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Original Research Article

Effect of core stability exercises on knee proprioception, function and quality of life in chronic total knee replacement patients

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ABSTRACT

Background: Chronic osteoarthritis of knee joint leads to severe pain after weight bearing and prolonged activities .TKR is widely used as a successful and effective last-stage surgical treatment for relieving chronic knee pain and functional disability. This research aimed to study the effect of core stability exercises on knee proprioception, function and quality of life in chronic total knee replacement patients.
Methods: Total 40 patients with chronic total knee replacement with age between 45-65 years were included. They were divided into two groups: Group-A (n=20) and Group-B (n=20). Both group received conventional treatment, in addition Group-B received core stability exercise. Patients were evaluated pre-intervention (0 week) and post-intervention (4 week) for proprioception (by universal goniometer), for function (LEFS) and for quality of life (SF-12). Statistical analysis was done using SPSS 20 version. Significance level was set at $p \leq 0.05$.
Results: Wilcoxon signed rank test was applied for within group comparison. There was statistically significant difference in mean of proprioception, function and SF-12 PCS in both groups during four week intervention period. Mann Whitney U test was applied for between group comparison. Significant difference was found between Group-A and Group-B in mean difference of proprioception, function.
Conclusions: The concluded that the core stability exercise along with conventional treatment is more effective for improving knee proprioception, function and quality of life than alone conventional treatment in chronic total knee replacement patients.

Keywords: Chronic TKR, Core stability exercises, Proprioception

INTRODUCTION

Osteoarthritis is most common form of arthritis.[1] Knee osteoarthritis is second most common rheumatologic problem and most frequent joint disease with prevalence of 22% to 39% in India.[2] Knee osteoarthritis is more common in women than men but with increase age prevalence will dramatically increase. 45% women over the age of 65 have symptoms and radiological evidence proved that 70% of those over the age of 65.

Self management programmes, physiotherapy, but this therapeutic intervention has small effect size on relieving knee pain. so when this intervention fail, surgical intervention like osteotomy and arthroscopy suggested but these intervention also has limited improvement on knee pain. Total knee replacement is the last surgical intervention that has large effect on relieving knee pain. According to Indian society of hip and knee surgeons (ISHKS) joint registry 34,478 total knee replacement surgeries have been done across India till 2011. There

included 25% males and 75% females. Average age was 64.4 years. Average body mass index was 29.1. After total knee replacement complication like pain, stiffness, infection, instability, neural deficit, Malalignment, vascular injury, fracture, muscle impairment, functional limitation like walking, stair climbing is there.[3,4] Decreasing proprioception of knee is because of soft tissue release during total knee replacement.[5] After total knee replacement, various rehabilitation protocols focus on controlling pain, muscle strengthening, improving range of motion, proprioception recovery, stretching, gait rehabilitation, improvement in neuromuscular function and activity of daily living.[6-8] Core stability exercise are one of them.

Core stability exercise improve core strength and lower limb balance.[9] Core stability training trains the strength and balance of the core muscle of body to resist external loads exerted on the body trunk, maintain the spine posture and enhance stability and coordination of the limb mobility.[10] Core stability exercise has been used for improve the activities of daily living. For sense of dynamic stability core musculature is important.[11]

The lower extremity functional scale (LEFS) is used to measure lower extremity function and it is very known and validated patient reported outcome measure.[12] Lower extremity functional scale (LEFS) develops by Binkley has high validity, reliability and test retest value. LEFS is used for measuring lower extremity function in various disorders and also in orthopedic surgeries.[12] 12 item short form version (SF-12) is questionnaire measuring quality of life from patient's perspective. SF-12 is self-reported health status tool. SF-12 is self administration and for personal interviews can be administered to most people.[13]

Various studies prove that core stability exercise improves knee joint position sense, functional ability and also improves balance ability and endurance. So core stability exercises can be beneficial in chronic total knee replacement patients. Hence the need arises to compare the effectiveness of core stability exercise with conventional exercise on improving knee proprioception, gait and quality of life in chronic total knee replacement patient.

