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EFFECTIVENESS OF COMBINED AND COMPARISION OF MANUAL THERAPY AND CLOSED CHAIN EXERCISES ON PAIN, STRENGTH, FUNCTION PERFORMANCE IN CHRONIC CHONDROMALACIA PATELLA -AN EXPERIMENTAL STUDY

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ABSTRACT

Background: Chondromalacia patella, characterized by softening and degeneration of the patellar cartilage, is a common cause of anterior knee pain in young and active individuals. Manual therapy and closed chain exercises are frequently used rehabilitation approaches, but their comparative effectiveness remains uncertain.
Objective: The present study aimed to evaluate combined and compare the effectiveness of manual therapy and closed chain exercises in improving pain, functional performance among individuals with chondromalacia patella.
Methods: An Experimental study was conducted with 40 participants diagnosed with chondromalacia patella. Participants were randomly assigned to two groups, Group A received manual therapy interventions including Medial Patellar Glide and Deep friction massage while Group B received closed chain strengthening exercises targeting quadriceps and hip stabilizers based on selection criteria. Both groups received treatment three times per week for six weeks. all subjects are approved with informed consent statement for participation .Outcome measures included the VAS ,strength ,KROM,KAKP scale with pre and post test values .
Results: Both interventions demonstrated significant improvements in post tests knee pain reduction and functional outcomes (p = 0.05). However, participants in the manual therapy and closed kinematic chain exercise group showed greater enhancement in pain, muscle strength ,functional performance with Kujala Anterior Knee pain Scale(KAKPS) showed greater improvement (p =0.05).
Conclusion: However both manual therapy and CKC are effective in managing symptoms of chondromalacia patella. whereas Manual therapy provides significant reduction in anterior knee pain , while closed kinematic

chain exercises provides increase in knee range of motion and Functional performance . A combined approach may offers significant rehabilitation outcomes subjects with chondromalacia patella .
Keywords: Chondromalacia patella, Manual therapy, CKC, Knee pain, VAS, ROM, KAKP score

INTRODUCTION:

Knee Knee pain is one of the most commonly reported musculoskeletal disorder with estimation that it will affect 30-40% of population by 65 years age [1]. Anterior knee pain is most prevalent disorder involving the knee with its prevalance being as high as 7% at any one time in active young adults Accounts for 25-40% of all knee problems seen in sports medicine centers [2,3,4,5,6]. This is second most commonly complaint for physical therapist most prevalently seen in sports [7]

The incidence in the general population is reported to be as high as 1 in 4 with this proportion increasing in the athletic population [8]. There are very limited studies conducted in India regarding Patello femoral pain. Patello femoral pain is a difficult condition to manage effectively. The success rate of most treatment regimes has been poor and in the long term the condition frequently recurs.

The study conducting involves two major components: a thorough understanding of the mechanics of the Patello femoral joint so that an adequate assessment of the patient's lower limb and specific training of certain muscles which contribute to Patellar alignment. These therapeutics techniques must be relatively pain free so that muscle control can be enhanced [9].

The condition Chondromalacia generally has an insidious onset, is characterized by a diffuse ache in the vicinity of the Patella [10,11]. It is softening and fissuring of the undersurface of the Patella has been visualized either directly during surgery or Arthroscopy [12]. Clinical Manifestation include a grating or grinding sensation during extension of the knee movement, which is often exacerbated by sporting activities, stair climbing and prolonged sitting with flexed knees (movie goers knee)[13].Anterior Knee pain is in front or inner side of the knee joint. The function of the Patella is to link the divergent Quadriceps muscle to a common tendon, so increasing the Quadriceps lever arm and thus its mechanical advantage [14]. For efficient functioning of this mechanism the Patella must be aligned so that it remains in the trochlear notch of the femur. Mal alignment of the Patella from altered mechanics will pre dispose an individual to the Patello femoral pain and possibly articular cartilage breakdown [15,16].

