

## Original Research Article

# EFFECT OF PROPRIOCEPTIVE EXERCISES IN OSTEOARTHRITIC AND REPLACED KNEES

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## ABSTRACT

**Background:** Osteoarthritis is a degenerative joint disease involving thinning or destruction of the smooth cartilage that covers the ends of bones and changes to the bone. Joint arthroplasty is an intervention for those patients who have severe disease, with severe pain and radiographic evidence.

**Objective:** To compare the effect of proprioceptive exercises in osteoarthritic and total replaced knees using the Knee Society Score and Joint Position Sense.

**Design:** A randomised clinical trial.

**Subjects:** A total of 95 subjects were selected based on the inclusion and exclusion criteria.

**Intervention:** Participants were divided into two groups; Group A comprised of the Total Knee Replacement and Group B was the osteoarthritic group. Group A was given exercises along with ambulation and static and resistance cycling and training of functional activities. Group B was given exercises and seven proprioceptive exercises followed by continuous short wave diathermy cross-fire method for 15 minutes.

**Outcome measure:** Pain Intensity, Functional Outcome and Joint Position Sense (JPS) were measured by using Visual Analog Scale (VAS), Knee Society Score (KSS) and Absolute angle of error, respectively.

**Results:** The results show a significant difference between the two groups using VAS and JPS whereas showed no significant difference between the two groups on using the KSS.

**Conclusion:** Based on the results of this study, it was observed that proprioceptive exercises are beneficial in improving the joint position sense in patients with osteoarthritis as well as total knee replacements.

**KEY WORDS:** Joint Position Sense, Total Knee Athroplasty, Osteoarthritic Knee, Knee Society Score, Proprioception.

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## INTRODUCTION

The Subcommittee on Osteoarthritis of the American College of Rheumatology Diagnostic and Therapeutic Criteria Committee defined osteoarthritis (OA) as "A heterogeneous group of conditions that lead to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to

related changes in the underlying bone at the joint margins" [1]. OA is known as degenerative arthritis or degenerative joint disease or osteoarthrosis [2].

Osteoarthritis is a degenerative joint disease that involves thinning or destruction of the smooth cartilage that covers the ends of bones, as well as changes to the bone underlying the

joint cartilage [3]. The prevalence of OA increases with age and generally affects women more frequently than men [4].

The Community-Oriented Program for the Control of Rheumatic Diseases (COPCORD) studies conducted in India, Bangladesh and Pakistan each collected data from several communities, aiming to detect rural–urban or affluent–poor differences. The two large surveys conducted in India by one group of researchers, presented data from these two communities adjusted to the Indian population census of 2001. This adjusted comparison revealed a significantly higher prevalence of knee pain in the rural (13.7%) compared with the urban (6.0%) community [5].

Common signs and symptoms of knee OA include knee pain, joint stiffness, decreased muscle strength, and proprioceptive deficits. Clinically, OA knee is characterized by pain during weight bearing, tenderness, and limitation of knee movement, crepitus, occasional effusion, and variable degrees of local inflammation [6]. Impaired proprioception also has been reported for the patients suffering from knee osteoarthritis [7] where reduced proprioception is responsible for initiation and/or perpetuation of degeneration of the knee [8].

Shortwave diathermy (SWD) is a non-pharmacological management approach that involves the application of deep heat and this treatment has been reported to have a measurable effect for patient with knee osteoarthritis. Shortwave diathermy frequencies approved by the Federal Communication Commission's (FCC) are 13.56 MHz (22 m wavelength), 27.12 MHz (11m), and 40.68 MHz (7.5m) of which the 27.12 MHz band is most commonly used [9].

Joint arthroplasty is an intervention for those patients who have severe disease, with severe pain and radiographic evidence, who have not responded satisfactorily to other treatment modalities [10]. Total knee arthroplasty is one of the most common orthopedic procedures performed [11]. By 2030, it is estimated that there will be an 85 percent increase in Total Knee Arthroplasty (TKA) [12]. Nearly 90% of patients who elected to have TKA had OA of the knee, 2/3 was female, and 1/3 was considered obese.

