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TITLE: EFFECTIVENESS OF EGOSCUE EXERCISES ON PAIN, BODY-FUNCTION AND BALANCE IN INDIVIDUALS WITH KNEE OSTEOARTHRITIS

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ABSTRACT

Background: Physical Therapy plays an important role in the management of Knee Osteoarthritis (OA). Egoscue exercise is a form of corrective exercise, it is the most convenient method for treating recurrent musculoskeletal pain caused by ageing, accidents, sports injuries, and other disorders. Effectiveness of Egoscue exercise showed that there was marked reduction in knee pain, improvement in body-function and balance in individuals with knee osteoarthritis.

Study Purpose: To evaluate the effectiveness of Egoscue exercise on Pain, Body-function and Balance in individuals with Knee Osteoarthritis.

Basic Methods: Eighteen (n=18) individuals with grade 2 and grade 3 knee OA were recruited for this study. The individuals were taken according to inclusion criteria and received set of Egoscue exercise for 5days/week for about 3 weeks. The outcome measures were numeric pain rating scale(NPRS), knee injury and osteoarthritis outcome score(KOOS), lower quarter Y balance test(YBT-LQ) assessed at pre and post intervention.

Main Results: The study showed statistically significant difference between pre and post treatment within subjects with knee OA after 3 weeks of intervention in pain, body-function and balance in terms of NPRS(p value<0.001), KOOS(p value<0.001), YBT-LQ (p value<0.001) which is highly significant.

Principal Conclusion: Egoscue corrective exercises considerably decreased pain in participants with OA knees while also enhancing bodily function and balance. However no discernible changes in the YBT-LQ test for balance in the posteromedial direction of the right leg was noted.

Keywords: Balance; Body-function; Egoscue Exercises; Knee Osteoarthritis; Knee Pain

INTRODUCTION

Osteoarthritis (OA) is the most common deterioration of the joint and usually begins by gradual deprivation of intra-articular cartilage or by the disappearance of synovial fluid in joint spaces [1]. Literature states that in men and women, 60 years and older, radiographic OA of the knee affected about 35% of them [2]. According to research, almost 27 million Americans, or a large portion of the population, would be impacted by knee OA by the year 2020, making it the country's main cause of disability. Those who are older than 50 years are more at risk for having knee OA which will gradually raises to almost 55% in those greater than 70 years of age. It leads to mild to moderate rigidity in the joint that causes pain, which is a main and considerable element of knee osteoarthritis [1].

Symptoms of osteoarthritis can affect the function and also reduces the standard of living of the individuals [3]. To determine the existence and extent of knee OA, the grades of the OA by Kellgren and Lawrence scale for OA are used, which includes, grade0= Normal joint space with no osteophytes, grade1=Doubtful narrowing of space in joints with possible osteophytes, grade2=Minimal but definite osteophytes with narrowing of joint space, grade3=multiple and moderate osteophytes with narrowing of joint space, grade4=large osteophytes, clearly reduced joint space, sever sub-chondral sclerosis [2]. Risk factors like past history of knee surgery, obesity, knee injury, and overuse injuries such as knee bending and repetitive stress on the knee joint [1].

Pain is the key OA symptom, involving both peripheral and central neurological mechanisms [4]. It worsens when the affected joint is used and is reduced at rest. Pain becomes the primary issue in knee OA [5]. So because of pain, the balance gets disturbed. For many functional activities, balance is required and it prevents falls. Reduced balance function is linked to an increased chance of falling, which is the major reason for individuals to be admitted to hospitals.

The malalignment of body segments results in improper posture giving rise to redeeming effort by other segments to manage the body balance, resulting in unwanted muscular strains and damage to the joints [7]. The most common condition in the aged population that significantly contributes to functional limits and impairment is knee OA [8].

As to reduce the pain, and improve the body function and balance in subjects diagnosed with grades of 2 and 3 knee OA, the Egoscue method is used. Because there will be an early stage of stiffness, functional limitations, and altered balance in patients with grade 2 and grade 3 knee OA.

