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Research Article

Effectiveness of stabilization exercises and conventional physiotherapy in subjects with knee osteoarthritis

Patchava Apparao*¹, Ganni Sandeep², Sudhakar S³, Ganapathy Swamy Ch⁴, Sudhan S.G¹, Satya Prakash T⁵, Geetha Mounika R⁶

¹School of Physiotherapy, Vels University, Chennai, Tamil Nadu, India

²GSL Educational Society, Rajahmundry, Andhra Pradesh, India

³Department of Physiotherapy, Dr. MGR Educational & Research Institute and University, Chennai, Tamil Nadu, India

⁴Department of Community Medicine, GSL Medical College, Rajahmundry, Andhra Pradesh, India

⁵Department of Pathology, GSL Medical College & General Hospital, Rajahmundry, Andhra Pradesh, India.

⁶Swatantra Institute of Physiotherapy & Rehabilitation, Rajahmundry, Andhra Pradesh, India

ABSTRACT

Osteoarthritis is a degenerative joint disease, occurring primarily in older person, characterized by erosion of the articular cartilage, hypertrophy of bone at the margins. Numerous Physiotherapeutic Interventions are available for degenerative Tibio femoral joint disease based on symptoms. Lack of literature regarding the effect of Stabilization exercises on changes in articular cartilage, and increase in glycoprotein content hence the need of the study arises. The aim of the study was to find out the effectiveness of Stabilization exercises on articular cartilage changes in subjects with Knee Osteoarthritis. Subjects were randomly allocated to either Control Group or Experimental Group of 52 each. Control group was treated with Quadriceps and Hamstring Strengthening and stretching exercises. Experimental Group was treated with Stretching exercises, Isometric Exercises, Multiple angle isometric Exercises, Co-contraction exercises, Active resisted exercises, Proprioception exercises and Neuro muscular Training exercises. Both groups were given hot packs for 10 minutes before the exercise programme. Patients were given exercises thrice a week for eight weeks. Independent student "t" test was performed to assess the statistical significant difference in mean values between the Groups for VAS, KOOS Score and Serum COMP parameters. Paired student "t" test was performed to assess the statistical difference with in the groups for the Serum COMP and Sub Components of KOOS Score (Pain, Symptoms, ADL and QOL) from pre test to post test values. The results of this study have shown that Stabilization exercises of knee joint were shown to be beneficial for improving functional out come scores and there was no effect on Pain and Articular cartilage changes in Knee Osteoarthritis when compared to Conventional Physiotherapy.

Keywords: Neuromuscular Training; Osteoarthritis; Serum COMP; Stabilization Exercises.

INTRODUCTION

Osteoarthritis is the most common degenerative joint disease, occurring primarily in older persons, characterized by erosion of the articular cartilage, Hypertrophy of bone at the margins and a range of biochemical and morphologic alterations of the synovial membrane and joint capsule (Srinivas Mondam *et al.*, 2012). Osteoarthritis is the most common type of arthritis and major health problem throughout the world. It effects any joint contains hyaline cartilage and knees are most commonly affected. Osteoarthritis is the most common

form of Arthritis, accounting for approximately 75% of the disease and ranking among the top 10 causes of disability worldwide (Denise Power J *et al.*, 2008). Osteoarthritis is a leading cause of pain and disability and generally affects women more frequently than men.

Literature is Limited on the incidence and prevalence of Osteoarthritis because of the problems of defining it. The prevalence of osteoarthritis Worldwide 9.6% of men and 18% of women of more than 65 years have symptomatic Osteoarthritis (Saloni Tanna, 2004). Males are affected more than females below 45 years, while females are more affected after 45 years.

