



Effects of non weight bearing strength training for knee osteoarthritis

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ABSTRACT

Osteoarthritis Knee is the most common problem among Indians. Generally weight bearing exercises are given to strengthen the muscles, which might aggravate symptoms where as Non weight bearing exercises relieves the stress created during exercise as well as it strengthens. This study proposed to perform Non weight bearing strength training exercises among Knee Osteoarthritis. 73 subjects randomized into two groups Group A treated with Interferential Therapy and Non Weight Bearing strength training exercises. Group B treated with Interferential therapy. WOMAC Osteoarthritis Index was used as a Pretest and Posttest. Group A proved to be statistically significant as the P value equals 0 by improving the WOMAC scores. Study concludes that Non Weight Bearing Strength training exercises improved WOMAC scores by reducing the Pain and Stiffness and Improving Physical function related to Quality of Life.

Keywords: Knee; Osteoarthritis; Non Weight Bearing; Strength training; Physical Function

INTRODUCTION

Osteoarthritis (OA) is a chronic joint disease leading cause of musculoskeletal pain and disability, which commonly affects the knee. OA can cause pain, stiffness, swelling, joint instability and muscle weakness, all of which can lead to impaired physical function and reduced quality of life (Carolyn J. Page et al; 2011). The prevalence of knee Osteoarthritis (OA) increases with advancing age. In addition, individuals with knee Osteoarthritis often exhibit poor neuromuscular control, slower walking speed, decreased functional ability, and an increased susceptibility to falling (Da-Hon Lin et al; 2009).

Several studies have demonstrated that strength training decreases joint stiffness and increases muscle strength in patients with knee Osteoarthritis (Da-Hon Lin et al; 2009). Exercise plays a major role in the management of this chronic disabling disease. Exercise is a broad concept that may include strength training, range of motion exercises, and aerobic activity (Mariette J Jansen et al; 2011). The quadriceps are the largest group of muscles crossing the knee joint and have the greatest potential to generate and absorb forces at the knee. Many clinical studies have shown consistent improvements in knee extension strength after training, as well as reductions in pain and physical

disability in people with knee OA. However, no particular method of strength training has been determined to be superior to others (Carolyn J. Page et al; 2011).

Systematic reviews reported that there is a high quality evidence that exercises reduces the pain and improves various components like muscle strength which improves the physical functions in patients with knee osteoarthritis (Mariette J Jansen et al; 2011). Strength training exercises are often performed in a standing or weight bearing position. Clinically, in individuals with knee Osteoarthritis, performance of exercises in weight bearing has the potential to aggravate symptoms (pain, swelling, and inflammation) due to excessive loading of the knee joint (Da-Hon Lin et al; 2009).

Clinical trials of strengthening exercise have spanned isometric, isotonic, isokinetic, concentric, concentric/eccentric and dynamic modalities. Strengthening improves strength, pain and physical function although the effects on quality of life and depression are yet to be confirmed. There appears to be no evidence that the type of strengthening exercise influences outcome (Kim L. Bennell et al; 2011). Non weight Bearing strength training exercises, where the distal extremity is free to move, have been thought to improve muscle strength rather than to improve proprioception during knee flexion and extension (Mei – Hwa Jan et al; 2009). So, the objective of this study was to investigate if high-resistance exercises performed in a non-weight-bearing position could be an effective compromise leading to improvement in function, while alleviating some of the loads applied to the knee joint and which influences to reduce pain and other symptoms and helps to improve in physical function of the patient. WOMAC questionnaire has been used in this study as it

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has been exclusively designed for Osteoarthritis knee it consists of 3 main categories it assess Pain, Stiffness and Physical function totally it consists of 24 items which are graded from 0 to 4. It helps in assessing about pain, stiffness and physical function consist of questions which helps to assess daily activities of the patient it indirectly influences on the quality of life.

Interferential therapy (IFT), is a treatment modality that is proposed to relieve musculoskeletal pain and increase healing. IFT delivers a crisscross current to deeper tissues through the use of kilohertz carrier frequency pulses or sinusoidal currents to overcome the impedance offered by the skin. It is theorized that IFT prompts the body to secrete endorphins and other natural painkillers and stimulates parasympathetic nerve fibers to increase blood flow and reduce edema (Atamaz FC *et al*; 2012)

Hence this study had been proposed to investigate on Non weight bearing strength training exercises in the management of knee osteoarthritis. It would be useful to determine the effectiveness of high-resistance training in a non-weight-bearing position to provide a possible treatment alternative for individuals with knee Osteoarthritis.

MATERIALS AND METHODS

Randomized controlled trial was undertaken. 79 subjects were screened of which 73 subjects met the inclusion criteria. Both males and females subjects with chronic knee pain for more than 6 months of duration were included, age group between 45 to 60 years, osteoarthritis grade 3 or lower as determined by Kellgren and Lawrence plain radiograph classification were included. And subjects were excluded if they had a history of trauma such as tendon or ligament injury in the knee joint, knee fractures and knee surgery, central or peripheral neurological disorders, hypertension, and those who received physiotherapy treatment for knee pain in last 3 months. Ethical clearance had been obtained and informed consent was obtained from partic-

ipants before the commencement of the study.

