

# Comparative Effect of Calisthenics Exercises and Conventional Knee Exercises on Pain, Stiffness and Functional Ability in Osteoarthritis of Knee

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## ABSTRACT

**Background:** Obtaining an effective rehabilitation program to improve pain and functional ability in elderly patients with Osteoarthritis (OA) has always been a concern for physical therapists. Therefore, the purpose of this study was to investigate the effectiveness of Calisthenics exercises on pain, stiffness and functional ability in elderly patients with OA knee.

**Study Design:** Comparative study design

**Source of Data Collection:** DAV institute of physiotherapy, Yamuna Nagar.

**Methodology:** 30 healthy young subjects were included in study on the basis of inclusion criteria were randomly allocated into 2 groups: Group A performed Conventional OA knee exercises and Group B received Calisthenics exercises. Exercises were performed for 4 weeks. Pain, stiffness & functional ability were measured as Outcome measure on 1<sup>st</sup>, 14<sup>th</sup> and 28<sup>th</sup> day using VAS scale, Goniometer and WOMAC scale respectively.

**Result:** Statistically significant improvement ( $p < 0.05$ ) noticed in both groups for all the outcomes. However, in between comparison showed that combining Calisthenics exercise to conventional treatment improved the pain, stiffness and functional ability of patients with OA more than the conventional treatment alone.

**Conclusion:** This study provides evidence that the addition of Calisthenics exercise to conventional treatment protocol resulted in superior outcomes in the treatment of OA.

**KEY WORDS:** Calisthenics exercise, Conventional OA Knee exercise, Pain, WOMAC Scale.

## INTRODUCTION

Knee osteoarthritis (OA) is a form of chronic disabling musculoskeletal disease affecting older adults, resulting in pain, reduction in quality of life, and physical disability.<sup>1</sup> The prevalence of osteoarthritis among elderly is 56.6%. Community survey data in rural and urban areas of India shows the prevalence of osteoarthritis to be in the range of 17-60.6%.<sup>2</sup> The process appears to begin in the second decade of life, but degenerative changes are not apparent until middle age, and by 55 to 65 years of age approximately 85% have roentgenologic

evidence, to a variable degree of disease. The disease is twice as prevalent in the obese.<sup>3</sup> It is well believed that increased age is the most common cause of knee OA (primary OA).<sup>4</sup> The rare cases of knee OA in young people under 30 years old are mostly because of the mutations in matrix genes that cause important structural anomalies and/or joint deformities.<sup>5</sup> Other causes include weight, and trauma to joint caused by repetitive movements, particularly, bending and kneeling.<sup>6</sup> These patients usually confront difficulties while doing daily activities such as taking the

stair, walking and other actions involving the lower extremities.<sup>7</sup>

The great increase in the elderly population worldwide is the most important change in the field of public health in the 21st century. It is being estimated that the number of people over the age of 65 will be doubled in the next 20 years.<sup>8</sup> Osteoarthritis (OA) and similar diseases that are more frequently encountered in advanced years will become much more important from both medical and economic aspects.<sup>9</sup>

American College of Rheumatology has recommended a mixture of non-pharmacological and pharmacologic treatments.<sup>10</sup> Conservative treatment includes rest, external support, administration of salicylates, intra-articular injections of steroids, and exercise therapy.<sup>3</sup> Physical therapy is one of the most widely used non-pharmacological interventions which includes various modes such as manual technique, massage, exercise, ultrasound, thermotherapy and so on.<sup>10</sup> People may accommodate for (sub) conscious proprioceptive decline by adapting their behavior. Therefore impaired proprioception may explain why people with symptomatic OA walk more slowly and with longer double limb stance to avoid risk of joint injury and prevent worsening of disease.<sup>11</sup>

Pain associated with OA knee may play a role in balance impairments. The presence of pain may reflexively inhibit the muscles around knee, which could compromise effective and timely motor responses in postural control. Early, the x-ray appearance is normal. Then joint narrowing gradually appears, reflecting thinning of the articular cartilage covering opposing subchondral cortices. A negative film does not rule out the disease. On the other hand; a film with typical characteristics of OA does not necessarily define this as the primary disease.<sup>3</sup>

Physical therapy management of OA knee is directed towards reducing joint pain and stiffness, maintaining and improving joint mobility, reducing physical disability and

handicap, improving health-related quality of life, limiting the progression of joint damage. There are many emerging evidences showing that light to moderate intensity physical activities play a preventive and restorative role in the health and functional capacity caused by osteoarthritis.<sup>12</sup> Therapeutic exercises which are generally prescribed include stretching, static and dynamic strengthening, aerobic and proprioceptive exercises.<sup>13</sup>