Most cases of osteoarthritis have no known cause and are referred to as primary osteoarthritis. Primary osteoarthritis is mostly related to aging. It can present as localized, generalized or as erosive osteoarthritis. Secondary osteoarthritis is caused by another disease or condition. Osteoarthritis (OA) is the second most

* Corresponding Author
Email: appuphysio@gmail.com
Contact: +91-9885070075
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common rheumatologic problem and is most frequent joint disease with prevalence of 22% to 39% in India (Mahajan A *et al.*, 2005; Maria Anderson LE *et al.*, 2006)

There is increasing evidence that physiotherapy, in the form of Exercise therapy, is an effective intervention. Exercise is considered the most important intervention in the management of osteoarthritis (Saloni Tanna., 2004).

Research shows that regular, moderate use of normal joints does not increase the risk of Osteoarthritis and can help maintain overall health, muscle strength and range of motion. Physiotherapy helps in increasing flexibility, maintain joint range of motion, strengthen surrounding muscles, decrease associated inflammation and improve overall fitness.

The hallmark of structural changes occurring in the osteoarthritis joint is cartilage loss. Since osteoarthritis is considered a wear and tear disease, one identified barrier to exercise is the belief that exercise will not improve or may even be harmful to joint cartilage.

However, with the recent onset of successful treatments for osteoarthritis, it becomes important to identify prognostic factors that can predict the evolution of arthritis. A valuable approach to monitor arthritis would be by measuring biological markers of cartilage degradation and repair to reflect variations in joint remodeling. One such potential biological marker of arthritis is Cartilage Oligomeric Matrix Protein (COMP) (Ahmed Awadullah M *et al.*, 2010)

Moderate exercise may be a good treatment not only to improve joint symptoms and functions, but also to improve the knee cartilage Glycoaminoglycans (GAG) component in patients at high risk of developing osteoarthritis (Ewa Roos M, Leif Dahlberg, 2005). Several studies have shown that the application of constant compressive loading is important to maintain the normal structure of the articular cartilage (Novelli C *et al.*, 2012)

Numerous Physiotherapeutic Interventions are available for degenerative Tibio femoral joint disease based on symptoms. Lack of literature regarding the effect of Stabilization exercises on changes in articular cartilage, and increase in glycoprotein content hence the need of the study arises. The purpose of this study was to determine the effectiveness of knee joint stabilization exercises in minimizing articular cartilage degeneration and to examine the effectiveness of knee joint stabilization exercises on decreasing pain, improving Range of Motion, Muscle Strength and Function.

Statement of Problem

Recent study suggests that osteoarthritis is the most prevalent ailment affecting people in India. 5.3 % of males and 4.8% females are aged more than 65 years; by 2020 the population of 65 years and more in India is

likely to be 177 million where as India had 100 million in 2010 .The etiology of knee OA is not entirely clear, yet its incidence increases with age and in women. The etiology may have genetic factors affecting collagen; there is increasing evidence that physiotherapy, in the form of Exercise therapy, Manual therapy and with the use of Electrotherapy Equipment and assistive equipment is an effective intervention.

Aims and Objectives of the Study

AIM: To find out the effectiveness of Stabilization exercises on Articular cartilage changes in Knee Osteoarthritis subjects

Objectives

Primary Objectives

To evaluate the effectiveness of Functional outcome in Knee Joint Stabilization Exercises group and compared with Conventional therapy Group among Knee Osteoarthritis Subjects.

Secondary Objectives

To Investigate the Pain Parameter and Serum COMP level in Knee Joint Stabilization Exercises group and compared with Conventional therapy Group among Knee Osteoarthritis Participants in minimizing Articular Cartilage degeneration

Hypothesis

Research Hypothesis (HA): Knee Stabilization exercises have significant role compared to Conventional physiotherapy in minimizing the degeneration of articular cartilage and Improving Function in subjects with Knee Osteoarthritis.

Null Hypothesis (H0): Knee Stabilization exercises do not have significant role compared to Conventional physiotherapy in minimizing the degeneration of articular cartilage and Improving Function in Subjects with Knee Osteoarthritis.