The individual with Patello femoral pain will experience increased pain when knee is flexed because the Patella femoral joint reaction force (PFJRF) increases with flexion of the knee from 0.5 times body weight during level walking to 3 to 4 times body weight when ascending or descending stairs and 7 to 8 times body weight during squatting [17]. Factors affecting patellar alignment. An increased Q angle which may be associated with the increased Femoral ante version, external tibial torsion and lateral displacement of the tibial tubercle increases the lateral pull of the Patella [18]. PFPS can be diagnosed clinically with special tests like Mc.connel and patellar glide test . Muscle Weakness include Rectus femoris,vastus medialis which if tights affects Patellar movement tilt laterally during knee flexion, vastus lateralis ,Iliotibial band musclular structures which if tights will pull the Patella laterally during knee flexion [19,20].Hamstrings which if tights will cause increased flexion of the knee thus increasing the the Patella femoral joint reaction force (PFJRF) in stance. It has been suggested that increased knee flexion will cause an increase in ankle dorsiflexion which cannot be adequately fulfilled by the Talocrural joint, so that the SubTalar joint assists, resulting in compensatory pronation [21].

Hence this Experimental study have been done on Effectiveness of combined and comparing Manual Therapy and Closed chain exercises on pain, strength, functional performance in Chondromalacia Patella have proved that Manual Therapy include Medial Glide of Patella, Deep Friction Massage have been proved significantly more effective than Closed chain Exercises in alleviating Anterior knee pain and functional performance ,where as combined approach of Manual therapy and Closed chain exercises helps in improving strength in lower extremity, functional performance significantly.

METHODOLOGY

Study Design

This study adopted an experimental research design to evaluate the comparative effects of two physiotherapy intervention techniques—Manual Therapy and Closed Kinematic Chain (CKC) Exercises—combined with therapeutic ultrasound in individuals with chondromalacia patella presenting with anterior knee pain. Manual Therapy interventions included medial patellar glide mobilization and deep friction massage, while the CKC exercise protocol consisted of squatting and step-up and step-down activities. Both treatment approaches aimed to reduce pain intensity, enhance knee range of motion (ROM), and improve flexion activities. The dependent variables of the study were pain intensity and knee range of motion, while the independent variable was the type of intervention administered.

Inclusion Criteria

- Individuals aged between 20 to 60 years .
- Both male and female participants
- Clinically diagnosed cases of chondromalacia patella with anterior knee pain
- Pain present for at least four weeks of VAS 4 to 8.
- Pain with ascending and descending stair.
- Pain with sitting and standing for prolonged period.
- Pain perceived with prolonged sitting (movie goers sign)
- Willingness to participate and provide informed consent

Exclusion Criteria

- History of knee surgery, trauma, dislocations, burns ,infections
- Ligamentous injury or meniscal tear
- Neurological or systemic musculoskeletal disorders
- Recent corticosteroid or intra-articular injections
- Skin conditions preventing application of ultrasound or manual therapy

Participants

A total of 40 participants diagnosed with chondromalacia patella were recruited based on the inclusion and exclusion criteria. Participants were randomly assigned into two equal groups using a simple random sampling method. The total duration of the study was six weeks for each participant, including pre-assessment, intervention, and post-assessment phases.

Intervention /Procedure

Participants were divided into two groups:

Group A: Received Manual Therapy interventions including medial patellar glide and deep friction massage
Group B: Performed Closed Kinematic Chain exercises consisting of squats and step-up and step-down exercises

Both groups received treatment sessions three times per week for six weeks. Each session lasted approximately 30–40 minutes. All interventions were administered by qualified physiotherapists following standardized protocols.

