EFFECTIVENESS OF PROPRIOCEPTIVE EXERCISES AND SIX WEEK RETRO WALKING PROGRAM TO REDUCE PAIN, IMPROVE MUSCLE STRENGTH AND PHYSICAL FUNCTION IN OSTEOARTHRITIS KNEE.

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ABSTRACT:

BACKGROUND: Osteoarthritis (OA) is the most common skeletal condition affecting quality of life of adults. It is the most frequent joint disease with a prevalence of 22% to 39% in India. OA is strongly associated with aging and heavy physical occupational activity. The overall prevalence of knee OA was found to be 28.7%. OA is more common in women than men, but prevalence dramatically increases with age. Nearly 45% of women over the age of 65 years have symptoms while radiological evidence is found in 70%.

AIM: To find out the effect of proprioceptive exercises and six-week retro walking program to reduce pain improve muscle strength and physical function in osteoarthritis knee.

Materials and Methods: Subjects were chosen according to inclusion and exclusion criteria.
Informed consent will be taken from subjects meeting inclusion and exclusion criteria. Subjects will be screened and base line data. Subjects will be divided into two groups using simple random sampling.

RESULTS:

The results suggest that the mean NPRS post score in group A was 2.466 with a standard deviation 0.516 and the mean NPRS post score in group B was 4.533 with a standard deviation 1.187 which was statistically significant (p value < 0.001).The mean MMT post score in group A flexors, extensors, abductors was(4.266,4.00,4.2) with a standard deviation (0.457,0.534,0.414) and the mean MMT post score in group B flexor, extensor, abductor was 3.466 with a standard deviation 0.516 which was statistically significant (p value <0.001).The mean WOMAC Score post score in group A was 29.666 with a standard deviation 2.768 and the mean WOMAC score post score in group B 36.8 was with a standard deviation 4.843 which was statistically significant (p value <0.001).

CONCLUSION:

From the above statistical analysis and literature review we can conclude that both the groups showed improvement in the parameters selected for the study. Proprioceptive and six-week retro-walking program is effective in reducing pain, improving the muscle strength and physical function in osteoarthritis knee but Proprioceptive exercises are

more effective than six-week retro walking program in reducing pain, improving the muscle strength and physical function in osteoarthritis knee.

KEY WORDS: Osteoarthritis, proprioceptive exercises, retro walking, muscle strength, physical function.

INTRODUCTION:

Osteoarthritis (OA) is the most common musculoskeletal condition affecting quality of life. It is a disease characterized by degradation of extracellular matrix and cell stress arising from micro and macro injury that initiates an inappropriate repair process including pro-inflammatory pathways of innate immunity. The articular cartilage wears away over time and joint space narrows, leading to increased friction resulting in pain. Weakness of shock absorbing and weight bearing muscles may lead to structural damage of the articular cartilage and subchondral bone as well as decrease joint stability, which is risk factor for knee OA progression. Three major physical impairments such as knee pain, stiffness, decreased quadriceps strength are believed to contribute to physical disability and progression of the disease. Quadriceps, hamstrings and hip abductor muscles are significantly impaired and affect physical function. Epidemiology approximately 250 million people worldwide 3.6% of the population have knee OA. OA is most frequent joint disease with a prevalence of 22% to 39% in INDIA. OA is more common in women than men, but prevalence dramatically increases with age. Nearly,45% of women over the age of 65 years have symptoms while radiological evidence is found in 70% of those over 65 years. Obesity as a primary risk factor for incident OA and indicated that obese women had nearly 4 times the risk of knee OA as compared with non-obese women.

