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Effects of Neoprene Knee Orthosis an Adjunct to ExercisesIn Persons Having Chronic Knee Osteoarthritis Comparision of Outcome Measures in Moderate Grade

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ABSTRACT

Treatment of OA incorporates patient training, weight the executives, prescriptions, restorative activity, actual modalities, orthosis, and surgery. A total of 51 individuals were enrolled in the study after signing consent form. Outof which, 40 individuals diagnosed as chronic knee OA completed the whole interventional program which lasted for 4 weeks and the data for them was analyzed statistically. From the 40 individuals, 20 who were not using knee sleeve previously were assigned to group A which were only given strengthening exercises. The remaining 20 in group B who were using neoprene knee sleeve with patella relief. The questions ask in this part of KOOS was about lifestyle modification to avoid potential damage to the knee, about lack of confidence in your knee and difficulty faced with your knee and how often the individual is aware of their knee problems. As we discussed before, 55% individuals could not modify which indirectly hampered their level of confidence and the difficulty face were increased while walking. When score on the last day was compared between group A & B, pain, symptoms, Neoprene knee sleeve with patella relief could not add any extra effect to improve balance in individuals with chronic knee OA. Strengthening exercises given in both the group has improved balance but no additional effect of neoprene knee sleeve with patella relief is seen in group B. In the exercises group (A) only strengthening exercises were given. These exercises have helped to reduce pain, improve proprioception, balance and functional activity.

Keywords: knee osteoarthritis, Exercises, Moderate grade, Neoprene knee orthosis

INTRODUCTION

Osteoarthritis (OA), or degenerative joint infection, is one of the most widely recognized joint sicknesses around the world. In the U.S., roughly 15.8 million individuals experience the ill effects of OA, and the predominance of OA in grown-ups matured from 25 to 74 years of age was 12.1%.[1] Among those more established than 26 years of age in the U.S., around 4.9% had suggestive osteoarthritis; in grown-ups more seasoned than 45 years of age, the pervasiveness rose to 16.7%.[2] Knee OA is portrayed by joint agony and solidness, which every now and again causes actual handicap, and influences personal satisfaction and working ability.[3]

The primary pathology of OA is obliteration of the articular ligament and subchondral bone redesigning, trailed by limiting of joint space and spike formation.[4] On the grounds that the focal point of gravity goes through the average part of the knee, there is seriously stacking on the average compartment of the knee, subsequently causing more harm of articular ligament on the average tibiofemoral joint. In this way, joint space is more restricted on the average side, and varus disfigurement of the knee develops.[5] A varus mechanical hub expands the separation from the focal point of the joint to the ground response force vector, bringing about increment of outer knee adduction second, which was accounted for by past studies.[5, 6] Treatment of OA incorporates patient training, weight the executives, prescriptions, restorative activity, actual modalities, orthosis, and surgery.[7] In 2017, Cochrane fundamental survey pooled information from 44 preliminaries showed that practice essentially diminished torment, and worked on actual capability and personal satisfaction in patients with knee OA. Furthermore, in excess of 10 examinations uncovered that two-month to half year post-treatment supported relief from discomfort and worked on

actual capability after practice training.[8] The American Foundation of Muscular Specialists (AAOS) and the Osteoarthritis Exploration Society Global (OARSI) additionally suggested reinforcing practices for patients with knee OA.[9, 10] In regards to actual specialists for knee OA, the outcomes from pooled examinations were inconclusive.[11, 12]

A dumping or working knee support is intended to address unusual arrangement and stress of the knee joint in view of biomechanical standards, and accordingly diminishes joint agony and works on personal satisfaction. It comprises one of the biomechanical approaches for knee osteoarthritis. For patients with average compartment knee OA, a valgus knee support is remembered to diminish torment by diminishing the heap on the average compartment through the utilization of an outer valgus force about the knee. What's more, lessening of tibiofemoral point, detachment of average tibial and femoral condyles, and diminishing the second arm between the ground response power and knee joint focus were likewise reported.[11, 12]

Throughout recent years, there have been a few examinations relating use of the dumping support in the treatment of knee OA.[13- 17] In a step investigation, Kirkly et al. demonstrated the way that patients with average compartment knee OA can benefit fundamentally from the utilization of a dumping knee support notwithstanding standard clinical treatment, and that the dumping knee support was more viable than a neoprene sleeve.[18] In a three-month follow-up study, Draper et al. affirmed that wearing a valgus support created a huge and prompt improvement in the capability of patients with unicompartmental knee OA.[19] Hurley et al. found that support use showed patterns toward progress in WOMAC torment and WOMAC capability, and that more prominent support use may emphatically influence physical activity.[20]

RESEARCH HYPOTHESIS

There is no effect of neoprene knee orthosis as an adjunct to exercises onproprioception, balance and functional activity in persons with chronic knee OA.

MATERIALS & METHODS

MATERIALS USED AND EQUIPMENT

Plinth with pillow, Weighing machine Goniometer, Measuring tape andMarker, Neoprene knee sleeve with patella relief and plastic hinges used by 20individuals with chronic knee OA, Computerized isokinetic System – Biodex 4 Pro.

STUDY DESIGN: Interventional design. (A comparative study involving 2 groups).

SAMPLE SIZE: Total 51 individuals diagnosed as OA of knee were referred from the outpatient department of the institute for this study and assigned into 2 groups after signing the consent form. Out of which, 11 individuals withdrew from the study. 40 individuals have completed the whole interventional program. All individuals had radiographs anterior- posterior view of their knees.

Group A consisting of 20 individuals (mean age±SD of 54.05±6.51, BMI =27.9±2.88) diagnosed with OA of knee who were not using knee sleeve were assigned in this group to give only strengthening exercises for knee flexors and extensors; hip abductors and ankle plantar flexors using isokinetic dynamometer for 3 times a week, for 4 weeks.

Group B consisting of 20 individuals (mean age ±SD of 55.6±5.07, BMI = 26.3±6.6) who were using knee sleeve prior to the study, for not more than 2 weeks during their activities of daily living involving standing & walking, were alsogiven strengthening exercises for knee flexors and extensors; hip abductors and ankle plantar flexors 3 times a week, for 4 weeks.

SELECTION CRITERIA

Inclusion Criteria

- Individuals diagnosed as OA of knee involving medial compartment withinthe age group of 40-60 yrs including both the sexes.
- Individuals not under any therapeutic intervention for the last 6 months.
  Kellgren- Lawrence grade of I, II, and III.
- Individuals having pain on VAS ≤ 4
- Individuals who were using knee sleeve for minimum of 2 weeks wereassigned to group B.
- Individuals who were not using knee sleeve were assigned to group A.

Exclusion criteria

- Individuals with KL grade IV,
- Lateral compartment knee OA,
- Previous knee operations, injury or fracture(s) to the lower limb bones,
- Limb length discrepancy,
- Individuals with neurological involvement,
- Individuals with any known metabolic or vascular conditions and allmusculoskeletal condition other than primary OA of knee joint.

METHODOLOGY

Title and synopsis were approved by the Ethics committee and the University. Following this, data collection was started. Subjects were selected according to the selection criteria by convenience sampling technique and the selected subjects were explained about the detailed procedure of the study and after which written informed consent was taken from them. Subjective and objective evaluation was carried out according to the Performa. The individuals wore comfortable clothing. Each and every test was done in the same place without any disturbance. The room was well lighted and ventilated.