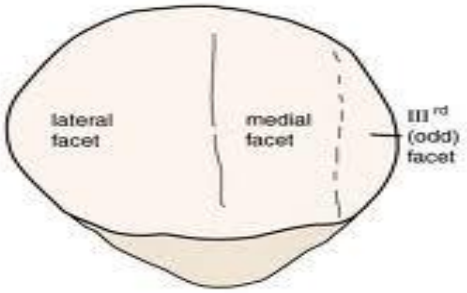


DIAGRAM 1 : INTERNAL STRUCTURE OF PATELLA

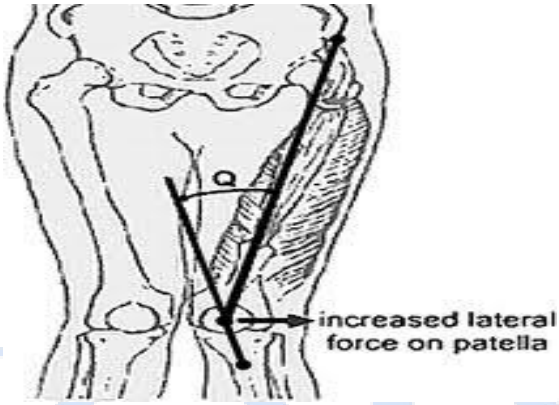


DIAGRAM 2 : INCREASED MUSCLE FORCE ON LATERAL MUSCULATURE OF KNEE

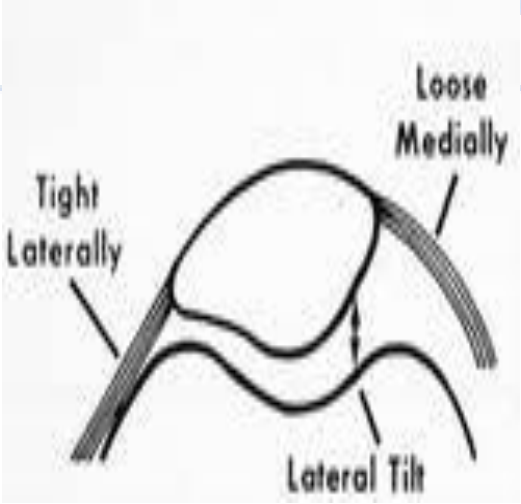


DIAGRAM 3 : LATERAL TILT OF PATELLA

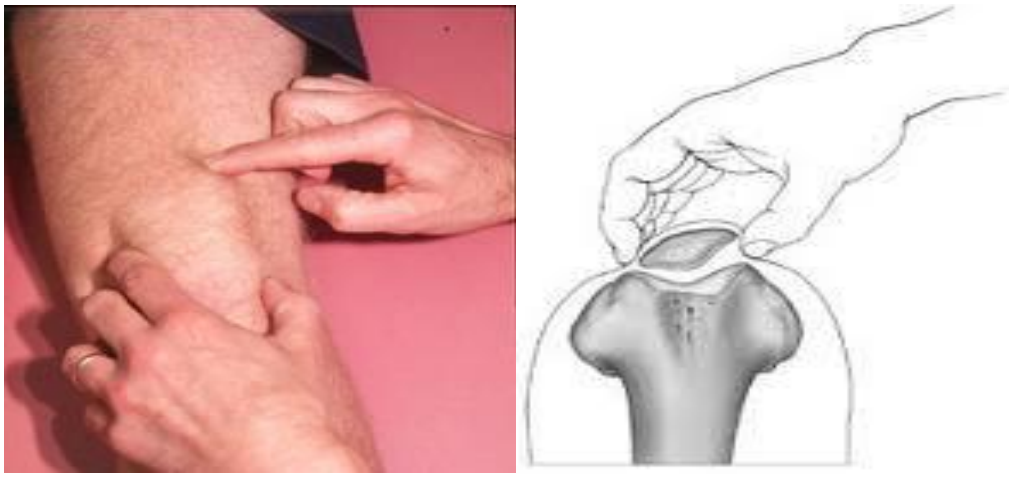


DIAGRAM 4 : PERFORMING PATELLA GLIDE TEST

DIAGRAM 5 : PERFORMING MEDIAL GLIDE IN MANUAL THERAPY

Ethical Considerations

The study was approved by the Ethical research committee of the Department of Physiotherapy ,School of Allied Health Sciences ,Malla Reddy University.

Outcome Measures

Pre- and post-intervention assessments were conducted using the following outcome measures:

Primary Outcome Measure:
• Visual Analogue Scale (VAS) – to assess pain intensity
• Goniometric Measurement – to evaluate knee joint range of motion (ROM)
Secondary Outcome Measure:
• Kujala Anterior Knee Pain Scale (KAKPS) – to assess functional improvement and symptom relief

Statistical Analysis

Data were collected before and after the intervention period. Statistical analysis was performed using SPSS software. Descriptive statistics were used to summarize demographic data. Paired t-tests were applied for within-group comparisons, and independent t-tests were used to compare between-group differences. The level of significance was set at $p <= 0.05$.