knee Pathology of OA includes progressive changes in articular cartilage include softening, flattening, splitting, fibrillation, fragmentation and breaking of flake of cartilage, bony changes include eburnation, cystic cavities, microfractures and accumulation of osteophytes at the margin of articular surfaces, synovial membrane is hypertrophy, edema and fibrous degeneration and there is low grade inflammatory changes, ligaments may become contracted or elongated muscles may undergo atrophy. Clinical features of OA are pain, stiffness, tenderness, swelling, crepitus and loss of movement, valgus or varus deformity, locking of the knee on auscultation of joint-scratching crepitus and later on load crackling sound. Investigations for diagnosis OA knee include knee radiographs, CT scan, MRI, Arthoscopy, synovial fluid analysis. Kellgreen- Lawrence grade is used to assess the severity of knee OA on a plain radiograph. Grade 0 - no radiological findings of OA. Grade 1- doubtful narrowing of joint space and possible osteophytic lipping. Grade 2- definite osteophytes and possible narrowing of joint space. Grade 3- moderate multiple osteophytes, definite narrowing of joint space, small pseudo-cystic areas with sclerotic walls and possible deformity of bony contours. Grade 4- large osteophytes, marked narrowing of joint space, severe sclerosis and definite deformity of bony contour.

Recent studies suggested a potential association between impaired knee proprioception and pathologic changes during the early stages of knee OA. proprioception is provided by proprioceptors in skeletal muscles, tendons, fibrous capsule in joints. As the knee muscles, tendons, ligaments and joint capsules in the patients with knee OA become weekend and damaged, proprioceptive sensation can also decrease. Furthermore, proprioceptive impairments may predispose patients with knee OA to pain or disability. Reduced proprioception in patients with osteoarthritis weakens the thigh muscles strength and could limit their walking ability and dynamic balance. Also, joint pain may have harmful effects on muscle function. When an individual performs balance keeping exercises on unstable surfaces, proprioception responses occur first among those generated by the somatic senses. These responses allow compensatory adjustments in the length of various muscles, their tension levels and position of the joints to facilitate joint movements. Advantages of a proprioceptive circuit exercises are reduced muscle fatigue, improved joint position, improved joint stability, reduced risk of injury, improved mobility. Reduced muscle compensation muscles may become overactive if proprioception is decreased as they will compensate to stabilize the joint. Patients with poor proprioception is associated with poor muscle strength and limitation in functional

ability. Diminished knee joint proprioception is highly correlated with level of pain, and interaction between proprioception and muscle strength is closely related to functional body movements. This related to functional body movements. This indicates that application of proprioceptive circuit exercises improves proprioception and knee joint muscle function thereby reducing patient pain. So, strengthening knee joint muscle function likely helps reduce pain. proprioceptive circuit exercises in patients with degenerative knee OA can be effective way of strengthening knee joint muscle function and reducing pain.

Retro walking program, a closed kinematic chain exercise program has drawn much attention in the management of OA knee. It aims to increase the strength and stability of knee joint. These exercises help to promote muscle strength, improve range of motion, increase mobility and ease pain. Retro-walking is walking backwards since there is propulsion in backward direction and reversal of leg movement in retro-walking, different muscle activation patterns from those in forward walking. A gait cycle during retro-walking can be defined as toe-on- of a limb to the subsequent toe-on-of a same limb. Along with a unique muscle activation pattern, retro walking is associated with increased cadence, decrease stride length and different joint kinematics. It significantly lowers peak patellofemoral joint compressive force and significantly slower rate of loading has been found. Consequently, trauma to the articular cartilage is reduced. It is an effective tool to increase quadriceps strength after immobilization, since quadriceps strength is activated for a longer period. It decreases compressive load on knee and improving the muscular strength. Retro-walking showed significant improvement in muscle activation pattern, reduction in adductor moment at knee during stance phase of gait and augmented stretch of hamstring muscle groups during the stride, all of these have helped in reducing disability and thus leading to improved function. Retro-walking is considered an effective closed kinematic chain to exercise to improve lower muscle strength and equilibrium of human body.

MATERIALS AND METHODOLOGY

Source of data:

Krishna institute of medical sciences in Secunderabad

In and around physiotherapy clinics, Hyderabad.

Method of collection of data:

Population: osteoarthritis patients

Sample design: Simple random sampling.

Sample size: 30

Type of Study: Experimental study.