RESULTS AND DISCUSSION

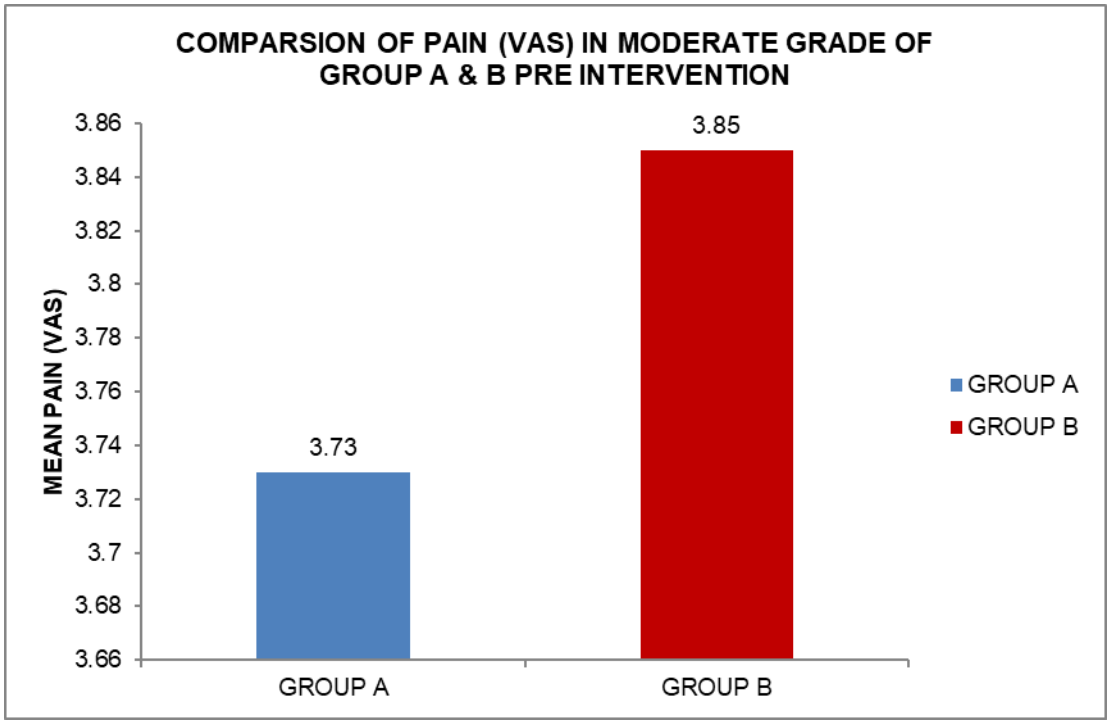
A total of 51 individuals were enrolled in the study after signing consent form. Outof which, 40 individuals diagnosed as chronic knee OA completed the whole interventional program which lasted for 4 weeks and the data for them was analyzed statistically. From the 40 individuals, 20 who were not using knee sleeve previously were assigned to group A which were only given strengthening exercises. The remaining 20 in group B who were using neoprene knee sleeve with patella relief and plastic hinges prior to the study, for minimum of 2 weeks during standing and walking, were also given strengthening exercises 3 times a week, for 4 weeks. Individuals with severe knee OA (Kellgren- Lawrence grade IV) were not considered for the study.

Table 1: Comparison Of Outcome Measures (Pain, Proprioception, Function & Balance) In Moderate Grade Between Group A & B Before the Intervention

PARAMETERS		GROUP A (N = 05) MEAN±SD	GROUP B (N = 06) MEAN±SD	t / z VALUE	p- VALUE p<0.05	SIGNIFICANCE
PAIN (VAS)		3.8±0.44	3.61±0.51	*0.471	0.637	NS
PROPRIOCEPTION (ERROR SCORE)	30° KNEEFLEXION	8.7±9.54	2.18±1.893	1.650	0.133	NS
	45° KNEEFLEXION	8.60±2.15	5.51±3.585	0.262	0.798	NS
	70° KNEEFLEXION	10.06±9.03	12.48±9.41	0.432	0.675	NS
SEBT (cm)	ANTERIOR EXCURSION	13.8±2.68	18.2±1.6	3.357	0.008	S
	MEDIAL EXCURSION	17.1±2.30	16.8±4.07	0.131	0.898	NS
	POSTERIOREXCURSION	13.8±3.88	16.66±2.42	1.501	0.167	NS
	LATERAL EXCURSION	14.6±4.33	11.83±3.43	1.186	0.265	NS
KOOS (%)	PAIN	67.8±13.67	72.25±14.06	*-0.184	0.854	NS
	SYMPTOMS	84.03±9.73	83.45±9.656	*-0.092	0.927	NS
	ADL	82.48±6.63	83.54±10.0	*-0.183	0.854	NS
	QOL	60.9±5.70	57.54±6.365	*-1.103	0.270	NS

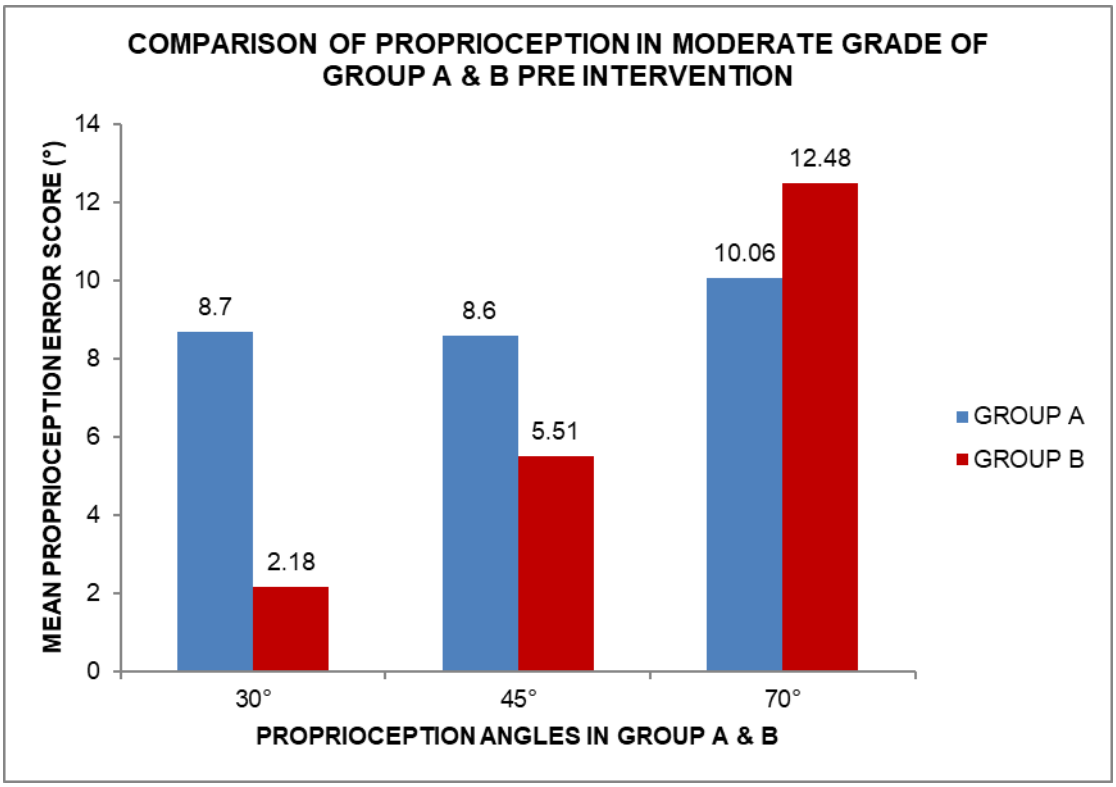
** indicates z- value for non parametric data. S = significant and NS = notsignificant*

A.) Pain using VAS is compared in both the in **moderate grade of group A and B pre intervention**