RESULTS

Data Analysis has been done with SPSS Software Version

TABLE 1.1: Descriptive Statistical Analysis T-Test for Age category – Group 1 and Group 2

Age	N	Mean	Std. Deviation	Std. Error Mean	t-test for Equality of Means		
					t	df	p-Value
Group-I	20	47.20	8.971	2.006	.038	38	.970
Group-II	20	47.30	7.554	1.689			

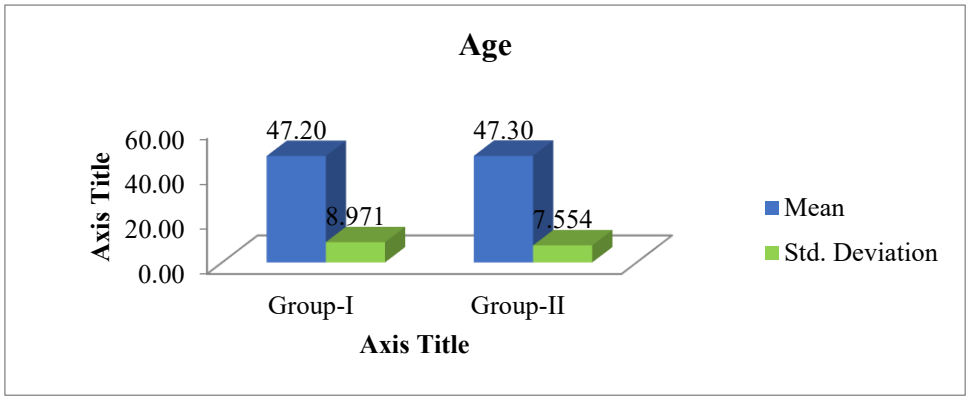


FIGURE 1.1 – Age category

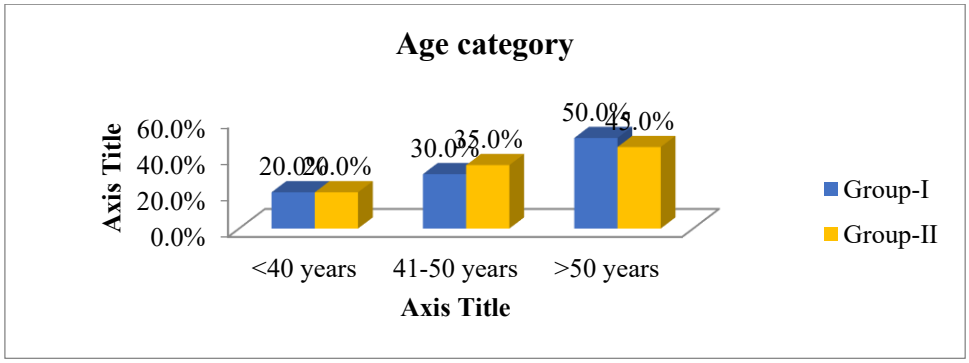
Table 1.2 - Group * Age category

Group	Age category			Total
	<40 years	41-50 years	>50 years	
Group-I	4	6	10	20
	20.0%	30.0%	50.0%	100.0%
Group-II	4	7	9	20
	20.0%	35.0%	45.0%	100.0%
Total	8	13	19	40
	20.0%	32.5%	47.5%	100.0%