Study duration: 6 weeks

INCLUSION CRITERIA

1.The subjects with age group 40 to 65 years

2. Both male and females

3. Pain for duration of greater than 3 months

4. Unilateral Osteoarthritis knee

5. Subjects with degenerative OA and had radiological findings stage 2 and 3 according to kellgreen -Lawrence scale

EXCLUSION CRITERIA

1.Previous, recent traumatic injury to knee

2.Heart, pulmonary conditions

3.Spinal problems

4.Recent knee surgery

5.Severe osteoarthritis knee

Subjects were chosen according to inclusion and exclusion criteria and allocated into 2 groups, A and B by simple random sampling. The Informed consent was taken from the subjects meeting inclusion and exclusion criteria prior to the evaluation and treatment sessions. subjects were screened and baseline data like gender, age, radiography evidence were obtained. Pain was measured through NPRS scale, muscle strength was determined through MMT grading scale and physical function was determined through WOMAC score.

Group A was given PROPRIOCEPTIVE EXERCISES 3times a week for 6 weeks.

The exercise program includes:

1.warm up exercises include ankle toe movements, jogging, hamstring stretch, gastrocnemius, calf stretches, quadriceps stretch.

2.isometrics of quadriceps, hip adduction and straight leg raising exercise.

3.proprioceptive exercise includes half squats, lunges, stationary cycle

4.cool down period exercise includes ankle toe movements, breathing exercises, gastrocnemius, calf stretch and hamstring stretches.

Group B was given Retro walking program 3times a week for 6 weeks.

The exercise program includes:

1.warm up exercises include ankle toe movements, jogging, hamstring stretch, gastrocnemius calf stretches, quadriceps stretch

2.isometrics of quadriceps, hip adduction and straight leg raising exercise.

3.backward walking

4.cool down period exercise includes ankle toe movements, breathing exercises, gastrocnemius, calf stretches and hamstring stretch.

After six weeks of program pain is calculated through NPRS scale, muscle strength through MMT and physical function through WOMAC score between group A and group B.

OUTCOME MEASURES

Numerical Pain Rating Scale (NPRS)

Manual Muscle Strength (MMT)

Western Ontario and Mc. Master Universities Osteoarthritis Index Scale (WOMAC)

MATERIALS USED:

1.Examination couch

2.Towels

3.Isometric ball

4.Stationary bicycle

Data analysis:

Descriptive Data analysis was performed by SPSS (version 17) for windows. Alpha value was set as 0.05. Descriptive statistics was performed to find out mean, standard deviation for the demographic variable and outcome variables. Chi square test was performed to find out gender and type of distribution among both groups. Unpaired t test was used to find out significant differences among demographic variable such as age.

Student t-test (Two- tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (inter group analysis) on metric parameters.

Chi-square test has been used to find significance of study parameters on categorical scale between two or more groups, non –parametric setting for qualitative data analysis, Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for Qualitative data analysis. Fisher Exact test used when cell samples are very small.

Microsoft excel, word was used to generate graph and tables.

RESULTS:

Table 1: Baseline data for demographic variables

SL.NO	VARIABLE	GROUP A	GROUP B	P VALUE
1	AGE	52.13 ± 6.78	52.4 ± 4.76	>0.443
2	GENDER	6/9	7/8	>0.741

Data are mean ± standard deviation (SD). In the Group A, the mean Age is 52.133 and SD is 6.780 and in the Group B, the mean Age is 52.4 and SD is 4.762 which was not statistically significant (p value >0.443). In the Group A, there were 6 males & 9 females and in the Group B, there were 7 males & 8 females which were not statistically significant (p-value >0.741). Data was homogenous among both groups for base line data of demographic variables.

Table 2: Age distribution of patients

AGE DISTRIBUTION OF PATIENTS STUDIED			
AGE IN YEARS	GROUP A	GROUP B	TOTAL
40 - 49	5 (50 %)	5 (50 %)	10 (100 %)
50 - 60	10 (50 %)	10 (50 %)	20 (100 %)
TOTAL	15 (50 %)	15 (50 %)	30 (50 %)
MEAN/SD	52.13 ± 6.78	52.4 ± 4.76	52.26 ± 5.75

Table 3: Gender distribution of patients

GENDER DISTRIBUTION OF PATIENT STUDIED			
GENDER	GROUP A	GROUP B	TOTAL
MALE	6 (46.1538461538462 %)	7 (53.8461538461538 %)	13 (100 %)
FEMALE	9 (52.9411764705882 %)	8 (47.0588235294118 %)	17 (100 %)
TOTAL	15 (100 %)	15 (100 %)	30 (100 %)