Calisthenics exercises of low intensity have recently been suggested by few clinicians to the OA knee patients. Callisthenic exercises comprise of several short muscle contractions intended to increase the body flexibility and strength using one's own body weight. These exercises are rhythmical movement exercises that increase the strength and flexibility.<sup>14</sup> Routinely, calisthenics exercises have been prescribed as part of warm up before aerobic exercises are performed. However, it is not been studied through scientific based research that prove its effectiveness in subjects with OA knee. Though there are many studies that justify the significance of proprioceptive exercises to be beneficial in the management of OA knee, there are limited studies done to support the efficacy of Calisthenics exercises in OA knee.

## **METHODS**

### **Participants**

Study design was Experimental and sampling technique was non-randomized convenient sampling technique. Total 30 subjects with OA Knee were included in the study on the basis of inclusion criteria and were randomly allocated into 2 groups as Group A and B using computer software program that generates random sequence.

### **Inclusion criteria**

- Age 60 -75 years
- Both Male & Female.
- BMI: 18-30 kg/m<sup>2</sup>
- Grade-2 or 3 unilateral OA of the knee (Kellgren-Lawrence Classification of Osteoarthritis)

- Average pain rating from 3 to 7 on a numerical pain rating scale.
- Subjects with chronic OA (symptoms for more than 3 months)

### Exclusion Criteria

- History of severe knee trauma, surgical interventions in last six months.
- History of intra-articular knee injections in last four weeks.
- Patient having polyarthritis, RA or other systemic inflammatory arthropathies.
- Patient with unilateral Total knee replacement (TKR )
- Medically unstable on examination i.e. poorly controlled BP or blood sugar, unstable coronary artery disease.

### Outcome Measures:

VAS, Knee ROM and WOMAC were used to evaluate pain, stiffness and functional ability on 1<sup>st</sup>, 14<sup>th</sup>, and 28<sup>th</sup> days.

### Study Protocol

Subjects in Group A performed conventional OA knee exercises and Group B performed Calisthenics exercises along with conventional exercise. Both the groups received continuous mode short wave diathermy before the exercises in contra planar method using pad electrodes for 20 minutes per day.

Treatment was given for 6 weeks, daily in first two weeks and then on alternate day in the rest of the 4 weeks.

### GROUP A

Patients in this group performed conventional OA knee exercises.

#### Conventional OA Knee Exercise Program<sup>15</sup>

Exercise protocol included stretching and strengthening exercises

- **Strengthening exercises included**
  - Quadriceps isometric
  - Hamstring isometric
  - Short arc terminal knee extension for VMO strengthening
  - Supine SLR for hip flexor strengthening
  - Side SLR for hip abductor strengthening

- Prone SLR for Hip extensor strengthening

10 repetitions of each exercise in three sets with 3 min rest between sets were performed.

The weight of cuff weights tied to the patient's ankle was selected according to the tolerance of patient and his/her basic status. The weight of cuff was added 250 grams each 2 weeks and finally it reached to 2 kilograms.

- **Stretching exercises included**

Stretching of Quadriceps, Hamstring and Plantar flexors

Stretching exercises were performed daily with 15 seconds hold and with 4 times repetition.

### GROUP B

Patients in this group performed calisthenics exercises for lower extremity along with conventional OA knee exercises

#### Calisthenic Exercise for Lower Extremity<sup>14</sup>

- **Abductor- leg raise:** Patient in Side lying with slightly flexed hip and knee of the lower side. Patient raised the leg placed on upper side, held it and then lowered down the leg.
- **Adductor Leg raise:** Patient in Side lying with slightly extended hip of the upper side. Patient raised the leg placed on lower side, held it and then lowered down the leg.
- **Prone leg extension:** Patient in prone lying. Patients flexed the alternate knee, held it and then lowered down the leg to extend the knee.
- **Alternate toe touch:** Patient in Stride standing. Patient bend the trunk forward and touch the toe of foot with the finger of the hand of contra-lateral side, held it and then returned to neutral position.
- **Knee bends:** Patient in Standing with bringing the arms forward by shoulder flexion and elbow extension to place them in horizontal plane and parallel to each other. Patient slightly flexed the

knees, held it and then again extended the knee.