MATERIALS & METHODS

This was a randomized controlled study design, carried out during the Year 2015 to 2017 in Out Patient Department of Physiotherapy, GSL Medical College & General Hospital, and Rajahmundry. The Study protocol was approved by the Ethical Committee of VELS University, Chennai (Ref: EC-PhD/14/FEB/PHY/004)

Sample Size: Total general population taken for the study was 104 participants (Including 10% drop outs). The overall attrition rate calculated was 10.4% and the differential attrition rate was 40. The number of participants was determined by power analysis with 85% power and a 1 –tailed level of significance of $P < 0.05$ based on data from the pilot study.

The eligible individuals with following symptoms were included in the study: Participants with diagnosis of knee Osteoarthritis according to the clinical ACR Crite-

ria (Umit Dincer *et al* 2016). Morning stiffness less than 30 min, Crepitus, Bony tenderness, Bony enlargement, Primary Osteoarthritis with Grade 1 and 2 of Kellegrens & Lawrence Scale (Shivani Vaid, 2015) age group of 35 to 65 years

Participants with history of knee trauma, previous surgery, deformity, local injections, subjects with extensor lag, Infection and obese (BMI>30) people were excluded from the study (Jibi Paul, Pradeep Balakrishnan, 2014).

The Recruited Participants were explained the purpose and relevance of the study. Those willing to volunteer were included in the study after obtaining informed consent. Participant's age, weight, height, and body mass index were determined.

All the eligible Participants were consecutively randomized to either control group or experimental group with 48 and 45 participants respectively. Randomization was done using a simple randomization and consecutively numbered, sealed in envelopes containing allocation information. Neither group was aware of the treatment that the other group was receiving.

Procedure

Group-I (Control Group) received usual Conventional physiotherapy consisting of Quadriceps and Hamstring Stretching (Odunaiya N.A, *et al* 2005) and Strengthening exercises (Shahanwaz Anwer, Ahmed Alghadir, 2014) and Group-II (Experimental Group) received Stabilization Exercises consisting of Stretching exercises, Isometric Exercises (Stephen Cryzlo M *et al*, 1994), Multiple angle isometric Exercises (Ibrahim Magdy Elanagar, Hoda Mohammad M, 2006), Co-contraction exercises, Active resisted exercises (Brian Horasak *et al* 2015), Proprioception exercises (Srinivas Mondam *et al* 2012, Micheal Reinold M *et al* 2015) and Neuro muscular Training exercises (Eva Ageberg *et al* 2010, Eva Ageberg, Ewa M. Roos, 2015), Both groups were given hot packs for 10 minutes before the exercise programme. Patients were given exercises thrice a week for eight weeks.

Outcome Measures

Primary outcome measures

KOOS Score (Ewa M Roos, Soren Toksvig-Larsen, 2003) (Measured at baseline and post test)

Secondary outcome measures

VAS (visual analogue scale) measured at the end of every week from baseline to post test

ELISA test to measure serum Cartilage Oligomeric Matrix Protein content at baseline and post test

Serum COMP levels were analyzed with a sandwich ELISA. Test was done by using ELISA kit (EK0913. Lot no. 55910123327 human COMP Elisa kit, Boster Biological Technology, CA.) (Sudhir Singh *et al.*, 2014) follow-

ing the standard protocol and readings displayed in the instrument were noted. This procedure was done at baseline and at post test and the values were noted.

Statistical analysis

Statistical analysis was performed by using MS Excel 2007 and SPSS version 21.0. Descriptive Statistical data was presented in the form of mean \pm Standard deviation and Mean difference Percentages were calculated and presented.

Independent student "t" test was performed to assess the statistical significant difference in mean values between the Groups for KOOS Score and Serum COMP parameters.

Paired student "t" test was performed to assess the statistical difference within the groups for the Serum COMP and Sub Components of KOOS Score (Pain, Symptoms, ADL and QOL) from pre test to post test values.

ANOVA and POST HOC test were performed to assess the statistical significant difference within the groups for the Pain variables

For all the statistical analysis, $P < 0.05$ was considered as statistically significant.

RESULTS

Results of the Table.1 and Graph A show that there was no significant difference of Serum COMP Value between the Control and Experimental Groups at baseline and post test values $P=0.23$ & $P=0.11$ respectively.