Significance of study-core stability exercise have been used as a treatment protocol for low back pain but till date less studies have been done to evaluate effect of core stability exercise for chronic total knee replacement. Various studies prove that core stability exercise improves knee joint position sense, functional ability and also improves balance ability and endurance. But their effects have not been widely investigated in rehabilitation of chronic total knee replacement patients. Hence this study will significantly contribute to use core stability exercise as an effective protocol to improve knee proprioception, function and quality of life in chronic total knee replacement patient.

This study aimed to determine the effect of core stability exercise on knee proprioception, function and quality of life in chronic total knee replacement patient and to determine the effect of conventional exercise on knee proprioception, function and quality of life in chronic total knee replacement patient. Also, to compare the effect of core stability exercise and conventional exercise on knee proprioception, function and quality of life in chronic total knee replacement patient.

METHODS

Study area

A pre - post experimental study conducted in the SPB Physiotherapy College OPD and other clinical OPDs of Surat.

Study subjects

Patients of total knee replacement with 45-65years of age were included into the study.

Study period

Study was conducted for the period of one month i.e. 18 November 2021 to 01 August 2022.

Inclusion criteria

Patient with age of 45-65 years, both male and female, both unilateral and bilateral chronic total knee replacement patients, patient will be included after 3 months of total knee replacement, referred cases of chronic total knee replacement from orthopedic surgeon, patient who can read and understand Gujarati were included.[16]

Exclusion criteria

Patient with neurological disorder and radiculopathy, Infection (within last 6 months) and inflammation in the knee joint, any previous surgery (within last 6 months), unwilling to provide informed consent or uncooperative patient were excluded.[12,16,23,24]

Procedure

Ethical approval was taken from institutional ethical committee. The patient was screened on the basis of inclusion and exclusion criteria and their demographic data was taken by an assessment Performa. Prior to the commencement of the study, detailed procedure of the study was explained to the patients and a signed informed consent form was taken from them. Descriptions of groups were given as follow: Group A: Conventional treatment. Group B: Conventional treatment + core stability exercise. On the first day of first week, baseline

measurement for knee proprioception, gait and quality of life was taken.

Outcome measures

For Proprioception joint position sense was measured using universal goniometer.[25] Joint position sense in non-weight bearing position: Patient was in high sitting with leg out of the plinth and thigh fully supported. To gain accuracy in measuring the angle the goniometer was tie to the lower limb. Patient's eyes were closed to avoid any visual cues. Therapist was passively flexed knee joint from extended position to the target angle of 30 degree. Then asked the patient to hold the position for 4 second to identify test position and then therapist passively returns the limb to the starting position. 3 practice repetitions were given and then patient was reproducing target position using the same limb and average of 3 repetitions was measure. Knee function measured using Gujarati version of lower extremity functional scale (LEFS) (annexure-6). The subjects were given a detailed explanation about the lower extremity functional scale. This questionnaire consists of 20-item measure that was specifically used for measuring lower extremity function in any lower extremity condition. Patient respond to each item by marking at any one in 0-4 Likert scale. The total score was the sum of the scores of all 20 items and can range from 0 indicating no disability to 80 indicating greatest disability.[12] Quality Of Life measured using 12 items short form questionnaire (SF-12) (Annexure-7). The subjects were given detailed explanation about 12 item short form questionnaire. This questionnaire consists of 12 questions that were specifically used for measuring quality of life. Patient responds to each item by marking at any one.PCS-12 and MCS-12 scales are have mean of 50 and standard deviation of 10.[13-15]

Sample size

For sample size calculation in this study, the effect size was calculated from the result of the pilot study. The sample size was estimated in G power 3.1.9.2 version with effect size 1.18 and $\alpha = 0.05$ at 95% power. Sample size calculated was 40, 20 samples in conventional treatment group and 20 samples in core stability exercise group.