Table 4: Baseline data for outcome variables

In the Group A, the mean NPRS Pain was 8.333 with standard deviation of 1.046 and in the Group B, the mean

SL.NO	VARIABLES	GROUP A	GROUP B	P VALUE
1	NPRS	8.333 ± 1.046	8.066 ± 1.032	0.244108462
2	MMT FLEXORS	2.533 ± 0.516	2.333 ± 0.487	0.14244514
3	MMT EXTENSORS	2.533 ± 0.516	2.266 ± 0.457	0.072834641
4	MMT ABDUCTORS	2.533 ± 0.516	2.333 ± 0.487	0.142445134
5	WOMAC	57.133 ± 6.034	58 ± 4.928	0.335000844

NPRS Pain is 8.066 with standard deviation of 1.032 which was not statistically significant (P-value >0.2441). In the Group A, the mean MMT Flexors was 2.533 with standard deviation of 0.516 and in the Group B, the mean is 2.333 with standard deviation 0.487 which was not statistically significant (P-value >0.1424). In the group A , the mean MMT Extensors was 2.533 with standard deviation 0.516 and in group B the mean was 2.266 with standard deviation 0.457 which was statistically insignificant(p value >0.0728) . the mean MMT Abductors was 2.533 with standard deviation 0.516 and in group B the mean was 2.333 with standard deviation 0.487 which was statistically in significant (p value >0.1424) the mean WOMAC score was 57.133 with standard deviation 6.034 and in group B the mean was 58 with standard deviation 4.928 which was statistically insignificant (p value >0.335). In summary data were homogenous among both groups for baseline data.

Table 5: NPRS – Pain items pre and post assessment

NPRS - PAIN ITEMS PRE AND POST ASSESSMENT				
NPRS	Group A	GROUP B	TOTAL	P VALUE
PRE	8.333 ± 1.046	8.066 ± 1.032	8.2 ± 1.030	0.244108462
POST	2.466 ± 0.516	4.533 ± 1.187	3.5 ± 1.383	<0.001**
DIFFERENCE	5.87	3.53	4.7	
P VALUE	<0.001**	<0.001**	<0.001**	

Student t test(unpaired) for between group analysis and student t test (paired) for within group analysis

TABLE 6: MMT KNEE FLEXORS PRE AND POST ASSESSMENT

MMT - ITEMS PRE AND POST ASSESSMENT				
KNEE FLEXORS	GROUP A	GROUP B	TOTAL	P VALUE
PRE	2.533 ± 0.516	2.333 ± 0.487	2.43 ± 0.505	0.142445134
POST	4.266 ± 0.457	3.466 ± 0.516	3.86 ± 0.485	<0.001**
DIFFERENCE	1.73	1.13	1.43	
P VALUE	<0.001**	<0.001**	<0.001**	

TABLE 7: MMT EXTENSORS PRE AND POST ASSESSMENT

MMT - ITEMS PRE AND POST ASSESSMENT				
KNEE EXTENSORS	GROUP A	GROUP B	TOTAL	P VALUE
PRE	2.533 ± 0.516	2.266 ± 0.457	2.395 ± 0.48	0.072834641
POST	4 ± 0.534	3.466 ± 0.516	3.733 ± 0.52	0.004812048
DIFFERENCE	1.47	1.2	1.335	
P VALUE	<0.001**	<0.001**	<0.001**	

MMT - ITEMS PRE AND POST ASSESSMENT				
HIP ABDUCTORS	GROUP A	GROUP B	TOTAL	P VALUE
PRE	2.533 ± 0.516	2.333 ± 0.487	2.43 ± 0.505	0.142445134
POST	4.2 ± 0.414	3.466 ± 0.516	3.83 ± 0.465	0.000102065
DIFFERENCE	1.67	1.13	1.4	
P VALUE	<0.001**	<0.001**	<0.001**	

TABLE 8: MMT ABDUCTORS PRE AND POST ASSESSMENT

WOMAC SCORE PRE AND POST ASSESSMENT				
WOMAC	GROUP A	GROUP B	TOTAL	P VALUE
PRE	57.133 ± 6.034	58 ± 4.928	57.565 ± 5.481	0.335000844
POST	29.666 ± 2.768	36.8 ± 4.843	33.23 ± 3.8055	<0.001**
DIFFERENCE	27.47	21.2	24.335	
P VALUE	<0.001**	<0.001**	<0.001**	