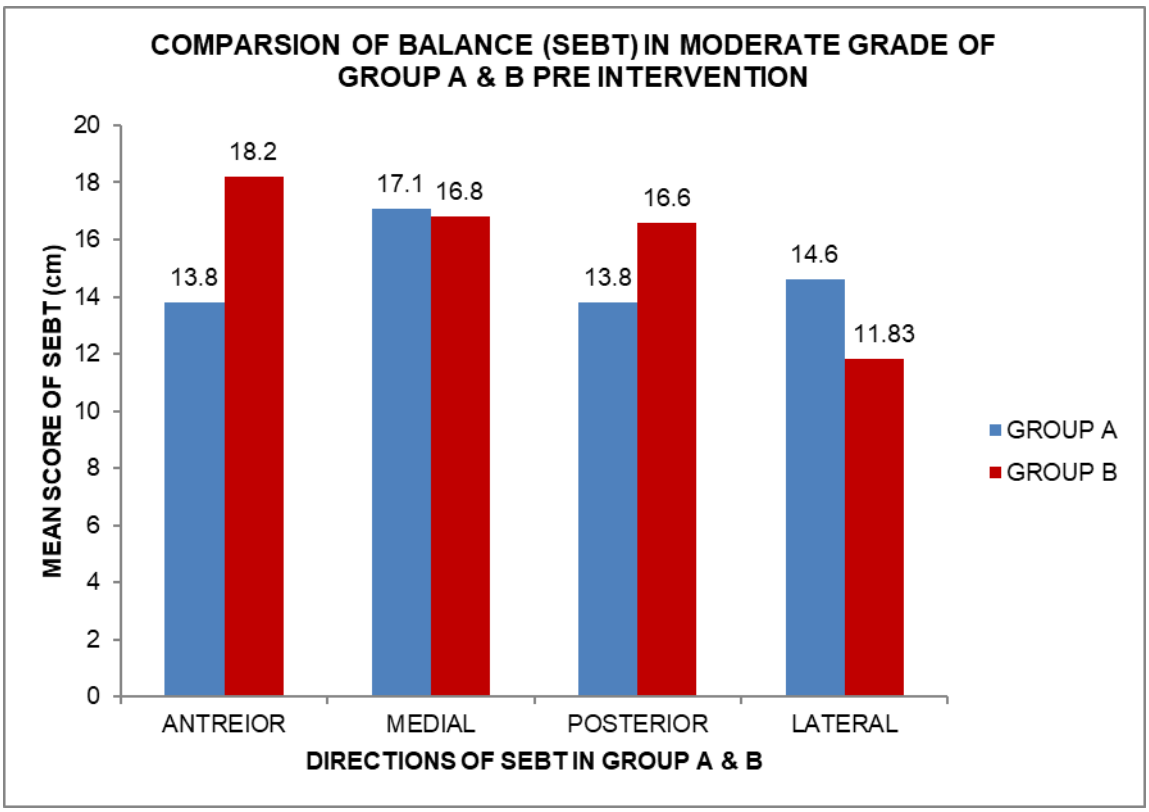
The above graph compares pain in moderate grade of knee OA between the group A and B pre intervention. There is no significant difference seen between group A and B with p value > 0.05.

B.) Proprioception (using error score)is assessed using isokineticdynamometer pre intervention in moderate grade of group A and B.



The above graph compares mean proprioception error score in moderate gradeof knee OA between the group A and B pre intervention. There is no significant difference seen between group A and B with p value > 0.05.

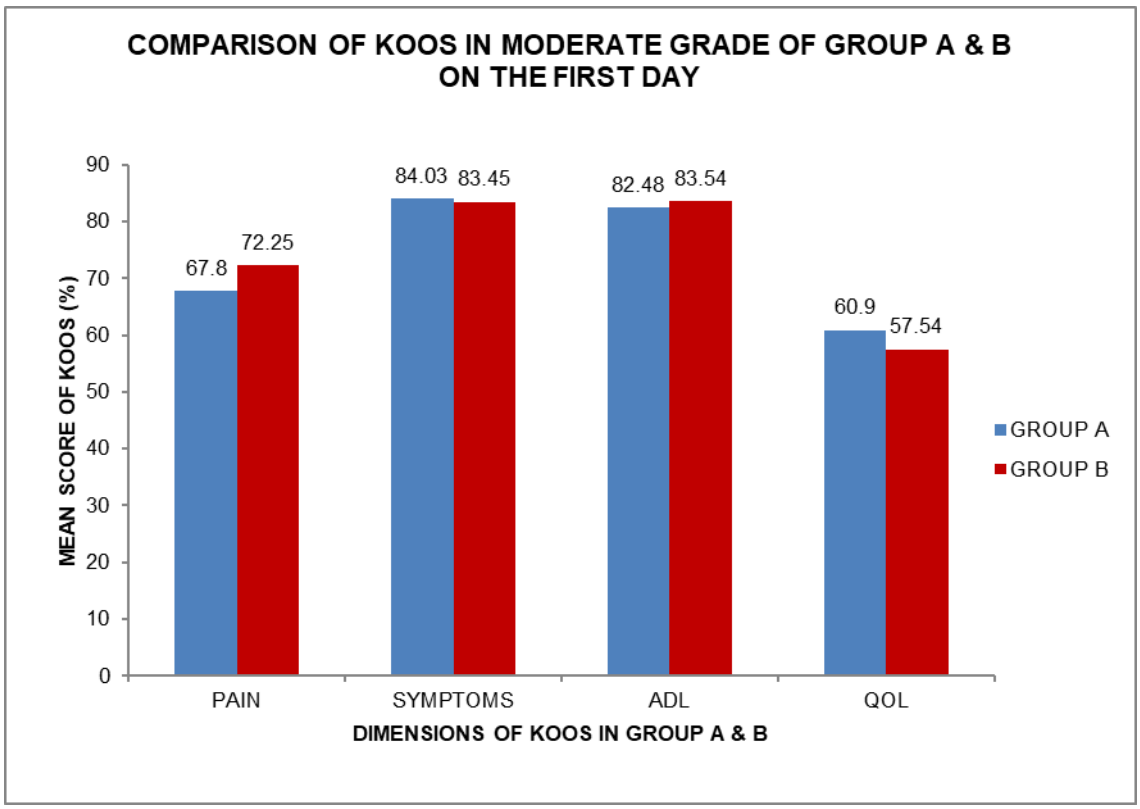
C.) Balance is assessed by Star Excursion Test pre intervention in moderate grade of group A and B 4 directions- anterior, posterior, medial and lateral excursions were measured using measuring tape.



The above graph compares mean score of SEBT in moderate grade of knee OA between the group A and B pre intervention. There is no significant difference seen between group A and B with p value > 0.05.

D.) Functional activity is assessed by Knee injury and Osteoarthritis Outcome Score (KOOS) pre intervention in moderate grade in group A and B. The dimensions are Pain, Other Disease-Specific Symptoms, ADL Function and knee-related

Quality of Life. Being non- parametric data, non parametric tests, Mann Whitney Test (Wilcoxon Rank Sum Test) is used to analyze the data.



The above graph compares mean score of KOOS in moderate grade of knee OA between the group A and B pre intervention. There is no significant improvement seen between group A and B with p value > 0.05

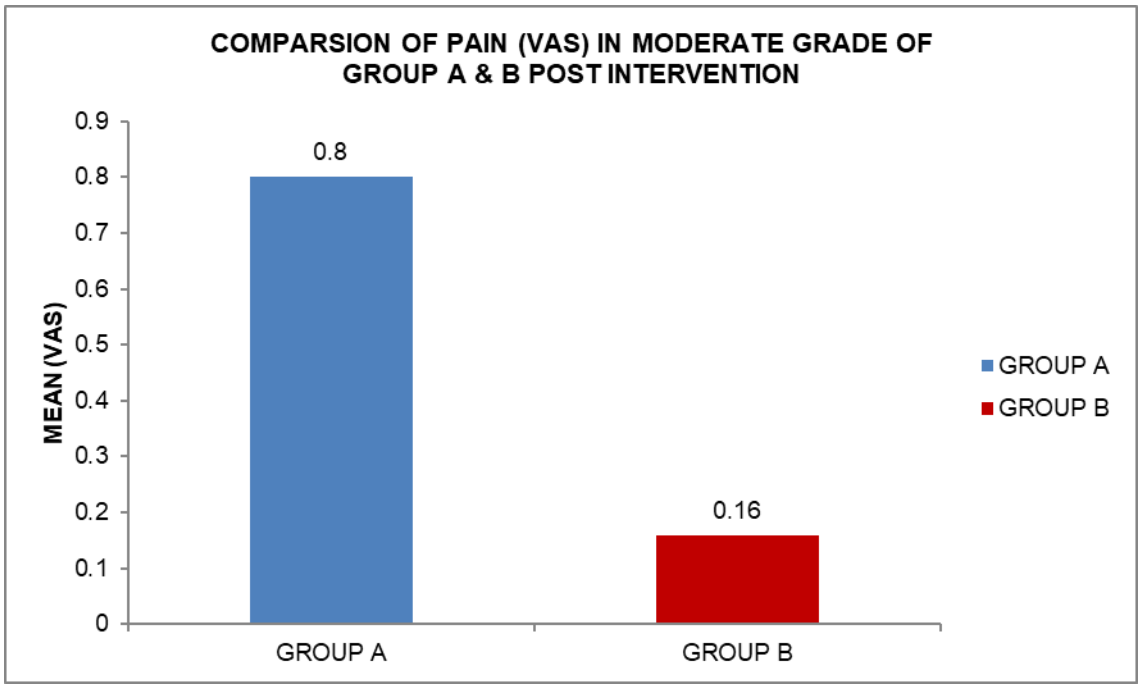
Fig 8: Compares the outcome measures of pain, proprioception, balance and functional activity in moderate grade of group A and B pre intervention using unpaired t test. Pain and KOOS, being nonparametric data, the non parametric test (Mann Whitney U Test) is used.