Student paired "t" test results of Table.2 shows that the all sub components of KOOS score and Serum COMP values changes within the group from baseline to post test in both control and experimental groups were found to be statistically significant ($P < 0.05$)

Results of the Graph B show that there was significant difference in all sub components of KOOS scores (Except Pain) between the Groups $P < 0.05$. But there was no significant difference in Pain subcomponent of KOOS score $P > 0.05$.

Results of the Table 3. and Graph C show that there was no significant difference of Mean VAS scores at baseline & post test between the groups ($P > 0.05$). One way ANOVA results shows that VAS measure changes within the group from baseline to post test in both control and experimental groups were found to be Significant ($P < 0.05$).

DISCUSSION

After eight weeks, statistically significant improvements in both the groups were observed in Pain Intensity, and functional outcome scores. There was a significant difference between pre-treatment and post-treatment measures of Pain intensity due to the increase in the power of the quadriceps muscles and stretching of the hamstring muscles. This breaks down

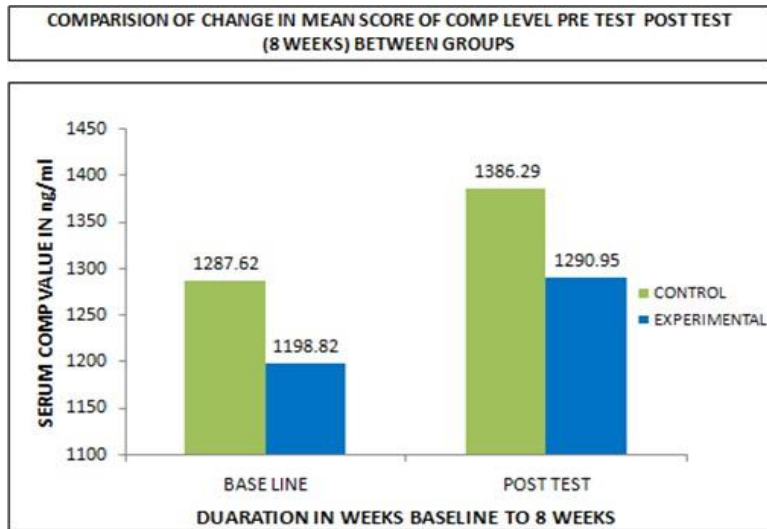


Figure 1: Comparison of mean scores of Serum COMP values between Control and Experimental Groups

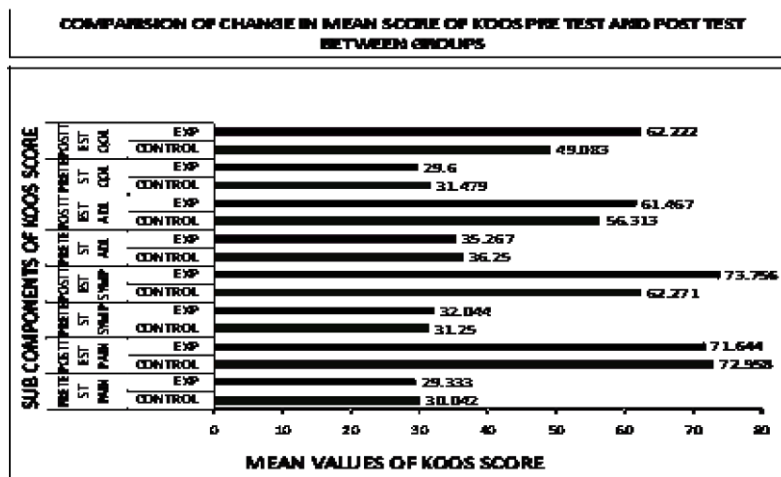


Figure 2: Comparison of mean scores of KOOS scores between Control and Experimental Groups