TABLE 9: WOMAC SCORE PRE AND POST ASSESSMENT

DISCUSSION

Results of our study **"EFFECTIVENESS OF PROPRIOCEPTIVE EXERCISES AND SIX WEEK RETRO WALKING PROGRAM TO REDUCE PAIN IMPROVE MUSCLE STRENGTH PHYSICAL FUNCTION IN OSTEOARTHRITIS KNEE."** Demonstrated that there is a significant effect of PROPRIOCEPTIVE EXERCISES in OSTEOARTHRITIS KNEE.

This study was conducted in physiotherapy OPD department in KIMS Hospital. Total of 30 subjects diagnosed with OA knee were recruited into the study and divided randomly into 2 groups. The present study investigated. The effectiveness of Proprioceptive exercises in comparison with six-week retro walking program to improve muscle strength and physical function in OA knee patients and it was conducted for a period of 6 weeks. The pre-test and post-test values were evaluated for the following scales NPRS, MMT, WOMAC SCORE.

At the end of the study differences of the scores evaluated before and after, the intervention statistically shown a significant improvement in Physical function in Group-A compared to Group-B. Group-A was treated with PROPRIOCEPTIVE EXERCISES and the group-B was treated with SIX WEEK RETRO WALKING PROGRAM.

The study shows that there are no significant differences in average scores of ages in both group A and group B as shown in table 1 and graph 1.

In our study we found that the patients between the age 45-60 years experiences symptoms of OA knee. There is also no significant difference in between the age of both groups which we can observe in the table 2.

Previous research of apexa-rathwa 2019, has stated about diminished knee joint proprioception is highly correlated with the level of pain, and the interaction between proprioception and muscle strength is closely related to functional body movements.

In group A who received proprioceptive exercises there is increase in post values of NPRS, MMT, WOMAC score compared to pre values which is shown in table 5,6,7,8,9.

The possible reason for reducing pain, improving muscle strength and physical function might be due to increase in proprioception and knee joint muscle function, thereby reducing patient pain. strengthening of knee joint muscle function likely helps to reduce pain.

Patients with degenerative knee OA show reduced quadriceps strength and a decline in proprioception and balance. Reduced proprioception in patients with OA weakens their thigh muscle strength and could limit their walking ability and dynamic balance. joint pain may have harmful effects on muscle function (muscle strength and activation) and senses (proprioception and balance) Sung-bum describes proprioceptive circuit exercises treatment for OA knee patients designed to strengthen the thigh muscles, enhance proprioception, and reduce pain in patients with degenerative OA.

Proprioceptive training improved neuromuscular coordination for sensoria-motor learning. Repeated proprioceptive training with functional elements increased cumulative neural inputs to the central nervous system via mechanoreceptors and proprioceptors in the joint capsules, ligaments, muscles, tendons and skin.

Konradsen et al, reported that afferent inputs from muscles and tendons were important than those from ligamentous mechanoreceptors, possibly because of mechanical stabilization.

Lin et al 2007 hypothesized that 10-25% of body weight as exercise resistance can facilitate knee proprioception. This has been attributed to isometric strengthening programmes ability to decrease pain that may enhance proprioception. The addition of strengthening exercises can optimize joint function and biomechanical stability.

Thus, the improvement found in NPRS, MMT& WOMAC in this study are due to the above-mentioned reasons.

In this study group B who received six-week retro-walking program there is increase in post values of NPRS, MMT, WOMAC score compared to pre values which is shown in table and graph.

The probable reason for this result was the retro-walking mainly involves the shear force at knee joint directed anteriorly. Additionally, retro-walking causes significantly reduced patellar compressive force at knee joint.

Biomechanically muscles around knee and ankle are reversed their action during retro-walking. knee gives the primary power producer with co-contraction of quadriceps and hamstrings and ankle plantar flexors works as shock absorber.

Previous study of masumoto k, et al 2017, supported that the retro walking reduces eccentric activity of the quadriceps, while isometric and concentric quadriceps activity was maintained. Reduced eccentric activity of quadriceps will results decrease compressive force at knee joint, therefore, pain intensity at the knee will be reduced.

compressive forces on medial compartment of knee joint are supported by balraj am, kutty rk in 2018.