Table 2: Comparsion Of Outcome Measures (Pain, Proprioception. Function & Balance) In Moderate Grade Between Group A & B After The Intervention:

PARAMETERS		GROUP A N = 5 MEAN±SD	GROUP B N = 6 MEAN±SD	t / z VALUE	p-VALUE p<0.05	SIGNIFICANCE
PAIN (VAS)		0.8±0.44	0.16±0.408	*-2.003	0.045	S
PROPRIOCEPTION (ERROR SCORE)	30° KNEEFLEXION	6.64±7.98	1.68±1.310	1.609	0.141	NS
	45° KNEEFLEXION	4.8±3.32	4.03±3.601	0.365	0.723	NS
	70° KNEEFLEXION	7.76±4.99	8.98±8.053	0.294	0.775	NS
SEBT (cm)	ANTERIOR EXCURSION	15.5±3.27	19.5±1.97	2.6627	0.025	S
	MEDIAL EXCURSION	16.4±2.88	18.5±3.728	0.688	0.508	NS
	POSTERIOREXCURSION	14.2±2.16	18.5±1.685	3.507	0.006	S
	LATERAL EXCURSION	16.6±3.84	11.91±2.332	2.276	0.048	S
KOOS (%)	PAIN	91.27±12.57	95.4±5.98	*-0.187	0.851	NS
	SYMPTOMS	96.85±2.69	95.85±2.656	*-0.751	0.453	NS
	ADL	95.15±4.75	96.18±4.726	*-0.462	0.644	NS
	QOL	84.3±5.62	76.64±7.35	*-1.573	0.116	NS

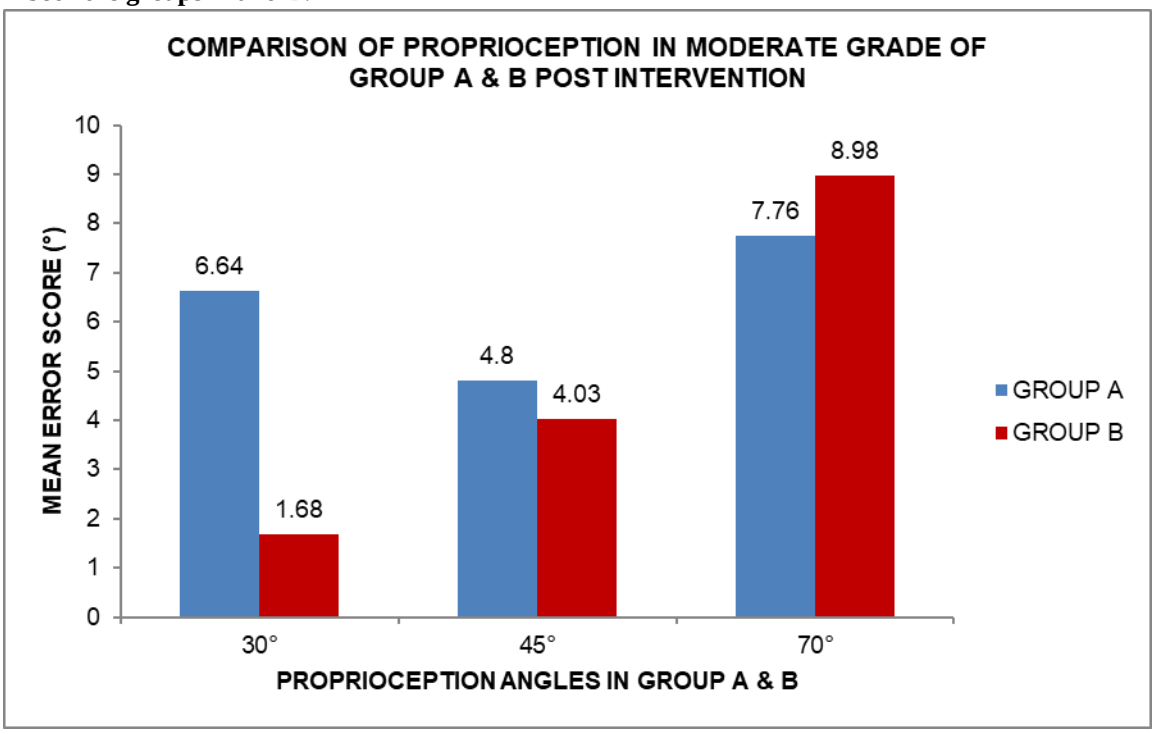
** indicates z- value for non parametric data. S = significant and NS = notsignificant*

A.) Pain using VAS is compared in both the in **moderate grade of group A and B on post intervention after 4 weeks of intervention**.



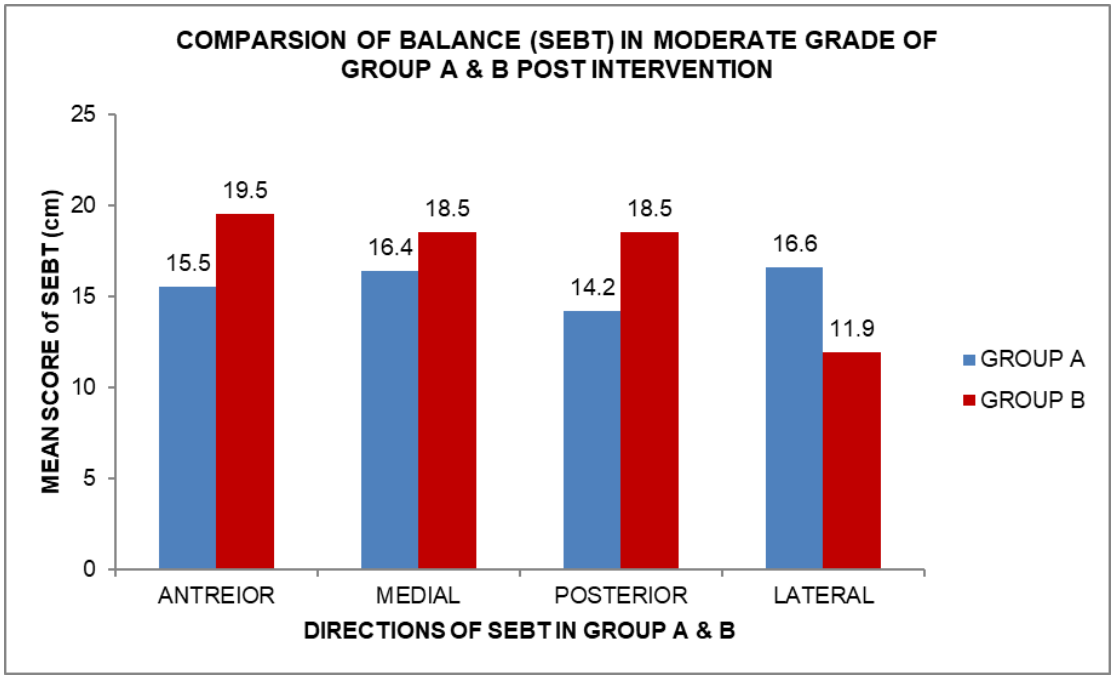
The above graph compares pain in moderate grade of knee OA across the groupA and B after the intervention of 4 weeks. There is significant improvement seen in group B suggesting that knee sleeve helps in reducing pain in individuals with chronic knee OA with p value < 0.05. Thus, rejects the null hypothesis.

B.) Proprioception (using error score) is assessed using isokinetic dynamometer on post intervention **in both the groups A and B**.