Table 1.3 – Pearson Chi - Square Test for Group 1 and Group 2 Age Category

Chi-Square Tests

	Value	df	p-value
Pearson Chi-Square	.130	2	.937



Graph -1.2 Age category of group 1 and group 2

Table – 2.1: Descriptive Analysis of Group 1 and Group 2 Gender Difference

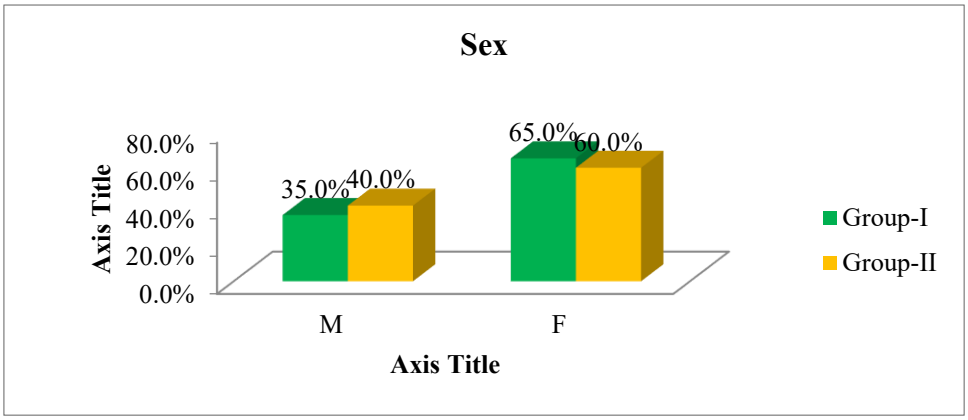
Group * Sex

Group	Sex		Total
	M	F	
Group-I	7	13	20
	35.0%	65.0%	100.0%
Group-II	8	12	20

	40.0%	60.0%	100.0%
Total	15	25	40
	37.5%	62.5%	100.0%

Table -2.2 : Pearson Chi – Square tests
Chi-Square Tests

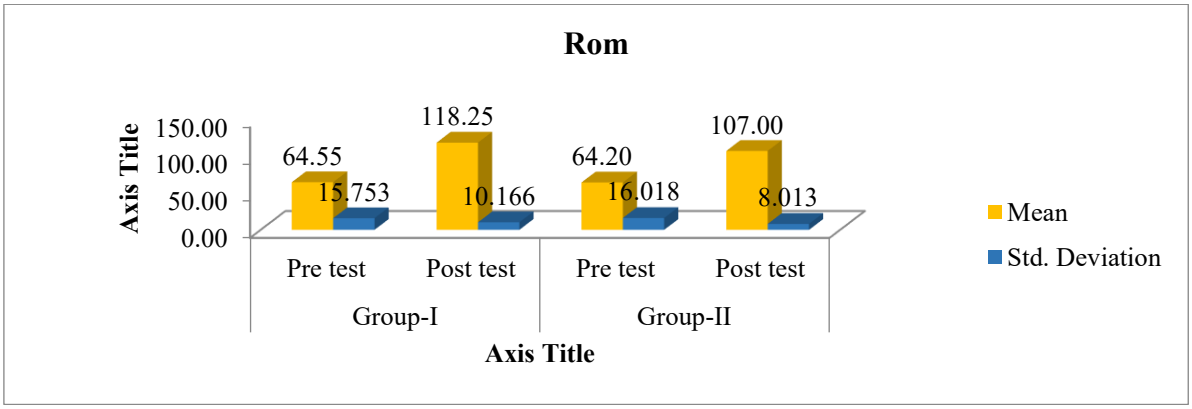
	Value	df	P-value
Pearson Chi-Square	.107	1	.744



Graph 2 – Gender Difference

Table 3- The Descriptive Analysis of baseline data pre and post ROM Values of Group 1 (64.55 &118.25) and Group 2 (64.20 &8.013) .paired t test scores of Group 1 (20.935) and (16.583) with Group 1 P = 0.000 & P = 0.000
T-Test