The “ideal” knee replacement candidate is between the ages of 65-75, as patients are healthy enough to recover well from surgery, yet old enough so replacement most likely lasts the rest of their lives (15-20 years) [11].

Although, to attain normal proprioception, range of motion exercises and progressive resistive exercises help re-establish joint proprioception, they are not as functional or effective as exercises in weight bearing position that help to develop joint proprioception [13].

There are no evidence based clinical guidelines post knee arthroplasty [14]. As Naylor et al. [15] phrase it “the evidence base regarding total knee replacement rehabilitation is somewhat fragmented” with considerable evidence for the use of acute postoperative cryotherapy and continuous passive movement but little for the treatments of choice such as exercise or hydrotherapy or for the progression of functional activities. Among literature, there is lack of experimental clinical trials which explore the therapeutic effects of proprioceptive exercises on the total replaced knee and the osteoarthritic group. Hence, the purpose of this study is to compare the effects of proprioceptive exercises in osteoarthritic and total replaced knees using the Knee Society Score and Joint Position Sense.

## MATERIALS AND METHODS

**Institutional Review Board Approval:** The study was approved by the institutional review board and was conducted in conformity with the ethical and humane principles of research.

**Patient Enrollment:** A total of 95 subjects were recruited from various out-patient departments of the Tertiary Care Set-up in Belagavi, Karnataka, India. The inclusion criteria included the subjects willing to participate, age between 45 to 75 years, subjects with osteoarthritis of the knee with Kellgren-Lawrence grade III, subject with replaced knee who is referred for rehabilitation on postoperative day six. The exclusion criteria consisted of subjects with neurological deficits, recent cardiovascular and respiratory, tumors, fractures, traumas, and infections. The subjects who agreed signed an informed consent form and their demographic data, symptoms and medical history were recorded.

Outcome measures: Pain intensity was given by Visual Analog Scale (VAS, 0= no pain: 100= unbearable pain). All the participants completed the VAS by indicating the average pain level experienced before and after the intervention [16]. Functional outcome was measured by the Knee Society Score (KSS), a well validated questionnaire that was developed in 1989 to objectively assess the TKA outcomes among other conditions. There are two distinct parts: Knee Score and Function Score with a maximum score of 100 [17].

The perceived sense of knee joint position was measured by absolute error angle using a knee model and a universal goniometer. The difference in the angle was calculated and the mean difference of two angles was taken. The procedure is repeated thrice and the average values were taken [18].

**Procedure:** Participants were recruited from a Tertiary Care Set-up, Belagavi. A brief history was taken about the neurological and musculoskeletal assessment for educational profile and socioeconomic status as per the inclusion criteria. The assessment took around 15-20 minutes.

The study protocol was explained to the participants. They were asked to read the informed consent thoroughly and those participants willing to take part in the study provided a written informed consent. The patients were allotted into the two groups; group A was the total knee replacement group and group B was the osteoarthritic knee group. The intervention was given 5 sessions of therapy per week for duration of six weeks and each session was for 30 minutes.

Group A was given exercises that consisted of ankle pump exercise, static quadriceps and hamstring exercises, heel drags, closed kinetic chain exercises along with ambulation and static and resistance cycling and training of functional activities .

Group B was given straight leg raises, vastusmedialisobliques strengthening, high sitting extension and seven proprioceptive exercises followed by continuous short wave diathermy cross-fire method for 15 minutes.

**Statistical Analysis:** Statistical analysis for the

present study was done manually as well as using statistical package of social sciences (SPSS) version 17 so as to verify the results obtained. For this purpose the data was entered into an excel spreadsheet, tabulated and subjected to statistical analysis. Descriptive statistics (mean and standard deviation) were computed for all data.

Various statistical tests of significance were done. Probability values less than 0.05 were considered statistically significant and probability values less than 0.001 were considered highly significant.