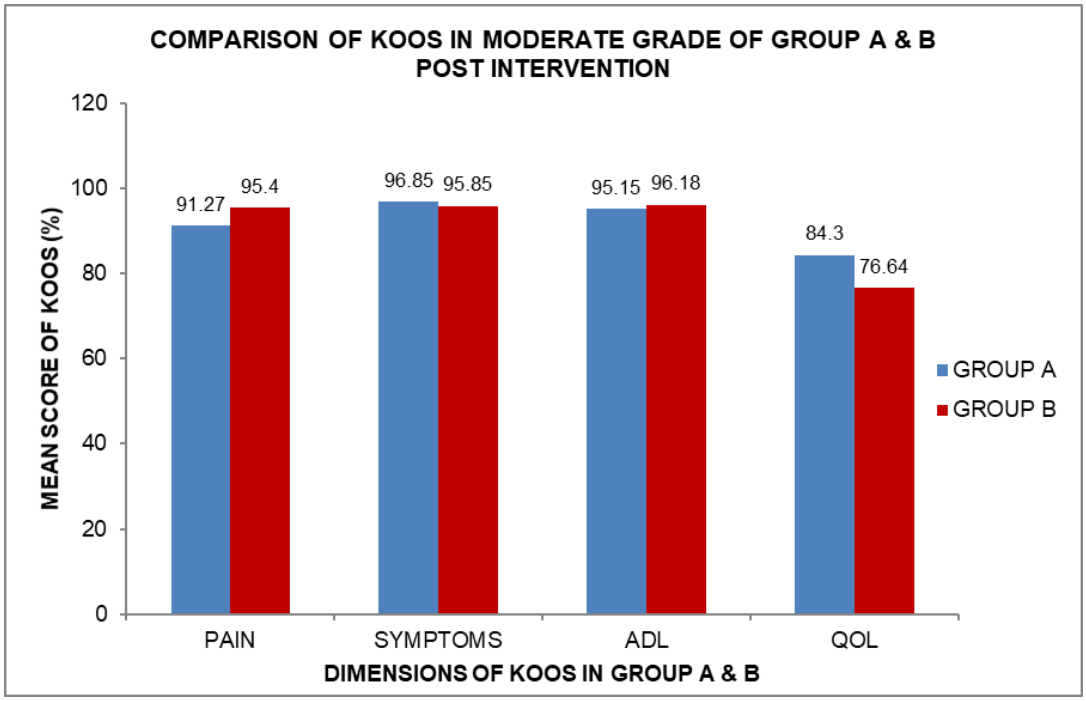
The above graph compares mean proprioception score in moderate grade of knee OA across the group A and B after the intervention of 4 weeks. There is no significant difference between groups A & B suggesting that knee sleeve makes no difference in knee proprioception in individuals with chronic knee OA (p>0.05). Thus, supports the null hypothesis.

C.) Balance is assessed by Star Excursion Test on post intervention **in moderate grade of groups A and B**. 4 directions- anterior, posterior, medialand lateral excursions were measured using measuring tape.



The above graph compares mean score of SEBT in moderate grade of knee OA between group A and B after the intervention of 4 weeks. There is significant difference between groups A & B in anterior, posterior and lateral excursion. Whereas, there is no significant difference in medial excursion. This suggeststhat knee sleeve appears to improve the balance at least in anterior, posterior and lateral directions in individuals with chronic knee OA. Thus, rejects the null hypothesis.

D.) Functional activity is assessed by Knee injury and Osteoarthritis Outcome Score (KOOS) **on post intervention in moderate grade of group A and B.** Thedimensions are Pain, Other Disease-Specific Symptoms, ADL Function and knee-related Quality of Life. Being non parametric data, non parametric test, Mann Whitney Test (Wilcoxon Rank Sum Test) is used to analyze the data.



The above graph compares mean score of KOOS in moderate grade of knee OA across the group A and B after the intervention of 4 weeks. There is no significant difference between groups A & B suggesting that knee sleeve makes no difference in functional activity in individuals with chronic knee OA [p >0.05). Thus, supports the null hypothesis.

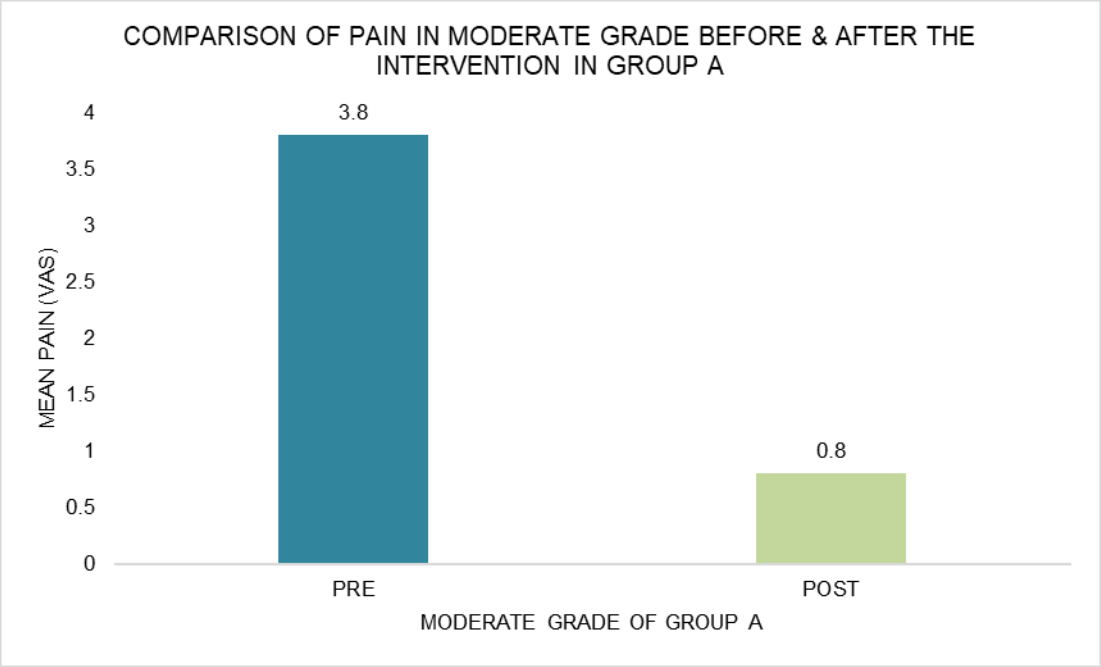
Fig 2: compares the outcome measures of pain, proprioception, balance and functional activity in moderate grade of group A and B after 4 weeks of intervention using unpaired t test. Pain and KOOS, being nonparametric data, the non parametric test (Mann Whitney U Test) is used.

Table 3: Comparison Of Outcome Measures (Pain, Proprioception, Function & Balance) In Moderate Grade In Group A Before & After The Intervention

PARAMETERS		PRE MEAN±SD	POST MEAN±SD	t / z VALUE	p-VALUEp<0.05	SIGNIFICANCE
PAIN (VAS)		3.8±0.44	0.8±0.44	*-2.060	0.039	S
PROPRIOCEPTION(ERROR SCORE)	30° KNEEFLEXION	8.7±9.54	6.64±7.98	2.333	0.080	NS
	45° KNEEFLEXION	8.60±2.15	4.8±3.32	1.234	0.1405	NS
	70° KNEEFLEXION	10.06±9.03	7.76±4.99	1.058	0.3495	NS
SEBT (cm)	ANTERIOR EXCURSION	13.8±2.68	15.5±3.27	4.543	0.0105	S
	MEDIAL EXCURSION	17.1±2.30	16.4±2.88	0.391	0.7151	NS
	POSTERIOREXCURSION	13.8±3.88	14.2±2.16	0.375	0.7264	NS
	LATERAL EXCURSION	14.6±4.33	16.6±3.84	1.135	0.3194	NS
KOOS (%)	PAIN	67.8±13.67	91.27±12.57	*-2.023	0.043	S
	SYMPTOMS	84.03±9.73	96.85±2.69	*-1.826	0.068	NS
	ADL	82.48±6.63	95.15±4.75	*-2.023	0.043	S
	QOL	60.9±5.70	84.3±5.62	*-2.023	0.043	S