Advantages of Retro-walking include improvement in muscle activation pattern, reduction in adductor moment at knee during stance phase of gait and augmented stretch of hamstring muscle groups during the stride is supported by Yang YR, Yen JG, Wang RY et al 2005, all of these may have helped in reducing disability thus leading to improved function.

Zhang W, Moskowitz RW et al 2007 has proved that walking improves pain, functional capacity, and knee muscle activity.

Researchers have found the many beneficial effects of backward walking such as enhanced knee extensor muscle activation and proprioception, muscle reflex initiation, change in motor control pattern, reduced gait speed and stride length, diminution in knee joint stresses, and improved hamstring and back muscle flexibility.

The reversal of movement in retro walking results in greater demand placed on the ankle joint to assist in foot clearance, especially with the role reversal of the muscles to extensor activation pattern. This reduces the impact of the forces on the knee joint particularly the compressive forces on the patella.

Inter-comparison of both groups proprioceptive circuit exercises and six-week retro-walking program pre and post values are shown in following tables 9 and graph7 for group A and for group B respectively. According to the above tables all the parameters in both the groups have improvement but group A is significantly more effective than group B.

Hence, we conclude that both the groups showed improvement, but comparatively Group A receiving proprioceptive exercises showed more significant improvement than Group – B receiving six-week retro walking program

On the basis of the present study, it can be said that proprioceptive exercises and six-week retro walking program are beneficial for treatment of OA knee. However, when compared proprioceptive exercises proved to produce more long-lasting effects than six-week retro walking program for reducing pain, to improve muscle strength& physical function in osteoarthritis knee.

The former two techniques are expected to play a role in all OA knee patients managed conservatively. This is the first preliminary study to compare the effectiveness of proprioceptive exercises and retrowalking in physical function improvement for performance into consideration.

We have taken patients irrespective of gender, particular number was not taken into consideration. Patients were randomly selected.

As per statistical analysis of the study Table 1 shows the demographic data of this study Table 5 shows baseline measure fo NPRS, MMT and WOMAC SCORE, Table 5,6,7,8,9 and shows the pre and post differences of and of both groups.

In the Group A, the mean NPRS Pain was 8.333 with standard deviation of 1.046 and in the Group B, the mean NPRS Pain is 8.066 with standard deviation of 1.032 which was not statistically significant (P-value >0.2441). In the Group A, the mean MMT Flexors was 2.533 with standard deviation of 0.516 and in the Group B, the mean is 2.333 with standard deviation 0.487 which was not statistically significant (P-value >0.1424). In the group A, the mean MMT Extensors was 2.533 with standard deviation 0.516 and in group B the mean was 2.266 with standard deviation 0.457 which was statistically insignificant (p value >0.0728). the mean MMT Abductors was 2.533 with standard deviation 0.516 and in group B the mean was 2.333 with standard deviation 0.487 which was statistically in significant (p value >0.1424) the mean WOMAC score was 57.133 with standard deviation 6.034 and in group B the mean was 58 with standard deviation 4.928 which was statistically insignificant (p value >0.335) In summary data were homogenous among both groups for baseline data.

The study outcomes accept the alternate hypothesis that there is significant effect of proprioceptive exercises in improving physical function in OA Knee patients.

LIMITATIONS:

1.The study was done on small sample size

2.The duration of the study was for short period

3.Lack of follow up after cessation of treatment.

4.It was done in patients of only 45 to 60 years of age.

FURTHER STUDY:

1.Further research should address on a large sample as this study done on smaller sample.

2.As this study was done only for 6 weeks which is of short duration.

3.weekly measurements to know the short-term benefits**.**

4. Long term follow up.

CONCLUSION

Therefore, after analyzing the data the following conclusions were done. Hence both the groups showed improvement in the parameters selected for the study. Proprioceptive and six-week retro-walking program is effective in reducing pain, improving the muscle strength and physical function in osteoarthritis knee, but Proprioceptive exercises are more effective than six-week retro walking program in reducing pain, improving the muscle strength and physical function in osteoarthritis knee.

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