, lessening forces on the affected compartment of the knee joint. The braces are thought to provide pain relief by reducing the load on the medial compartment through the application of an opposing external valgus moment about the knee joint. The knee braces are designed to mechanically reorient the frontal plane knee alignment to reduce the medial compartment joint loading. The moment arm (perpendicular distance between ground reaction force and knee joint center) lowers the external knee adduction moment and shifts the compressive loads away from the degenerative compartments, thereby lessening exposure to damaging and provocative mechanical stresses [10]. Knee sleeves provide warmth and mild compression and are made from cotton elastic or neoprene, nylon, or other synthetic fibers that can be used by patients having an allergic reaction to the skin. Some sleeves have a patellar cut-out, an open popliteal fossa, a patellar reinforcement with C or J-shaped cushions with or without buttress straps. Knee braces are helpful in alleviating symptoms of osteoarthritis by reducing loading on the more affected compartment of the knee joint, providing stability, and enhancing proprioception of the knee joint [14].

The aim of the study was to compare functional mobility with and without the use of assistive device [knee brace] in patients with knee osteoarthritis.

Materials and Methods

1. Inclusion criteria

- Males and females
- 40-60years of age
- Patients diagnosed with grade 2 and 3 osteoarthritis on Kellgren- Lawrence scale
- Patients with unilateral and bilateral knee osteoarthritis.



Statistical Analysis

Descriptive analysis of the data collected was done using the SPSS sheet.

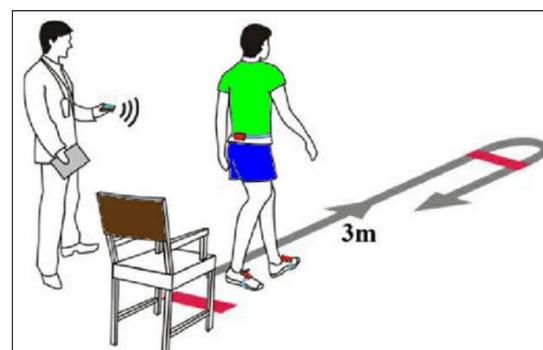


Fig 1: Timed up and go test

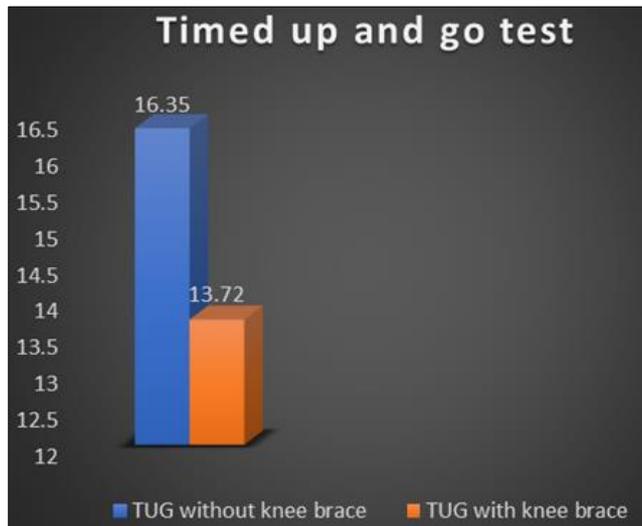
Results

80 patients with knee osteoarthritis participated in the study. There were 66.3% females and 33.7% males between the age group of 40-60 years. 41.25% of patients were diagnosed with grade 2 OA and 58.75% of patients were diagnosed with grade 3 OA.

Table 1: Demographic data for age, TUG without a knee brace and TUG with a knee brace, grades of OA

Demographics	Age (in years)	TUG without knee brace (in seconds)	TUG with a knee brace (in seconds)	Grade 2 and 3 osteoarthritis
Mean	53.73	16.35	13.72	2.6
Standard Deviation	±5.84	±3.36	±3.52	±0.49

The mean (Standard deviation) age of patients with knee osteoarthritis was 53.73±5.84 years. The mean (Standard deviation) of TUG without knee brace was 16.35±3.36 seconds and the mean (standard deviation) of TUG with knee brace was 13.72±3.52 seconds.

**Fig 2:** Comparison of TUG without and with a knee brace

The data was analysed using statistical test: Paired t-test. The results of the test revealed a significant difference between TUG without a knee brace and TUG with a knee brace (P .000) which suggests that wearing a knee brace for patients with osteoarthritis is beneficial during static and dynamic activities.