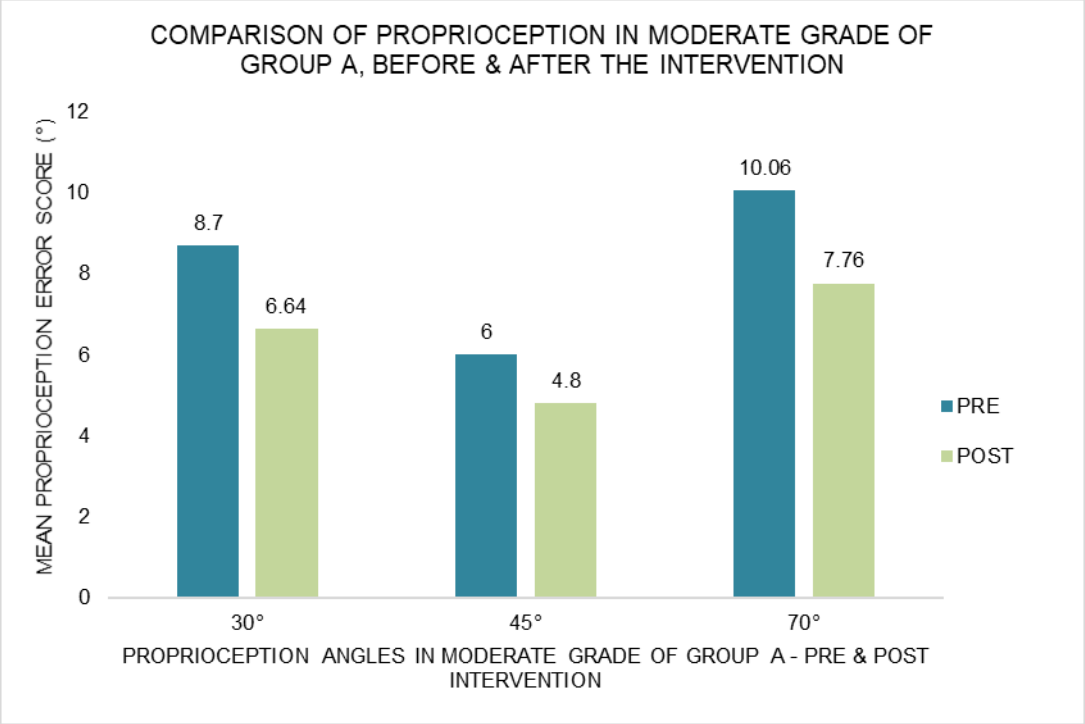
** indicates z- value for non parametric data. S = significant and NS = notsignificant*

A.) Pain using VAS is compared in the in **moderate grade of group A, before**



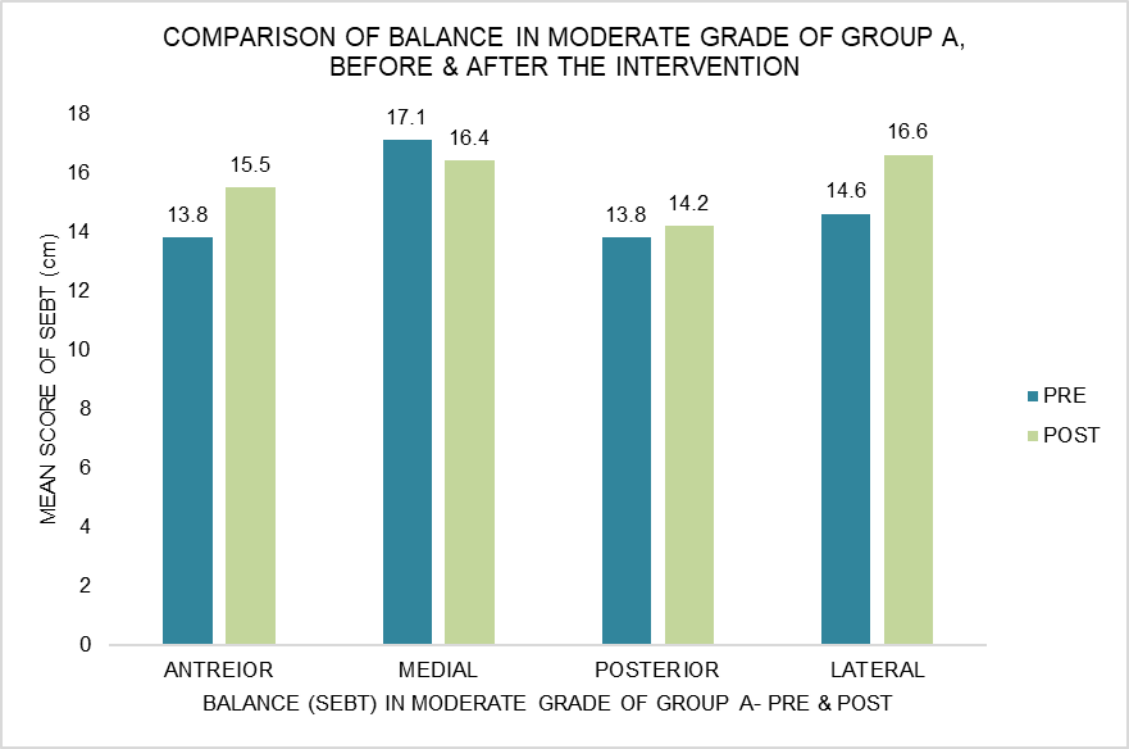
The above graph shows pain (VAS) in moderate grade of group A, before and after the intervention of 4 weeks. Results show significant reduction in pain in group A after 4 weeks of intervention with p value < 0.05.

B.) Proprioception (using error score) is assessed using isokinetic **dynamometer before and after the intervention of 4 weeks in group A**.



The graph show comparison of proprioception (error score) at 3 angles (30°, 45° and 70°) in group A before and after 4 weeks of intervention which show no significant difference at all the angles, p value being > 0.05.

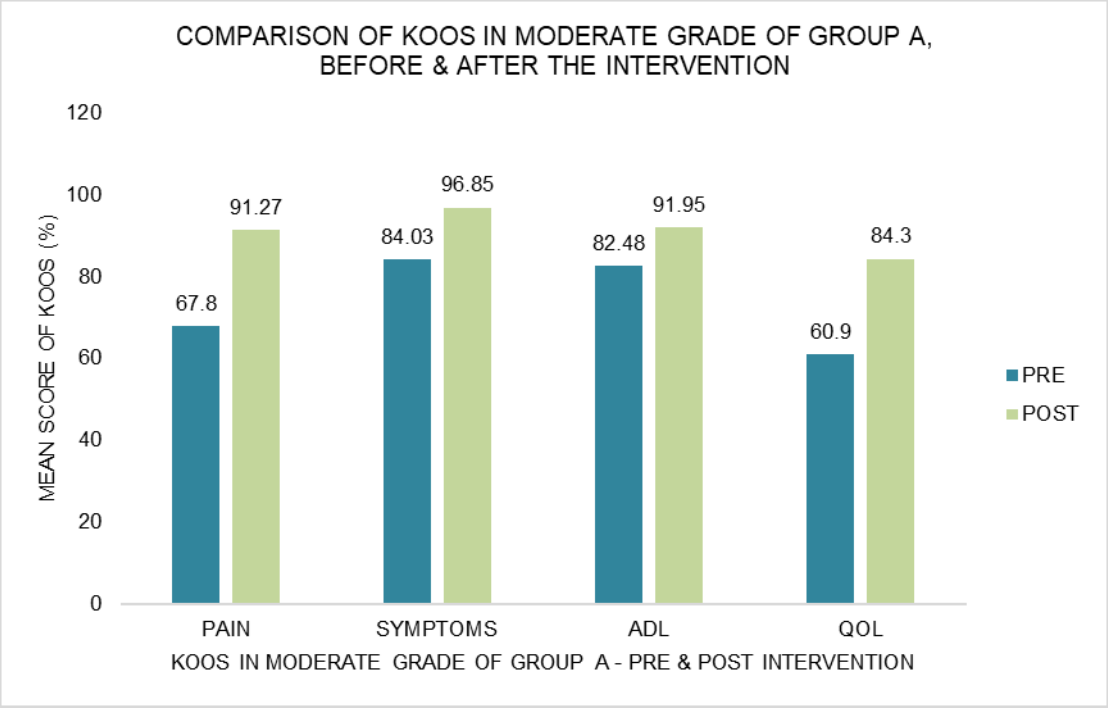
C.) Balance IS assessed by Star Excursion Test **before and after the intervention of 4 weeks in group A of moderate grade**. 4 directions anterior, posterior, medial and lateral excursions were measured using measuring tape.



The above graph presents comparison of balance using SEBT in moderate gradeof group A, before and after the intervention of 4 weeks. This shows that balance is improved significantly in anterior direction with p value of 0.0105. Medial,lateral and posterior directions did not show improvement after the exercises.

D.) Functional activity is assessed by Knee injury and Osteoarthritis Outcome Score (KOOS) **before and after the intervention in group A of moderate grade**. The dimensions are Pain, Other Disease-Specific Symptoms, ADL Function and knee-related Quality of Life. Being non- parametric data, non parametric tests, Wilcoxon Matched pairs signed ranks test is used to analyze the

data.



Above graph show comparison of functional assessment using KOOS in moderate grade of group A pre and post intervention. The dimensions of pain, ADL and QOL were improved significantly after strengthening exercises with p value being < 0.05. Symptoms in group a of moderate grade show no significant difference within the group A.