This Egoscue method was introduced by Pete Egoscue in 1978 and is still contemplated one of the major respected and admired non-medical pain relief systems in the world. It is the most approachable treatment to treat chronic musculoskeletal pain in sports injuries, accidents, aging, and other conditions. Over the years, Pete created hundreds of simple exercises that help improve mobility, correct posture, and get rid of chronic pain [9]. It uses corrective exercises designed to improve whole-body postural alignment and reduce musculoskeletal pain by improving joint mobility and stability [7]. Because the body is out of balance, pain exists. Pete Egoscue says that surgery may temporarily relieve the pain but exercises eliminate the impulses and suppress the pain symptoms by treating underlying musculoskeletal dysfunctions [9]

These Egoscue exercises (E-cises) are arranged in menus and are easy to perform and very effective in individuals with musculoskeletal problems. This method focuses on balance and posture to get rid of chronic pain brought on by our contemporary lifestyles, including repetitive use, commuting, typing, texting, sports injuries, accidents, aging, and more. These exercises are developed as a customized set of exercises that will restore the body balance and get rid of the dysfunction that's generating the discomfort. The Egoscue method's success mostly derives from its capacity to restore a person's intrinsic kinesthetic sense or muscle memory.

E-cise helps the muscles to reeducate what to do and how to do it. Pete Egoscue said that E-cises look uncomplicated, but they are estimated to spot specific musculoskeletal functions that are adjusted by various factors [9]. So the aim of our study is to find out the immediate effect of Egoscue corrective exercise training to decrease pain and improve body function and balance in the individuals with grade 2 and grade 3 OA of knee.

METHODS

The present pre-post intervention study was conducted on grade 2 and grade 3 knee OA individuals referred by an physician in the physiotherapy outpatient department setting of a tertiary care centre. The ethical clearance was obtained by the Institutional Research Committee with approval number (Ref.No.SUIP/UG22/106/2023) and the procedures followed during the study were in accordance with the Helsinki Declaration of 1975, as revised in 1983. Twenty (20) participants were screened out of which 2 participants were excluded as they did not meet the inclusion criteria. Sample size calculated for the study was eighteen based on Sample size: $N=Z\alpha 2\ s2/\ d2$ Where $Z\alpha = 1.96$ at 95% confidence level s= standard deviation and d= Relative precision= 15% of Mean (85% power).

Eighteen participants took the regular Egoscue exercises for 5 days/week for about 3 weeks. Inclusion criteria was individuals aged between 45 and 75 years, diagnosed with grade 2 and grade 3 knee OA according to Kellgren Lawrence classification of knee OA. Individuals diagnosed with neurological conditions or sensory vascular conditions, participants receiving immune suppressants or other painkillers throughout the trial, participants who have taken any corticosteroids since 6 months and participants who had any unhealed lower limb or knee fractures or congenital abnormalities were excluded from the study.

Outcome assessment:

Demographic details such as age, gender, height, weight and BMI of the subjects were recorded following which, the outcome measures including NPRS, KOOS, YBT-LQ were noted at baseline and 3 weeks post intervention. NPRS score was taken by the participants by informing them to rate their pain from 0 to 10 where, 0 denoting "no pain" and 10 denoting the "worst imaginable pain." before and after the intervention by the investigators. For body-function, the KOOS questionnaire containing subscales like Pain, Symptoms,

Activities of daily living, Sports and recreational activities and Quality of Life were filled by the participants. The Y balance test for the lower quarters of both legs in the anterior, posteromedial, and posterolateral directions was used to determine balance (Insert Figure 1 here).

Procedure for intervention:

The exercise intervention: Participants underwent an intervention five days a week for three weeks, which was carried out in the physiotherapy outpatient department under the close monitoring of an investigator. Following that, patients were asked to repeat the same exercises five days a week for three weeks at home without the investigator's supervision.

Each session lasted 45 minutes, which included a 5-minute warm-up, 35 minutes of Egoscue exercises, and a 5-minute cool-down. The participants were asked to perform warm-up exercises such as stretching, forward, backward, and sideways walking, side bends, and arm circles, march on the spot and knee lifts. In cool down exercises like breathing exercises.

Egoscue exercises (n=18): The participants were explained about the Egoscue exercises on the first session (Insert Table 1, Figure 2 here)

Dosage: The session was started with warm-up exercises for 5 minutes, then 10 Egoscue exercises was continued for 35 minutes and the session ended with cool down exercise for 5 minutes. So the session was for about 5 days per week for 3 weeks

STATISTICAL ANALYSIS

A statistical package is the SPSS version. 24.0was used to do the analysis. The data was entered into an excel spreadsheet, tabulated, and statistical analysis was performed. For continuous variables, the data were summarized as mean and standard deviation. Data analysis had done by descriptive statistics. Shapiro-Wilk showed that the data were normally distributed after the data were analyzed for normal distribution. To determine the difference between pre- and post-treatment within-subject effects, a paired student t-test was conducted.