Intervention

Same conventional treatment (CT) was given to both the groups. Conventional treatment included: Ankle pumps, Straight leg raise in supine, Short arc quads, Quadriceps setting exercise, 60 degree Squats, Ice pack for 15 min after the exercise.[16,23,24] All exercise was done with 10 repetition × 2 sets with 5 seconds hold, Total exercise duration approximately 25-30 minutes.[16] Group A: [conventional treatment], Group B: [conventional treatment + core stability exercise] Core stability exercises included[17,19]

- Curl ups (2 set × 10 repetitions)
- Prone knee flexion (2 set × 20 repetitions)
- Lateral straight leg raise (2 set × 15 repetitions)
- Draw foot circle in supine lying (2 set × 15 repetitions)
- Draw foot circle in side lying (2 set × 15 repetitions)
- Bridging (2 set × 10 repetitions).

Total exercise duration approximately 25-30 minutes. Intervention duration was for 4 weeks and 5days/week.[19]

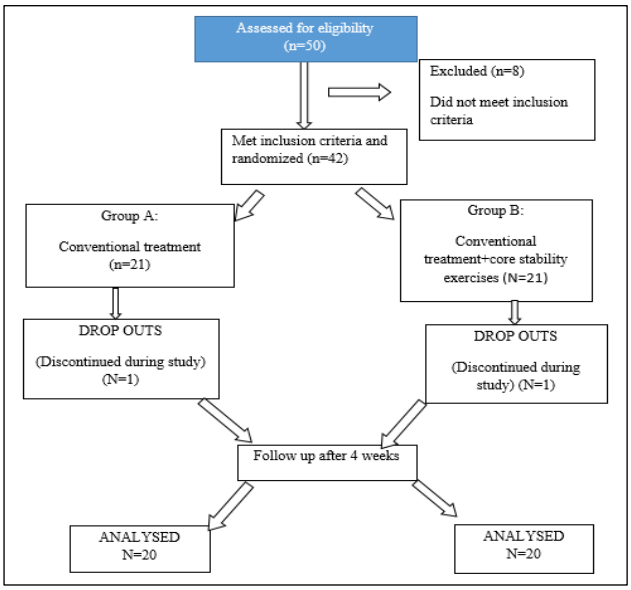

Figure 1: Study overview.

Statistical analysis

The statistical software named statistical package of social sciences (SPSS) version 20.(SPSS 20.0) was used for the analysis of the data and Microsoft word 2007 and Excel 2007 was used to generate graphs and tables. Level of significance with p value set at 0.05; the data were ensured for their normal distribution using (Shapiro-Wilk Test). All variable's p value was less than 0.05 so all variables followed the non-normal distribution. So, the non-parametric tests were performed. Wilcoxon signed rank test as a non-parametric test have been used to analysis the variables pre intervention to post-intervention with calculation of change. Mann Whitney U test as a non-parametric test have been used to compare the means of variables between two groups with calculation of difference between the means.

RESULTS

Mean age and BMI of subjects of conventional treatment group and conventional treatment + core stability exercise group is mentioned in Table 1.

Table 1: Mean age and BMI of subjects of conventional treatment group and conventional treatment + core stability exercise group.

	Group A	Group B
Mean age	59.8	60
Mean BMI	25.3135	25.2605

Table 2: Within group comparison of proprioception.

	Postprop-preprop (Group A)	Postprop-preprop (Group B)
Z	-4.042[B]	-3.925[B]
Asymp. sig (2-tailed)	0.000	0.000

Wilcoxon Signed Ranks Test; B-based on positive ranks.

Table 2 shows within group comparison of proprioception (Wilcoxon signed rank test), significant changes pre-post within both groups (Table 3).

Table 3: Within group comparison of lefs.

	Postlefs-prelefs (Group A)	Postlefs-prelefs (Group B)
Z	-3.952[C]	-3.946[C]
Asymp. sig (2-tailed)	0.000	0.000

Wilcoxon Signed Ranks Test; C-based on negative ranks.

Within group comparison of lefs Wilcoxon signed rank test), significant changes are observed pre-post within both groups. Table 4 shows within group comparison of SF-12 PCS and SF12 MCS, significant changes was found in physical component of SF12. Table 5 shows between group comparison of LEFS, proprioception and quality of life, significant changes were found between group for LEFS and proprioception.