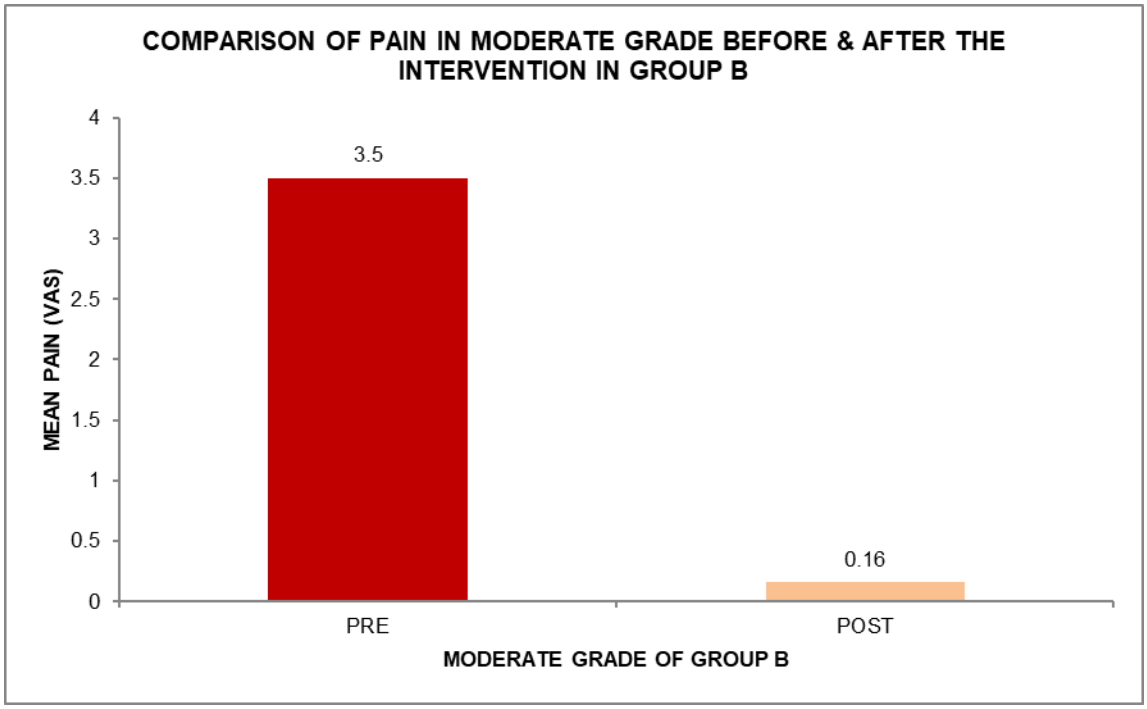
Fig 3: compares the outcome measures of pain, proprioception, balance and functional activity in group A of moderate grade, before and after the intervention of 4 weeks using paired t test. Pain and KOOS, being nonparametric data, the non parametric test (Wilcoxon Matched pairs signed ranks test) is used.

Table 4: Comparison Of Outcome Measures (Pain, Proprioception, Function & Balance) In Moderate Grade In Group B Before & After The Intervention

PARAMETERS		PRE MEAN±SD	POST MEAN±SD	t / z VALUE	p-VALUE p<0.05	SIGNIFICANCE
PAIN (VAS)		3.61±0.51	0.16±0.408	*-2.251	0.024	S
PROPRIOCEPTION(ERROR SCORE)	30° KNEEFLEXION	2.18±1.893	1.68±1.310	1.150	0.193	NS
	45° KNEEFLEXION	5.51±3.585	4.03±3.601	3.914	0.011	NS
	70° KNEEFLEXION	12.48±9.418	8.98±8.053	3.238	0.023	NS
SEBT (cm)	ANTERIOR EXCURSION	18.2±1.6	19.5±1.97	3.500	0.024	S
	MEDIAL EXCURSION	16.8±4.07	18.5±3.728	4.810	0.008	NS
	POSTERIOR EXCURSION	16.66±2.42	18.5±1.685	5.250	0.006	NS
	LATERAL EXCURSION	11.83±3.43	11.91±2.33	2.390	0.0751	NS
KOOS (%	PAIN	72.25±14.06	95.4±5.98	*-2.207	0.027	S
	SYMPTOMS	83.45±9.656	95.85±2.65	*-2.023	0.043	NS
	ADL	83.54±10.0	96.18±4.72	*-2.207	0.027	S
	QOL	57.54±6.365	76.64±7.35	*-2.207	0.027	S

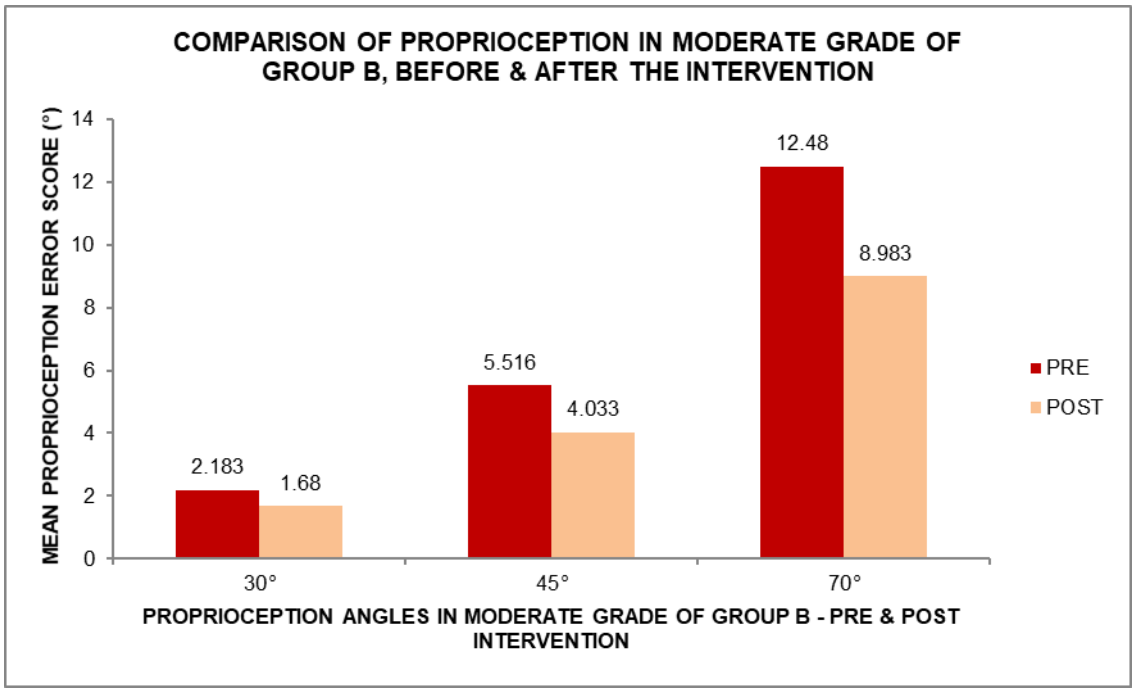
** indicates z- value for non parametric data. S = significant and NS = notsignificant*

A.) Pain using VAS is compared in the in **group B, before and after theintervention of 4 weeks**.