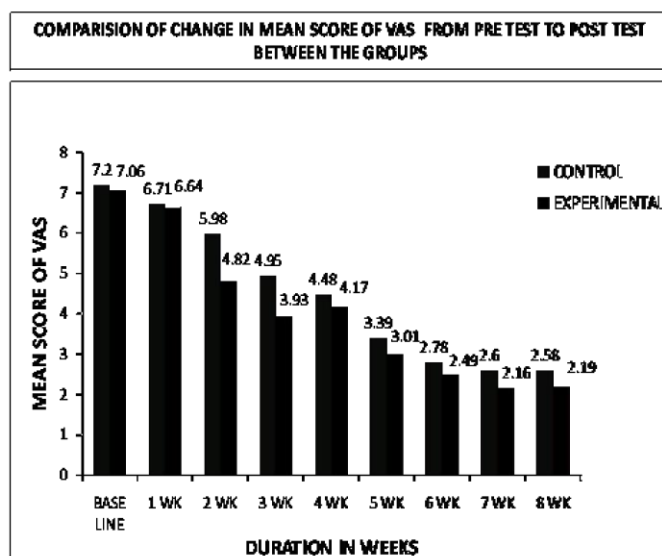


Figure 3: Comparison of mean scores of VAS between Control and Experimental Groups

Table 1: comparison between control and experimental group scores of Serum COMP value, and KOOS score

Parameter	Duration	Control Group	Exp Group	Mean Difference	P. Value	
		Mean± S.D	Mean± S.D			
Serum COMP	Base Line	1287.62±402.57	1198.82±300.16	88.80	0.233 ^{NS}	
	Post test	1386.29±404.03	1290.95±294.48	117.55	0.173 ^{NS}	
KOOS SCORE	PAIN	Base Line	30.04±9.90	29.33±10.66	0.70	0.74 ^{NS}
		Post test	72.95±12.08	71.64±13.18	1.31	0.61 ^{NS}
	SYMPTOMS	Base Line	31.25±14.13	32.04±18.62	-7.94	0.81 ^{NS}
		Post test	62.27±14.79	73.75±16.03	-11.48	0.01 ^{**}
	ADL	Base Line	36.25±11.10	35.26±11.38	0.98	0.67 ^{NS}
		Post test	56.13±10.94	61.46±12.12	-5.15	0.03 ^{**}
	QOL	Base Line	31.47±11.47	29.60±10.43	1.87	0.41 ^{NS}
		Post test	49.08±11.22	62.22±14.39	-13.13	0.00 ^{**}

**Statistically Significant (P<0.05), NS- Not Significant

Table 2: Comparison of subcomponents of KOOS score and Serum COMP value within the groups

Control group				Experimental group			
Group	Duration	Mean ± S.D	P. Value	Group	Duration	Mean ± S.D	P. Value
KOOS PAIN	Pre test	30.04±9.90	0.00 ^{**}	KOOS PAIN	Pre test	29.33±10.66	0.00 ^{**}
	Post test	72.95±12.08			Post test	71.64±13.18	
KOOS SYMPTOM	Pre test	31.25±14.13	0.00 ^{**}	KOOS SYMPTOM	Pre test	32.04±18.62	0.00 ^{**}
	Post test	62.27±14.79			Post test	73.75±16.03	
KOOS ADL	Pre test	36.25±11.10	0.00 ^{**}	KOOS ADL	Pre test	35.26±11.38	0.00 ^{**}
	Post test	56.31±10.94			Post test	61.46±12.12	
KOOS QOL	Pre test	31.47±11.47	0.01 ^{**}	KOOS QOL	Pre test	29.60±10.43	0.00 ^{**}
	Post test	49.08±11.22			Post test	62.22±14.39	
COMP	Pre test	1287.62±402.57	0.00 ^{**}	COMP	Pre test	1198.82±300.16	0.00 ^{**}
	Post test	1386.29±404.03			Post test	1290.95±238.65	