- **Lunges:** Patient in Standing. Patient placed one of the leg forward to a distance of three foot lengths with the knee bending. The other leg remained straight and the trunk in upright position held it and then returned to standing position.
- **Toe Raise/ Calf raise:** Patient in Standing. Patient raised the heels and stands on the toes, held it and then lowered down.
- **Leg kicks/lifts:** Patient in Standing. Patient flexed the hip and raised the leg with knee extension as if he/ she was

kicking something in front, held it and then returned to standing position.

- **Jack Twists:** Patient in Stride Standing. Patient rotated the trunk towards one direction, held it and then returned to neutral position.

Patient performed all the above-mentioned exercises alternatively on both the sides. 3 Sets of 10 repetitions with 10 second hold was performed for each exercise. There was a pause of 3 seconds between repetitions and 3 minutes rest between the sets.

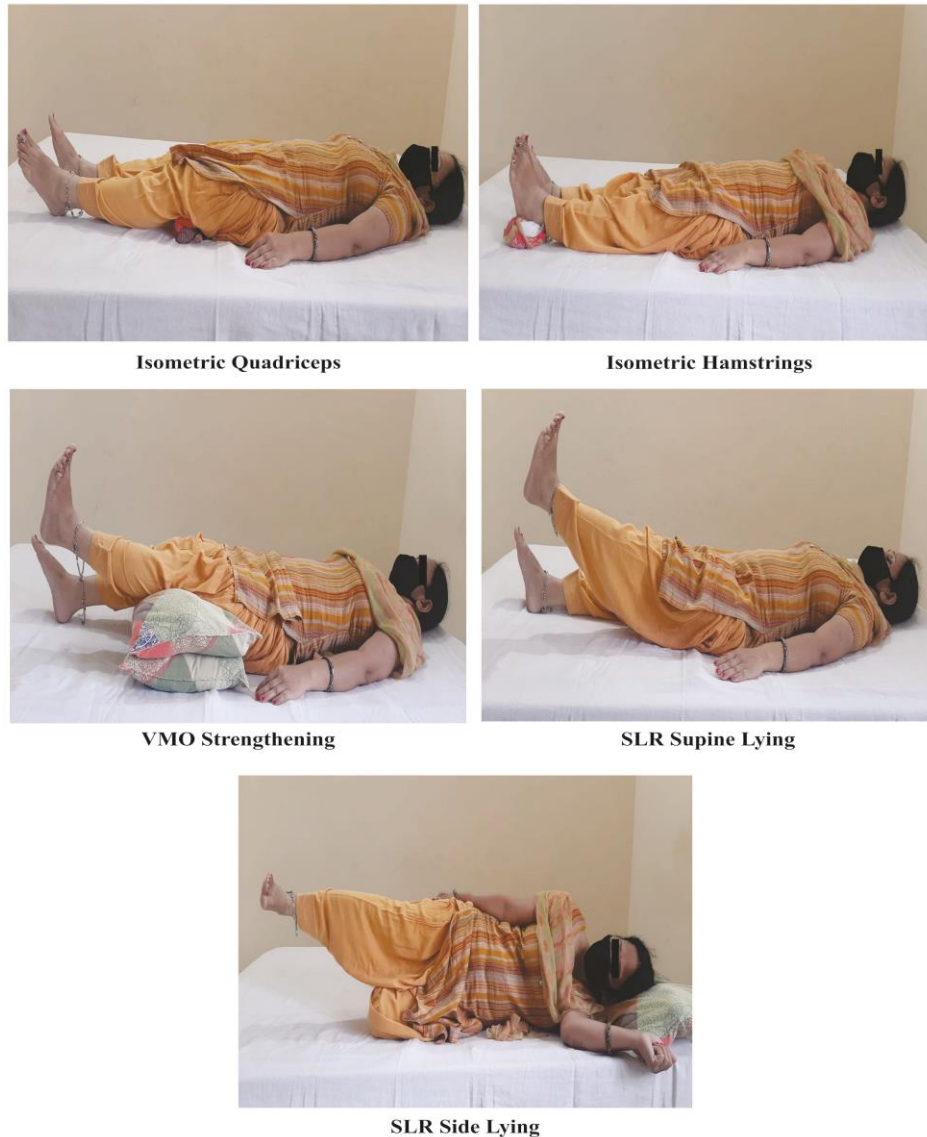


Figure 1: Patient Performing Conventional Knee Exercises





Figure 2: Patient Performing Calisthenics Exercises of Lower Extremity

Unpaired T Test	PAIN					
	PRE 1		POST 14		POST 28	
	Group B	Group A	Group B	Group A	Group B	Group A
Mean	7.53	7.6	6.26	6.6	5.27	5.67
S.D.	.915	.736	.883	.828	.883	.723
Number	8	8	6	7	5	6
Maximum	15	15	15	15	15	15
Minimum	9	9	8	8	7	7
Range	6	6	5	5	4	4
Mean Difference	0.07		0.34		0.40	
Unpaired T Test	-.22		-1.066		-1.358	
P value	.332		.756		.386	
Result	Not-Significant		Not-Significant		Not-Significant	