Discussion

In this study, we tried to gain the insight of comparison of functional mobility with and without the use of assistive device [knee brace] in patients with knee osteoarthritis. The findings of the study say that the patients wearing the knee brace while performing the timed up and go test showed a reduction in time calculated in seconds as compared to patients performing the timed up and go test without the knee brace. The current study suggests that the patients wearing knee braces showed improved functional mobility and reduction in loss of balance [P .000]. A knee brace reduces the load on the medial compartment of the knee joint during locomotor activities. Mechanisms by which the knee braces alter the knee joint biomechanics include altering the distribution of load and reducing the magnitude of the load on the knee joint through improvement in malalignment, increasing the joint stability, reducing muscle contraction, and improving knee joint proprioception. Similarly, a study conducted in Taiwan in the year 2007 demonstrated that the patients with knee osteoarthritis wearing knee sleeves showed better balance control than those without neoprene sleeves. Patients wearing neoprene sleeves showed a 28% reduction in the static balance test. Therefore, the neoprene sleeves offer good balance control in static and dynamic conditions.

A study done on reduction of medial compartment load with valgus bracing stated that during gait, valgus bracing reduced the net varus moment about the knee joint by 13% and medial compartment load by 11%. Another study done in Cairo University in the year 2008 suggested that older women with knee osteoarthritis present worse performance in static and dynamic balance and require a longer period of time and exert more force and less directional control during balance tests when compared with age, gender, and BMI matched controls. A study done on reduction of medial compartment load with valgus bracing of osteoarthritic knee suggested that the brace shares a portion of the external varus load with the knee, which in turn reduced the medial compartment load. The reduction in the net knee moment with the valgus brace significantly affected the load on the medial compartment. Therefore, one of the possible reasons why patients experience symptomatic pain relief with valgus bracing is as a result of reduced load on the affected compartment.

Valgus bracing attempts to reduce the excessive compartmental loading and increase the knee joint function. The brace unloads the painful compartment of the knee joint by applying a three-point force system. A knee brace might achieve increased function and a more symmetrical gait, through increased proprioceptive feedback or a placebo effect which gives the wearer more confidence in the stability of their limb. A study conducted in England in the year 2005 suggested that valgus knee braces can be used as an alternative treatment option for carefully selected patients with osteoarthritis of the medial compartment of the knee joint. A knee brace reduces the need for muscles and ligaments to counteract the pathological forces, reducing the pain symptoms. The main effect of a knee brace is compensation for a portion of the external load which reduces the internal moment created by muscles and ligaments resulting in reduced forces on the affected compartment of the knee joint. A knee brace reduces the external knee adduction moment during walking and other locomotor tasks. Knee brace use is associated with a decrease in pain and knee joint function. Knee braces apply a valgus moment altering the knee joint loading during ambulatory tasks. Knee braces are helpful in alleviating symptoms of osteoarthritis of the knee joint by reducing loading in the most affected compartment by improving the stability of the knee joint and enhancing proprioception of the knee joint. Knee joint bracing increases mechanical stability, improves proprioception, pain, and function through the nonspecific effects. Bracing at the knee joint is helpful to reduce pain and swelling at the knee joint or to delay the knee surgery. On the contrary, a study conducted on functional knee bracing says that a knee brace increases oxygen consumption [O₂] and heart rate, resulting in decreased energy reserves. These effects ultimately show impairments in performance, especially during locomotor tasks and prolonged activities. A knee brace may impair performance by disrupting the normal neuromuscular control patterns and the wearer would need to adapt wearing of the brace. The findings of the current study demonstrate

that the patients with knee osteoarthritis could improve their functional mobility after wearing the knee brace. The improvement might prevent the patients with knee osteoarthritis by reducing the risk of falling down and increasing their sense of security during physical activity.

Conclusion

The findings of the study suggested that patients with knee osteoarthritis wearing knee braces showed improvement in functional mobility. The knee brace, a less cumbersome and less costly alternative, has been accepted on the basis of subjective performance. Therefore, it is effective to prescribe knee brace in patients with knee osteoarthritis while performing static and dynamic activities.

Clinical Implication

The use of a knee brace shows significant improvement in enhancing knee joint proprioception, thus, improving the static and dynamic balance of the patients with knee osteoarthritis. Knee brace for patients with knee osteoarthritis is safe and along with exercises to strengthen the muscles to provide stability to the knee joint, improving functional mobility of the patients.

Limitations of the study

- Allocation of an equal number of patients diagnosed with grade 2 and 3 osteoarthritis was not done.
- Blinding was not done.
- Pain assessment, pre and post the assessment was not done.

Further scope of the study

The study could be done on a larger population group, taking the limitations into consideration. Different types of knee braces can be included in further study. In addition to the above limitations, different outcome measures should be used to assess functional mobility and balance of the patients with knee osteoarthritis. In the further study, pain assessment pre and post the outcome measure used can be recorded to see whether there is any change after the use of knee brace for patients with knee osteoarthritis. The risk of fall assessment should also be included in further study.

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