RESULTS

Demographic information suggests that all participants were taken homogenously (Insert Graph 1). Patients' age, gender, weight, height, and BMI were all recorded as part of their demographic information (Inset Table 2 here). A statistical analysis was done using SPSS version 24.0. The data were analyzed for normal distribution with Shapiro-Wilk showing the data as normal distributed (Insert Table 3 here)

To assess the impact of a single corrective exercise session on pain levels, NPRS pain scores before and after the first visits were compared. Over the course of the three weeks, there was a significant reduction in pain during movement.

The mean and standard deviation of numeric pain rating scale at baseline is 6.278±1.179 and at post treatment were 4.944±1.349 respectively (Insert Graph 2 here). Paired student t-test was done to find the difference between pre and post treatment within subject effects (Insert Table 4 here). t value=7.376 and the p value<0.001 which is highly significant within subject effects at post treatment

The mean and standard deviation of KOOS scale at baseline in pain is 59.405 ±10.618, symptoms 64.085±19.272, ADL is 62.903±11.761 and QOL is 55.556±10.695 and at post treatment in pain is 66.817±10.459, symptoms is 73.366±16.572, ADL is 68.866 ±12.553 and QOL is 61.111±10.181 respectively (Insert Graph 3 here). Paired student t-test was done to find the paired difference between pre and post treatment within subject effects (Insert Table 5 here). p value<0.001 which is highly significant within subject effects at post treatment.

The mean and standard deviation of YBT-LQ at baseline for right leg in anterior direction is 74.882±10.164, posterolateral direction is 62.400±10.584, posteromedial is67.050±10.522 and at post treatment in anterior direction is 76.259±10.158, posterolateral direction is 63.663±10.497, and posteromedial is 67.314±10.013 respectively. And for left leg in anterior direction is 79.202±11.041, posterolateral direction is 67.004±10.410, posteromedial is 68.881±12.325and at post treatment in anterior direction is 80.305±11.062, posterolateral direction is 68.267±10.374, and posteromedial is 70.478±11.847 respectively (Insert Graph 4 here). Paired student t-test was done to find the paired difference between pre and post treatment within subject effects (Insert Table 6 here), p value<0.001 which is highly significant within subject effects at post treatment except posteromedial direction in right leg (p value=0.545).

DISCUSSION

The present pre and post intervention study was done to evaluate the effect of Egoscue corrective exercises on pain, body function, and balance in participants with knee osteoarthritis after three weeks of performing Egoscue exercises. The outcome measures of this study suggests that corrective exercises showed a significant decrease in pain over the three weeks, as well as a significant improvement in body function and balance with marked reduction in NPRS, KOOS and improvement in YBT-LQ.

In our study, after Egoscue exercise intervention, knee pain considerably decreased. It has been claimed that Egoscue exercise can quickly relieve pain [9] which has been demonstrated to be true in our study, in which there was a significant decrease in pain as measured by the NPRS following a 3-week exercise intervention. A study done by Zachery Vehrs et al. shown a substantial decrease in knee and hip pain following three weeks of Egoscue exercise, which had a relatively quicker pain-reduction [7]. Similarly other two studies by Sidra Zaidi et.al stated that, corrective exercise reduced neuropathic pain [1] and S.E. Sequeira et.al, found that both Egoscue exercises and lumbar stabilization exercises are equally beneficial in reducing pain in lower crossed syndrome [16]. Along with these supportive studies and post intervention NPRS score, E-cise found to be effective in pain reduction on OA knee patients in our study.

Our study the result show that reduction in post intervention KOOS score by stating that there is improvement in body-function in subjects with knee OA. Corrective exercise training, according to Sidra Zaidi et al., improved functional results in individuals with knee OA [1]. Zachery Vehrs et al. study also supported to this statement in improvement of function in knee OA patients [7]. Egoscue exercise helps to improve the body-function by improving joint mobility and stability [7]. The exercises are designed to affect each of the major joints in the body, and statistics from our study indicate that the Egoscue Method of corrective exercises can assist to manage knee pain and enhance physical functions as well.