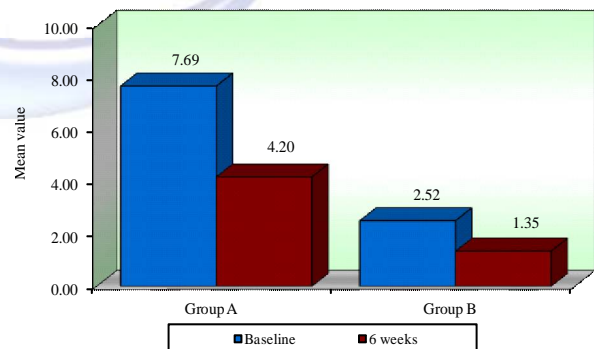
**RESULTS**

**Subject's Characteristics:** Table 1 presented the means ± SD of age and gender for both groups. Characteristics of both groups were matched at the baseline. No significant differences were recorded (p>0.05).

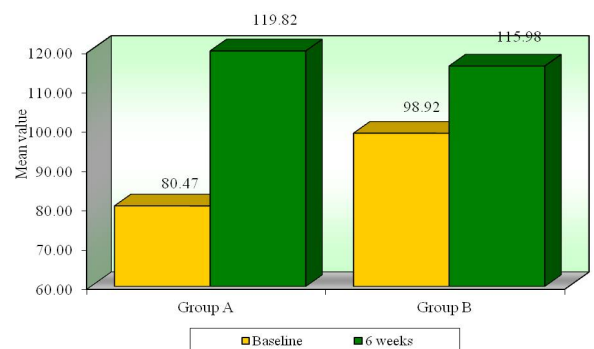
**Table 1:** Demographic data.

	Group A	Group B
<b>Gender (M:F)</b>	17:28	24:26:00
<b>Age (years)</b>	57.76±9.51	64.25±9.76

**Graph 1:** Comparison of two groups (A, B) with respect to baseline and 6 weeks VAS scores.

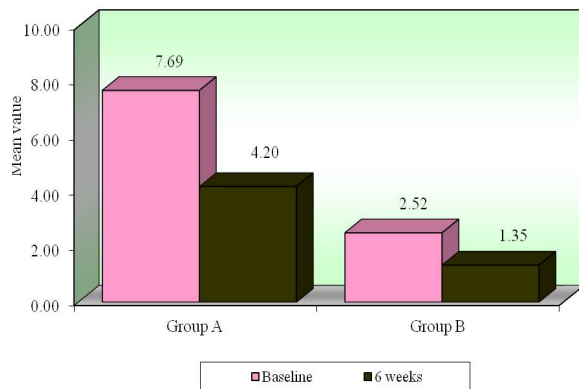


**Graph 2:** Comparison of two groups (A, B) with respect to baseline and 6 weeks KSS scores





**Graph 3:** Comparison of two groups (A, B) with respect to baseline and 6 weeks JPS scores.



### Outcome's Results:

1. VAS results: Figure 1 presents the mean value of the VAS score for both groups. Comparison of two groups (A, B) with respect to baseline and 6 weeks VAS scores was done using Kruskal-Wallis test. There was a significant difference between both groups ( $p < 0.000$ ).

2. KSS results: Figure 2 presents the mean value of the KSS score for both groups. Comparison of two groups (A, B) with respect to baseline and 6 weeks KSS scores was done using one-way ANOVA test. There was no significant difference between both groups ( $p < 0.668$ ).

3. JPS results: Figure 3 presents the mean value of the JPS score for both groups. Comparison of two groups (A, B) with respect to baseline and 6 weeks JPS scores was done using one-way ANOVA test. There was a significant difference between both groups ( $p < 0.000$ ).

### DISCUSSION

This study was conducted to examine the effect of proprioceptive exercises on osteoarthritic and replaced knee using VAS, KSS and the perceived joint position sense. The results indicated that proprioceptive exercises are effective in the total knee replacement and in the osteoarthritic group as well. There was a statistical difference between both groups with respect to VAS and JPS. However, no statistical difference between both groups with respect to KSS was seen.

This study was conducted to examine the effect of proprioceptive exercises on osteoarthritic and replaced knee using VAS, KSS and the perceived joint position sense. The results indicated that

proprioceptive exercises are effective in the total knee replacement and in the osteoarthritic group as well. There was a statistical difference between both groups with respect to VAS and JPS. However, no statistical difference between both groups with respect to KSS was seen.