Table 1 Comparison of Pain Between Group B and Group A

Unpaired T Test	KNEE STIFFNESS					
	PRE 1		POST 14		POST 28	
	Group B	Group A	Group B	Group A	Group B	Group A
Mean	123.53	121.8	128.0	127.1	129.8	129.8
S.D.	7.8	6.97	4.88	4.50	3.51	2.69
Number	122	122	128	125	130	130
Maximum	15	15	15	15	15	15
Minimum	135	135	135	135	135	135
Range	110	110	120	120	125	125
Mean Difference	-2.27		-0.9		0	
Unpaired T Test	.641		.505		.583	
P value	.676		.895		.131	
Result	Significant		Significant		Significant	

Table 2 Comparison of Knee ROM Between Group B and Group A

Unpaired T Test	FUNCTIONAL ABILITY					
	PRE 1		POST 14		POST 28	
	Group B	Group A	Group B	Group A	Group B	Group A
Mean	.554	.595	.433	.4995	.339	.4144
S.D.	.176	.158	.185	.159	.191	.164
Number	.55	.602	.455	.500	.308	.398
Maximum	15	15	15	15	15	15
Minimum	.78	.87	.69	.79	.60	.74
Range	.22	.22	.15	.16	.09	.13
Mean Difference	0.41		.66		.75	
Unpaired T Test	-.672		-1.057		-1.151	
P value	.611		.267		.222	
Result	Significant		Significant		Significant	

Table 3: Comparison of Functional Ability between Group B and Group A

## DISCUSSION

Present study was intended to find the effect of calisthenics exercises on pain, stiffness and functional ability in patient with Osteoarthritis of knee.

Result of current study suggests that addition of calisthenics exercises to conventional therapy results in better outcomes in treatment of OA knee.

This is supported by result of Harshneet kaur, P. Sathiya, 2015 who showed that combining balance exercises to conventional exercises improves the functional ability of OA knee patients more than the conventional exercises alone.<sup>16</sup>

The improvements seen in the present study can be attributed to the fact that calisthenics exercises promote contraction of multiple muscle groups. In the long run, these exercises promote weight loss by burning fat and also enhance the flexibility.<sup>17</sup> The positive results of the present study are in accordance to many prior studies conducted. A randomized control trial study was conducted to assess the effect of calisthenics exercises alone with conservative therapy on pain threshold, pain, severity and muscle strength on sedentary women with low back and upper extremity pain. The authors concluded that calisthenics exercises administered along with conservative treatment increases pain threshold and muscle strength than only conservative treatment.<sup>18</sup>

Another study by Iwamoto et.al studied calisthenics exercises along with balance-flexibility-walking exercises for 5 months resulted in significant improvement in flexibility and strength.<sup>19</sup> Yet another study demonstrated higher pain threshold values in patients with fibromyalgia syndrome who received calisthenics training.<sup>20</sup> A significant reduction in VAS scores and increase in muscle endurance was shown in a study by Keser et.al where calisthenics exercises were administered in patient population with multiple sclerosis.<sup>21</sup>

The present study included only light intensity of calisthenics exercises since the study population belonged to an older age

group who had degenerative joint disease. There is lack of literature support where high intensity of calisthenics exercises have been prescribed or assessed in lower limb degenerative conditions.<sup>18, 22</sup>

Comparing the result of the effectiveness of the calisthenics exercises versus conventional therapy technique in osteoarthritis of knee shows calisthenics exercises and conventional therapy is more effective in reducing pain than conventional therapy treatment. So, these interventions can be applied in clinical setup in combination with conventional treatment for better and long term improvement.

## CONCLUSION

The result of the present study suggests that calisthenics exercises along with conventional Exercises is more effective than conventional exercises alone and resulting in speedy and early recovery in patient with OA knee.

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**Conflict of Interest:** None

**Source of Funding:** None

**Ethical Approval:** Approved

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