Table 4: Within group comparison of SF-12 PCS and SF12 MCS.

	POSTSF-12PCS-PRESF-12PCS (Group A)	POSTPCS-PREPCS (Group B)
Z	-3.883[C]	-3.926[C]
Asymp. sig. (2-tailed)	0.000	0.000
	POSTSF-12MCS-PRESF-12MCS (Group A)	**POSTMCS-PREMCS (Group B)**
Z	-1.532[C]	-.056[B]
Asymp. sig. (2-tailed)	0.126	0.955

B-based on positive ranks; C-based on negative ranks.

Table 5: Between group comparison of lefs, proprioception and quality of life.

Test statistics[a]				
	MEANDIFPROP	**MEANDIFLEFS**	**MEANDIFSF12PCS**	**MEANDIFSF12MCS**
Mann-Whitney U	73.500	51.500	170.500	157.500
Asymp. Sig. (2-tailed)	0.000	0.000	0.424	0.249

DISCUSSION

This study was conducted to find if there was significant difference in core stability exercises than conventional exercises in chronic total knee replacement patients. In present study, knee Proprioception, function and quality of life were taken as the outcome measures and they were scored by using the universal goniometer, lower extremity function scale and SF-12 scale, respectively. Result of this study showed that conventional treatment was effective on knee proprioception, function and SF-12 PCS but not effective on SF-12 MCS in chronic total knee replacement patients.

Core stability will cause good translation of force and that leads to improve the proprioception. Present study found that there was significant difference in core stability exercises than conventional exercise in chronic total knee replacement patients. Core stability exercises improve overall function by improving flexibility, endurance, strength and neuromuscular control of joints, hence improving functional performance of patients better than the conventional exercises. Core stability exercises in chronic total knee replacement patients have positive effect on functional outcome which can be measured by detachable difference on lower extremity functional scale that proved core stability exercises are better than the conventional exercises.[16]

As, in chronic total knee replacement patients have impairment in quadriceps function and also decrease in quadriceps strength, hence limiting knee proprioception, function and also quality of life. So in this study since conventional treatment includes the quadriceps strengthening exercise hence there is improvement in knee proprioception, function and quality of life.[20]

In another study, Soleman and Muhammad conducted a single blinded randomized control trial, patients with sub-acute total knee replacement in a 6-week program showed

that conventional treatment were not as effective as the core stability exercise on function contrary to present study which included the patients of chronic total knee replacement with protocol for 4-week program.[16]

In this study, both the group (A & B), showed significant improvement in knee proprioception, function and SF-12 PCS. But both the groups showed no significance on SF-12 MCS. But after comparing mean difference of both the group there was more significant improvement in Group-B than Group-A on knee proprioception, function but not in quality of life.

As, in chronic knee replacement patients have core region weakness which affect proprioception, function and quality of life. So as core stability exercises strengthen the abdominal muscles which are related to the ilium and improve the lower extremity function. So It WAS observed that there is significance increase in knee proprioception, function and SF-12 pcs in Group-B after intervention.[20]

Similar results were found in study conducted by Sellentin and Jones, effect of core stability exercises in lower extremity proprioceptive performance and found that proprioception of lower extremity improved after the core stability exercise.[9,20,22]

This study has few limitations. There was no follow up evaluation, once the treatment was completed. The study included only chronic TKR patients hence result cannot be generalized for acute and sub acute TKR subjects.

CONCLUSION

There was no follow up evaluation, once the treatment was completed. The study included only chronic TKR patients hence result cannot be generalized for acute and sub acute TKR subjects.

Recommendations

Further study can be conducted using other method for measuring joint position sense like joint position detection-active/passive to see if any variation exists .further studies can be conducted with 6 week of intervention protocol. Further study can be done by taking follow up effects of intervention of the patient. Also future studies can be done including acute and sub-acute TKR patients and see the effect of treatment protocol on the outcome measures.

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