The improvement in the balance was found in our study using YBT-LQ outcome measure. Parisa Sedaghati et.al also agreed in their study that corrective exercises can improve the functional balance in elderly individuals [17]. There was significant improvement in the balance for both the legs in all three directions like anterior, posterolateral and posteromedial but except in right leg posteromedial direction. As because right

knee pain affected the majority of the participants in this study. The reasoning behind the improvement in the balance is due to E-cise because it is a sequence of designed exercises that will correct the discomfort caused by dysfunction and thereafter helps in the rebalance of the body [9]. However, there is paucity in literature on the impact of Egoscue exercises on balance in knee osteoarthritis patients. This appears to be the only study to date to evaluate the effectiveness on balance in individuals with knee OA.

The founder of Egoscue method Pete Egoscue, said that it is the most approachable way for treating chronic musculoskeletal pain caused by accidents, ageing, sports injuries, and other disorders [9]. It employs corrective exercises that increase joint mobility and stability to minimize musculoskeletal discomfort and enhance overall body postural alignment [7]. The purpose of corrective exercises and the Egoscue approach is to improve the way the body is positioned and reduce pain. And the Egoscue Method's basic principle is that treating pain should take into account the whole-body postural alignment because postural misalignments of one joint can result in pain at another joint.

The present study resulted in a significant decrease in pain, improvement in body function and balance as daily diaries of participants, over the course of this 3-weeks study. This indicates that the Egoscue corrective exercises have a relatively quick effect on reducing knee pain. Although it has been asserted that the Egoscue corrective exercises can ease pain, improve body function and balance.

Since Egoscue exercise requires no much manpower, an individual can readily complete it by themselves at home. By adjusting the posture of the body that is out of alignment, it even lessens additional joint difficulties brought on by knee OA and enhances the person's quality of life. This exercise is one of the practical corrective exercises because it requires minimum set-up to perform them out.

However there are some limitations in the present study, such as smaller sample size of our study, the exclusion of patients with sports-related or recreational activities, and the inclusion of only patients with grades 2 and 3 of knee osteoarthritis.

Future studies can use a large sample size, individuals with other grades of knee osteoarthritis can be explored as well as individuals involved in sports and recreation can also be incorporated. Additionally, the Egoscue exercises can be implemented in the treatment of pain in various other undiscovered conditions.

CONCLUSION

The study concluded that three weeks of Egoscue corrective exercises considerably decreased pain in participants with OA knees while also enhancing bodily functions and balance. Despite no discernible changes in the YBT-LQ test for balance in the posteromedial direction of the right leg, the reduction in discomfort and improvement in function were reported.

CONFLICT OF INTEREST: The authors have no conflict of interest to report

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APPENDIX 1

Figure 1: YBT-LQ for Right leg: (A) anterior direction; (B) posteromedial direction; (C)posterolateral direction

Figure 2: Egoscue exercises: (A) Standing gluteal contraction; (B) Sitting heel raises; (C)Isolated hip flexor lift on a towel; (D) Supine groin stretch on towel; (E) Static back; (F) Sitting knee pillow squeezes; (G) Sitting floor; (H) Progressive supine groin; (I) Supine calf-hamstring stretch with a strap; (J) Foot circles and point flexes.

APPENDIX 2

Table 1. Egoscue Exercise protocol for participants

Egoscue Exercises	Dosage
• Warm-up exercises - Stretching - Walking:- forward, backward, sideways - Side bends - Arm circles - March on the spot - Knee lifts	• Total for 5 minutes
• Standing gluteal contractions (bilateral)	• 3 sets of 20 repetitions
• Sitting heel raises(bilateral)	• 3 sets of 15 repetitions
• Isolated hip flexor lifts on a towel(bilateral)	• 3 sets of 10 repetitions
• Supine groin stretch on towels(bilateral)	• 3 sets of 10 repetitions
• Static back	• 3 sets of 10 repetitions
• Sitting knee pillow squeezes	• 4 sets of 10 repetitions
• Sitting floor	• 3 sets of 10 repetitions
• Progressive supine groin	• 3 sets of 10 repetitions
• Supine calf-hamstring stretch with a strap	• 3 sets of 30 seconds hold
• Foot circles and point flexes	• 3 sets of 10 repetitions
• Cool down exercises - Breathing exercises	• For 5 minutes