NS- Not Significant, ** Statistically Significant

Table 3: Comparison of VAS scores within the groups

Control group				Experimental group			
Duration	Mean±S.D	ANOVA F	P. VALUE	Duration	Mean±S.D	ANOVA F	P. VALUE
Base line	7.20±0.97	171.207	0.00 ^{**}	Base line	7.06±1.09	164.727	0.00 ^{**}
1 week	6.71±0.98			1 week	6.64±0.91		
2 week	5.98±0.87			2 week	4.82±0.98		
3 week	4.95±0.99			3 week	3.93±0.10		
4 week	4.48±1.03			4 week	4.17±1.04		
5 week	3.39±0.88			5 week	3.01±0.93		
6 week	2.78±0.83			6 week	2.49±0.86		
7 week	2.60±0.84			7 week	2.16±0.80		
Post Test	2.58±1.13			Post Test	2.19±0.89		

Note: NS- Not Significant (P>0.05), ** Significant (P<0.05)

the cycle of pain by decreasing muscle spasm, increasing muscle strength and improving circulation, which decreases the concentration of metabolites. The increased power of the quadriceps muscles also improves ROM and functional performance. The improvement in ROM of knee extension occurs secondary to pain reduction, which is responsible for the improvement in muscle function. The improvement in ROM may be due to the influence of the stretching exercises, which increase muscle flexibility, leading to reduced muscle shortening, decreased pain and increased ROM. When maintained by strengthening ex-

ercises, this may lead to increased practice of activities of daily living and, therefore, improved functional performance. Our study supported by previous study done by Ashraf Ramdan Hafeez et al., 2013 and concluded that strengthening Hamstring Muscles in addition to Quadriceps proved to be beneficial for perceived knee pain, range of motion, and decreasing the limitation of functional performance of patients with knee osteoarthritis

In this study VAS was used to assess pain. VAS score post intervention in the Control group reduced from 7.20 to 2.58 in post test p<0.05. A reduction in pain in

the control group is consistent which supports the study done by Topp et al., 2015 in Experimental group pain reduced from 7.06 to 2.23 with P value <0.05 intra group comparison of both the group showed significant difference in VAS score however when compared between groups there was no statistical difference $P > 0.05$. This might have been due to the moist heat given in both the groups and exercises performed in control group are equally effective in reducing pain.

Muscle plays a major role in the structure and function of joints as evidenced by disuse atrophy of the muscles surrounding knee joint. Quadriceps weakness is associated with disability in subjects with knee pain. As the quadriceps is of key importance in walking, standing, and using stairs, muscle weakness may be direct cause of impaired function. Knee Osteoarthritis affects the hamstring muscles more than the quadriceps; therefore there is a need for the physiotherapists who have traditionally focused primarily on quadriceps strengthening in Osteoarthritis patients to include Hamstrings, Adductors and Abductors strengthening in their management protocol (Shahanwaz Anwer, 2014).

In the present study, we found that there were significant differences between pre and post intervention measures in all the sub components of KOOS Score in both groups. But there was no statistical significant difference in Pain Component between the groups ($P > 0.05$). Possible reasons for the result include high intensity of exercises, which might have overloaded the participants with mild to moderate Osteoarthritis. Reduction observed in other components of Experimental group. was statistically highly significant than the control group with P value <0.01

In our study serum COMP values were increased from 1198.82 to 1290.95ng/ml in eight weeks duration, there was no statistical difference between the control and experimental group values. It shows that the addition of stabilization exercise to the conventional physiotherapy has no effect on Serum COMP Values. One possible reason for the changes in serum COMP during physical exercise is mobilization of COMP from cartilage. Increased cartilage degradation without compensatory increased synthesis cannot be ruled out. Our study supports the previous study by Umit Dincer et al., 2016 that there was no effect of closed kinetic exercises on articular cartilage

CONCLUSION

The results of this study have shown that Serum COMP values were not influenced in both Conventional Physiotherapy and Stabilization Exercises groups. There was no statistical significant difference in pre test and post test values of serum COMP in between the groups.

Both the groups have shown similar improvements on Pain Parameters and there are no statistical significant differences. However Stabilization Exercises of Knee Joint are found to be effective on Improving Functional

out Come scores when compared to Conventional Physiotherapy.

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