Knee osteoarthritis (OA), generally defined by the narrowing of the joint space, is a prevalent condition that is often associated with debilitating pain [3]. The prevalence of OA increases with age and generally affects women more frequently than men [4]. Female sex, lower educational levels, obesity, and poor muscular strength are associated with symptomatic disease and subsequent disability [19]. All of the above coincides with this study.

Primary osteoarthritis is a common disorder of the elderly, and patients are often asymptomatic. Approximately 80-90% of individuals older than 65 years have evidence of radiographic primary osteoarthritis [20]. On the basis of the radiographic criteria for osteoarthritis, more 50% of adults older than 65 years are affected by the disease [21]. Clinically, OA knee is characterized by pain during weight bearing, tenderness, and limitation of knee movement, crepitus, occasional effusion, and variable degrees of local inflammation [6] along with reports of patients suffering from impaired proprioception [7]. A study done where they found that reduced proprioception in elderly and osteoarthritic subjects may be responsible for initiation and/or perpetuation of degeneration of the knee [8].

Previous evidences suggest the possibility that quadriceps weakness is a primary risk factor for knee pain, disability, and progression of joint damage in persons with osteoarthritis of the knee [22]. Also, another study concluded that in patients with knee OA, articular damage may reduce quadriceps motorneuron excitability, which decreases voluntary quadriceps activation thus contributing to quadriceps weakness, and diminishes proprioceptive acuity [23]. Another study showed that advanced – stage knee osteoarthritis with American College of Rheumatology Criteria with grade of 3 showed that proprioception was impaired in the patients [24]. The criteria of the study were in conformity of previous evidences.

A comparative study conducted by Thompson et al.[25], showed that proprioception significantly improved in both groups by 6 weeks. Their finding suggested that improvements in proprioception can be obtained via regular activity that is independent of heavy muscle loading. In a survey conducted for rehabilitation of TKA, the mean duration of the program was 5.6 weeks [14]. In another study suggested treatment programs when conducted for 5 days per week for 6 weeks showed improvements in symptoms [26]. This study as well utilized a 6 week protocol which was for both the groups.

Application of shortwave diathermy to the involved tissues may increase vascular circulation with changes of tissues temperature, which directly results in vascular dilatation, increase in pain threshold, decrease in pain and swelling. Such vascular improvement also decelerates the inflammatory process by increasing nutrition and oxygen supply and by removing metabolic waste product [9]. This present study also showed the reduction of pain upon using the VAS scale. Rehabilitation of OA that focus in muscle strength endurance and flexibility when combined with kinaesthesia and balance demonstrate that improve dynamic muscle strength and functional status and suggest using proprioceptive exercise in a rehabilitation protocol [27].

A randomised clinical trial proved that proprioceptive training led to greater improvements in proprioceptive function, while strength training resulted in a greater increase in knee extensor muscle strength [28].

The main aims of physiotherapy rehabilitation following knee arthroplasty were to reduce pain, to maintain/increase joint range of motion, to maintain/improve muscle strength, to maximize functional ability, to support/advise and educate patients as necessary and to encourage self-care and self-management [30] and prevention of post-operative complications [31]. Clinical evidences showed that progressive quadriceps muscle strengthening improves functional outcome following knee arthroplasty [31-33]. Hence, our study was consistent with the previous studies.

Contrary to this study, the effect of knee replacement on proprioception in general remains elusive. Some authors report significant improvement in proprioception after knee replacements [34,35], while others have found no differences between replaced and unreplaced knees [36,37]; even a reduction in proprioception after knee replacements has been reported [38].

## CONCLUSION

Based on the results of this study, it was observed that proprioceptive exercises are beneficial in improving the joint position sense in patients with osteoarthritis as well as total knee replacements. Also, the results necessitate the implementation of proprioceptive exercise into the protocols for rehabilitation of both conditions for improving functional activity and proprioception.

**Conflicts of interest: None**

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