APPENDIX 3

Table 2: Basic demographic characteristics of participants

Variables	Mean	Median	Standard deviation	Range
Age (year)	54.556	54.000	7.014	23.00
Height (cm)	160.389	159.000	6.599	30.00
Weight (kg)	66.167	65.000	10.461	41.00
BMI (kg/m^2)	24.883	25.500	2.713	8.40

BMI= body mass index; cm= centimetre; kg= kilogram; kg/m^2= kilogram per meter square

Table 3: Within Individuals Pre and Post Test analysis

Variables	Pre		Post	
	Statistics	Significance	Statistics	Significance
NPRS	0.924	0.153	0.923	0.146
KOOS (%) -Pain	0.958	0.564	0.973	0.844
KOOS (%) -Symptoms	0.936	0.248	0.911	0.088
KOOS (%) -ADL	0.927	0.174	0.9	0.057
KOOS (%) -QOL	0.926	0.166	0.914	0.101
YBT-LQ (%)-Anterior RL	0.913	0.096	0.898	0.052
YBT-LQ (%)- Anterior LL	0.939	0.274	0.945	0.348
YBT-LQ (%)-Posterolateral RL	0.952	0.456	0.968	0.764
YBT-LQ (%)-Posterolateral LL	0.978	0.927	0.98	0.946
YBT-LQ (%)-Posteromedial RL	0.985	0.985	0.984	0.983
YBT-LQ (%)-Posteromedial LL	0.932	0.211	0.951	0.446

ADL=activity of daily living; KOOS=Knee Injury and Osteoarthritis Outcome Scores; LL=Left leg; %=percent; RL=right leg; YBT-LQ= Y Balance Test Lower Quarter; QOL=quality of life

Table 4: Paired Samples Test for NPRS

	Mean	Standard Deviation	t value	p value
NPRS Pre - NPRS Post	1.333	.767	7.376	<0.001

NPRS= numeric pain rating scale

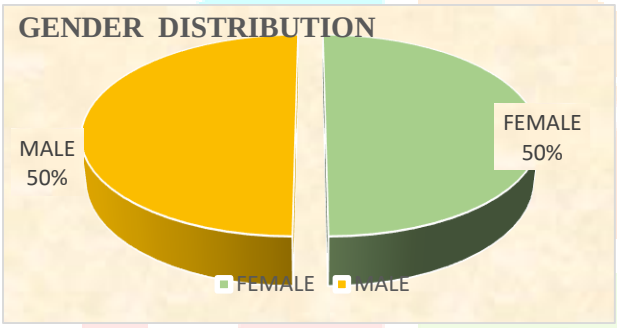
Table 5: Paired Samples Test to find paired difference between pre and post intervention for KOOS

	mean	Standard Deviation	t value	p value
KOOS (%) -Pain Pre -post	7.412	7.452	4.220	<0.001
KOOS (%) -Symptoms Pre -post	9.281	7.401	5.320	<0.001
KOOS (%) -ADL Pre - post	5.963	3.583	7.060	<0.001
KOOS (%) -QOL Pre -post	5.556	5.627	4.189	<0.001

ADL=activity of daily living; KOOS=Knee Injury and Osteoarthritis Outcome Scores; %=percent; QOL=quality of life

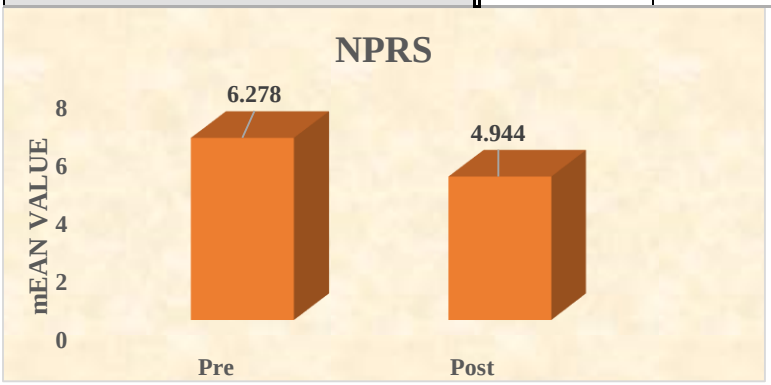
Table 6: Paired Samples Test to find paired difference between pre and post intervention for