73 subjects were randomly assigned into 2 groups Group A - Experimental group and group B - Control group. Group A – consists of 37 subjects were treated with Interferential therapy and non weight bearing strength training. Group B - 36 subjects were treated only with interferential therapy. Both the groups were treated with Interferential therapy with the same parameters. WOMAC osteoarthritis index was used to test before and after the intervention protocol.

Interferential therapy: was applied for subject knee joint with the parameters mentioned below.

Method – Quadripolar method

Duration – 15mins

Frequency – 130hz

Intensity – According to the patients maximum comfort level.

Interferential therapy was applied for 5 sessions per week and so on for 2 weeks.

Group A – Experimental group

Group A received non weight bearing strength training exercises in addition to interferential therapy for duration of 4 weeks. 2 weeks with interferential therapy, 2 weeks without interferential therapy

Strength training protocol

Patient was asked to sit comfortably in chair with their back supported and their knees at 90 degree of flexion with the distal extremity free. Both the hands were used to grasp the sides of the seat. Before training, quadriceps 1 RM was determined using quadriceps table and weights in which weight was placed on the anterior aspect of the distal lower leg. During training, participants were asked to extend the knee from 90 degree of knee flexion to full knee extension and then to flex the knee joint to starting position with eccentric quadriceps contraction. Baseline resistance was set at

Table 1: Characteristics of Participants

	Experimental Group (37) (Mean±SD)		Control Group (36) (Mean±SD)	
	Females (24)	Males (13)	Females (25)	Males (11)
Age (years)	48.88±3.47	51.77±4.48	49.72±4.45	53.27±4.56
Height(cms)	159.38±7.34	163.92±6.81	156.56±5.76	167.36±8.03
Weight(kg)	70.54±9.33	81.31±8.27	64.88±5.94	77.55±11.22
BMI(kg/m ²)	27.77±3.48	30.34±3.8	26.5±2.91	27.5±3.31

Table 2: Comparison of Pretest and Posttest values within Group A

Outcome Measures		Mean	Std. Deviation	t value	P value
Pain	Pretest	13.73	2.46	25.991	0
	Post test	7.62	2.24		
Stiffness	Pretest	5.24	1.75	12.476	0
	Post test	2.35	0.97		
Physical Function	Pretest	39.97	6.27	21.322	0
	Post test	28.81	6.21		

Table 3: Comparison of Pretest and posttest values within Group B

Outcome Measures		Mean	Std. Deviation	t value	P value
Pain	Pretest	13.67	2.76	1.086	0.285
	Post test	13.42	2.91		
Stiffness	Pretest	4.86	1.53	1.268	0.213
	Post test	4.67	1.54		
Physical Function	Pretest	41.78	8.59	1.956	0.059
	Post test	40.83	8.02		

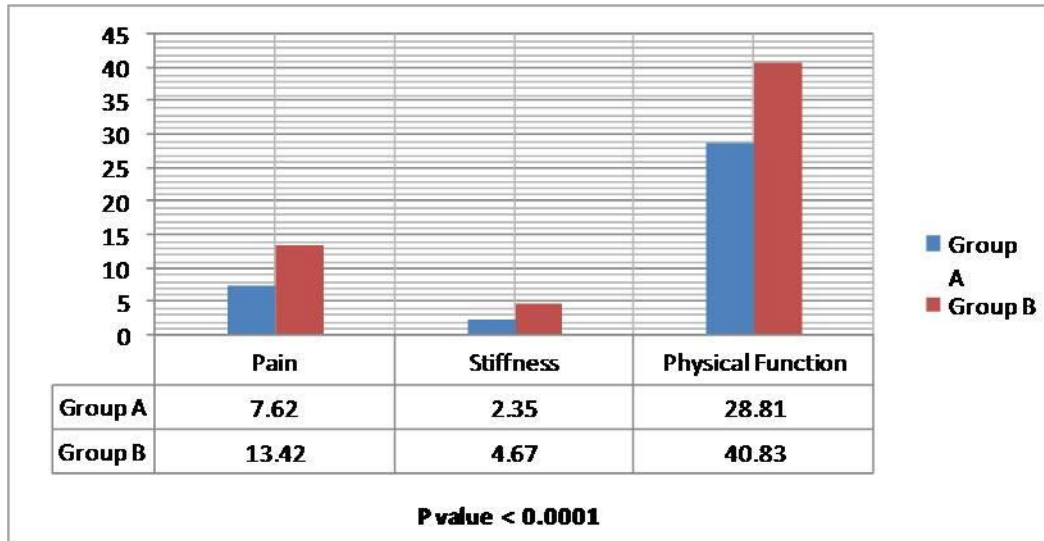


Figure 1: Comparison of Posttest results of Group A and Group B

50 % of 1 RM, with a progressive increment of 5 % of the original 1-RM every week. Subjects were asked to perform the exercises for 4 weeks –5 sessions per week. Each session consists of 5 sets with 10 repetitions per set. For subjects with Bilateral Involvement Both the Knees were treated with 10 minutes interval.