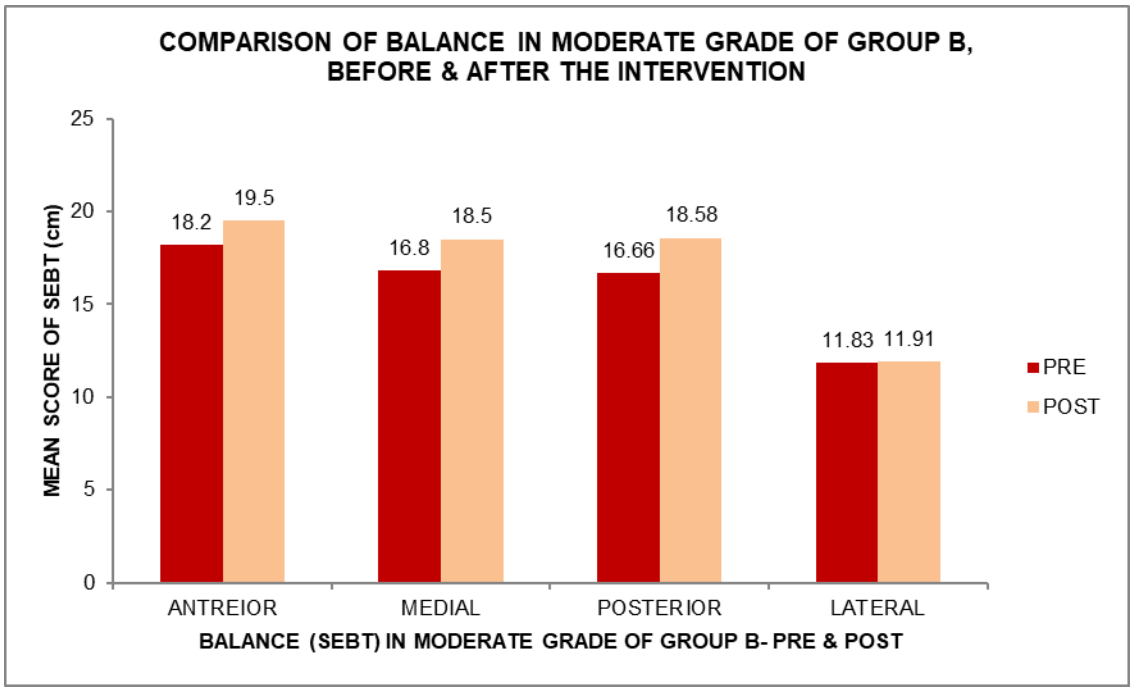
The above graph shows pain (VAS) in moderate grade of group B, before and after the intervention of 4 weeks. Results show significant reduction in pain in group B after 4 weeks of intervention with p value < 0.05.

B.) Proprioception (using error score) is assessed using isokinetic dynamometer **before and after the intervention of 4 weeks in group B of moderate grade**.



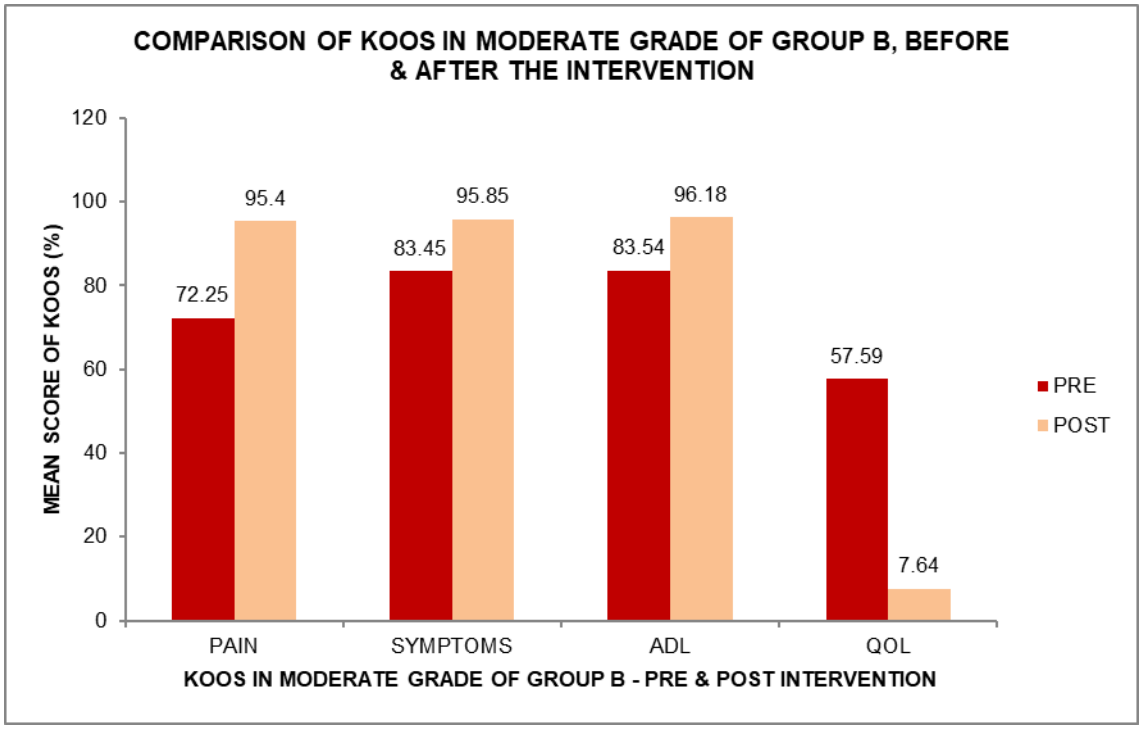
The above graph show comparison of proprioception (error score) at 3 angles (30°, 45° and 70°) in moderate grade of group B, before and after 4 weeks of intervention which show significant difference at the end of 4 weeks at 45° and 70°, p value being < 0.05. At 30° of knee flexion, there is no significant difference pre and post intervention, p value > 0.05

C)**Balance** is assessed by Star Excursion Test **before and after the intervention of 4 weeks in group B of moderate grade**. 4 directions anterior, posterior, medial and lateral excursions were measured using measuring tape.



The above graph presents comparison of balance using SEBT in moderate gradeof group B, before and after the intervention of 4 weeks. This shows that balance is proved significantly in anterior and posterior (sagittal) direction as well as medial lion after the intervention. No improvement seen in lateral direction.

D.) Functional activity is assessed by Knee injury and Osteoarthritis Outcome Score (KOOS) **before and after the intervention**



in group B of moderate grade. The dimensions are Pain, Other Disease-Specific Symptoms, ADL Function and knee-related Quality of Life. Being non- parametric data, non parametric tests, Wilcoxon Matched pairs signed ranks test is used to analyze the data.

Fig 4: Compares the outcome measures of pain, proprioception, balance and functional activity in moderate grade of group B, before and after the intervention of 4 weeks using paired t test. Pain and KOOS, being nonparametric data, the non parametric test (Wilcoxon Matched pairs signed ranks test) is used.

The above graph shows comparison of functional assessment done by KOOS in individuals with moderate grade of group B, pre and post intervention. The dimensions of pain, symptoms. ADL and QOL were improved significantly after strengthening exercises along with the neoprene knee sleeve with patella relief and hinges with p value being < 0.05.

In moderate grade, the score of the 1st day was compared between groups A & B which show no significant difference in any of the dimensioned except Knee related QOL was statistically significantly better in group A as compared to group B before the intervention. The questions ask in this part of KOOS was about lifestyle modification to avoid potential damage to the knee, about lack of confidence in your knee and difficulty faced with your knee and how often the individual is aware of their knee problems. As we discussed before, 55% individuals could not modify which indirectly hampered their level of confidence and the difficulty face were increased while walking. When score on the last day was compared between group A & B, pain, symptoms, ADL & QOL have improved symmetrically in both the groups after theintervention showing no significant difference statistically. In group B, there was significant improvement in all the dimensions of KOOS after the exercises. This reveals that exercises and use of neoprene knee sleeve with patella relief and plastic hinges have helped the individuals in group B. When compared within the group A for pairing (pain, ADL & QOL show improvement with statistically significant difference. Symptoms improved. Clinically but not statistically (pre: 84.03±9.7 and post: 96.85±2.6) as many of them had knee stiffness after awakening in the morning and they could feel the grinding, hear clicking noise with knee movements.

CONCULSION

The primary aim of the study was to evaluate the effect of neoprene knee sleeve with patella relief as an adjunct to exercises in chronic knee OA. 40 individuals with chronic knee OA were assigned in the study, mainly in 2 groups the control group (A) who were given strengthening exercises were given strengthening exercises for hip abductors, knee flexors and extensors and ankle plantar flexors. The experimental group (B) who were using neoprene kneesleeve with patella relief for minimum of 2 weeks prior to the entry in the study, wear it during the activities of daily living and were also given the same strengthening exercises as in control group. Neoprene knee sleeve with patella relief has helped to reduce pain in individuals with chronic knee OA as well as in the subgroups of moderate grade of knee OA.

Neoprene knee sleeve with patella relief has also helped to improve the function assessed by KOOS in overall grade and also in moderate grade chronic knee OA but not helped the symptoms, ADL as the sample size was too small to document the definitive inference. Neoprene knee sleeve with patella relief could not add any extra effect to improve balance in individuals with chronic knee OA. Strengthening exercises given in both the group has improved balance but no additional effect of neoprene knee sleeve with patella relief is seen in group B. In the exercises group (A) only strengthening exercises were given. These exercises have helped to reduce pain, improve proprioception, balance andfunctional activity.

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