YBT-LQ= Y Balance Test Lower Quarter

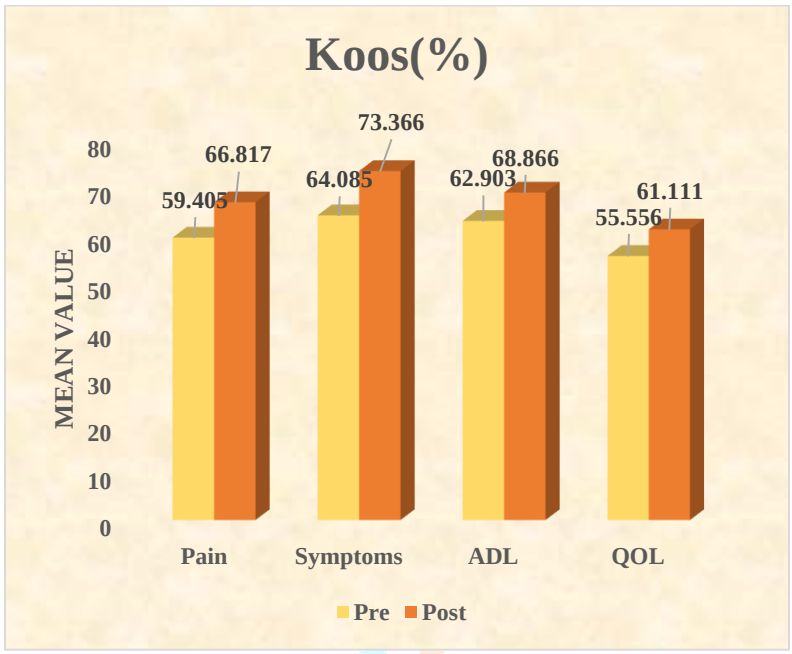


Graph 1: Gender homogeneously distributed

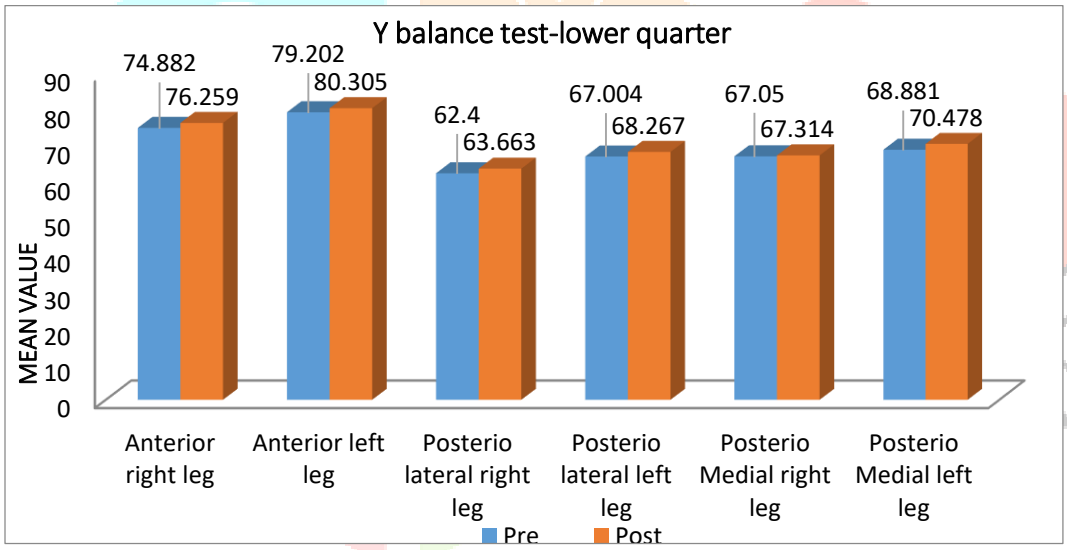
	Mean	Standard Deviation	t value	p value
YBT-LQ -Anterior right leg-pre -post	1.377	.921	6.341	<0.001
Y BT-LQ -Anterior left leg-pre -post	1.103	1.170	3.998	<0.001
Y BT-LQ -Posterolateral right leg-pre -post	1.263	1.153	4.647	<0.001
Y BT-LQ -Posterolateral left leg-pre -post	1.263	1.133	4.733	<0.001
YBT-LQ - Posteromedial right leg-pre -post	0.264	1.818	0.617	0.545
YBT-LQ - Posteromedial left leg-pre -post	1.597	1.348	5.025	<0.001



Graph 2: Pre and post NPRS score by participants



Graph 3: Pre and post KOOS subscales score by participants



Graph 4: Pre and post YBT-LQ score by participants