Group B – control group

These participants were treated with Interferential Therapy alone for pain relief. They were not prescribed any form of exercises. Interferential therapy was prescribed with similar parameters for both the groups.

RESULTS

Pretest had been performed following which pretest data had been calculated to test the normality of the samples using Shapiro-Wilk test performed in SPSS version 17. P value > 0.05 considered to be statistically significant Group A & Group B consists of WOMAC questionnaire as Outcome measures which are categorized into Pain, Stiffness, and Physical Function. Group A shows P values for Pain being 0.264, Stiffness being 0.107and Physical Function being 0.114. Group B p values being 0.585 for Pain, 0.171 for Stiffness, 0.60 for Physical function. P values for all the outcomes are greater than 0.05 there by it rejects the alternate hypothesis and it concludes that data is normally distributed.

Characteristics of Participants was explained in Table 1. Statistical significance of Pretest and posttest data for all the outcome measures are analysed using the

paired t test within the group and unpaired t test for between the groups. P value < 0.05 is considered to be statistically significant and Data has been tabulated Table 2 shows the results of Group A comparison of Pretest and Posttest values. Table 3 shows the pretest and post test results of Group B. comparison of post test results between Group A and Group B are shown in Figure 1.

DISCUSSION

Osteoarthritis (OA), the most common rheumatic disease, primarily affects the articular cartilage and subchondral bone of a synovial joint and results in joint failure. The most typical radiographic features are the formation of osteophytes at the joint margins, joint space narrowing, subchondral sclerosis, subchondral cyst formation and chondrocalcinosis. It has been estimated that about 40% to 80% of people with radiographic changes will have symptomatic disease (Fransen M et al; 2008).

Primary osteoarthritis is mostly related to aging, it is a commonest problem in the late adult life which causes severe musculoskeletal pain. 79 subjects were screened of which 2 subjects were excluded as kellgren plain Radiograph Grade 4, 2 subjects were hypertensive, 1 subject was associated with ACL injury, 1 subject duration of illness was acute. Therefore 73 subjects met the inclusion criteria and were randomized and 3 dropouts were reported. 2 subjects did not report back, there pretest analysis has been used for post test analysis and 1 subject transferred at 3rd week of inter-

vention and post test were performed at 3rd week. Intention to treat analysis has been performed. Subjects with both unilateral and bilateral osteoarthritis knee were involved in this study. In experimental group 28 subjects were unilateral knee involvement and 9 were bilateral. Control group shows 24 subjects with unilateral and 12 were bilateral involvement.

The development and progression of knee OA is multifactorial, with quadriceps weakness being one of the main factors that is modified by resistance training according to this review (Angela K. Lange et al; 2008). Mei- Hwa Jan et al demonstrated that Non weight bearing exercises mostly used the isolated knee extensor muscles, performed from 90° of knee flexion to full extension with concentric action of quadriceps, and then flexing the knee joint to the starting position with eccentric action of quadriceps. It is different from usual knee extension with concentric quadriceps followed by knee flexion with concentric hamstrings, that explain why a greater improvement of knee extensor strength was observed in the Non weight bearing exercise group (Mei- Hwa Jan et al; 2009).

Da-Hon Lin et al conducted an 8 weeks exercise intervention with 3 sessions per week and he has demonstrated that non-weight-bearing Proprioceptive and Strength training exercise interventions were effective in improving pain, function, walking speed on different terrains, and knee strength in patients with knee Osteoarthritis. Strength training was demonstrated to be more effective to improve knee extension strength and functional performance, including going up and down stairs. (Da-Hon Lin et al; 2009)

This study was conducted for a period of 4 weeks and 5 sessions per week was effective in improving WOMAC scores. WOMAC osteoarthritis Index has been extensively tested for Reliability, Validity, and Responsiveness. Pain was assessed during 5 activities like walking on the ground, upstairs and down stairs or rest, mostly subjects complain of symptoms were aggravated during activities like walking on floor and up and down stairs. Pain was reduced during all the activities after the strength training protocol in Group A from 13.73 to 7.32. Stiffness was assessed which part of the day stiffness gets severe early in the morning or sitting, lying. Subjects complain that Stiffness often occurs later in the day. Physical function was assessed for a total of 17 daily activities which are unavoidable. Subjects complain of very severe problems with squatting positions and climbing up and down stairs.

Interferential therapy reduced pain in both the groups and combined with Non weight bearing Strength training exercises help to strengthen the muscles around the knee joint and reduced pain and it improved the strength as the functional activities were made easier without any difficulty.

After 4 weeks of intervention, Non weight bearing strength training led to greater reduction in WOMAC

score. Therefore, Strength training primarily facilitates increased knee extension strength and subsequently, enhances walking speed and functional performance.

CONCLUSION

This study has demonstrated that Non Weight Bearing strength training exercise interventions were effective in improving the WOMAC score by reducing the pain and stiffness and improved Physical Function which is associated with functional performance in daily activities among patients with knee Osteoarthritis.

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