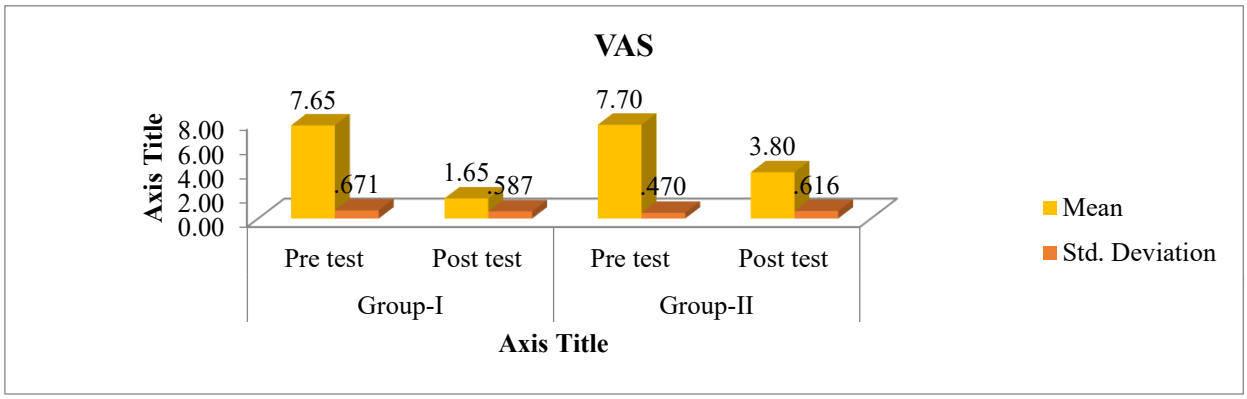
Group	Rom	Mean	N	Std. Deviation	Std. Error Mean	Mean Differences	Paired-t	df	P-value
Group-I	Pre test	64.55	20	15.753	3.522	53.700	20.935	19	.000
	Post test	118.25	20	10.166	2.273				
Group-II	Pre test	64.20	20	16.018	3.582	42.800	16.583	19	.000
	Post test	107.00	20	8.013	1.792				



Graph 3- ROM Difference between pre and post Tests of Group 1 and Group 2

Table 4 : Descriptive Statistical Analysis of paired T-Test in Pre and Post test of Group 1 and Group 2 VAS score of Group 1 (58.481)and Group 2 (31.568) and Group 1 P = 0.000 and P =0.000

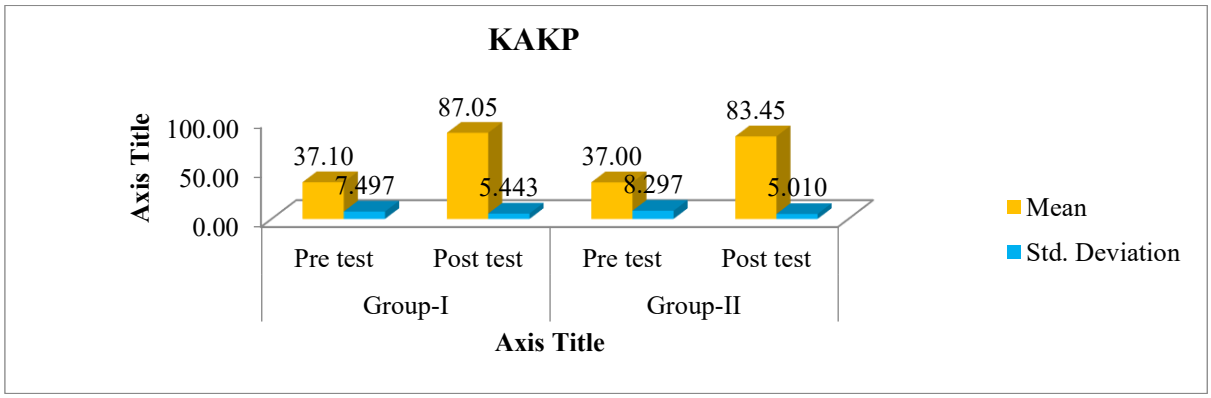
Group	VAS	Mean	N	Std. Deviation	Std. Error Mean	Mean Differences	Paired-t	df	P-value
Group-I	Pre test	7.65	20	.671	.150	6.000	58.481	19	.000
	Post test	1.65	20	.587	.131				
Group-II	Pre test	7.70	20	.470	.105	3.900	31.568	19	.000
	Post test	3.80	20	.616	.138				



Graph 4 : VAS difference between Pre and Post scores

Table 5 – Descriptive Statistical Analysis of Paired t tests values KAKP scores Group 1 and Group 2 (41.408& 29.425) and group 1 P =0.000 & P=0.000 Paired T-Test

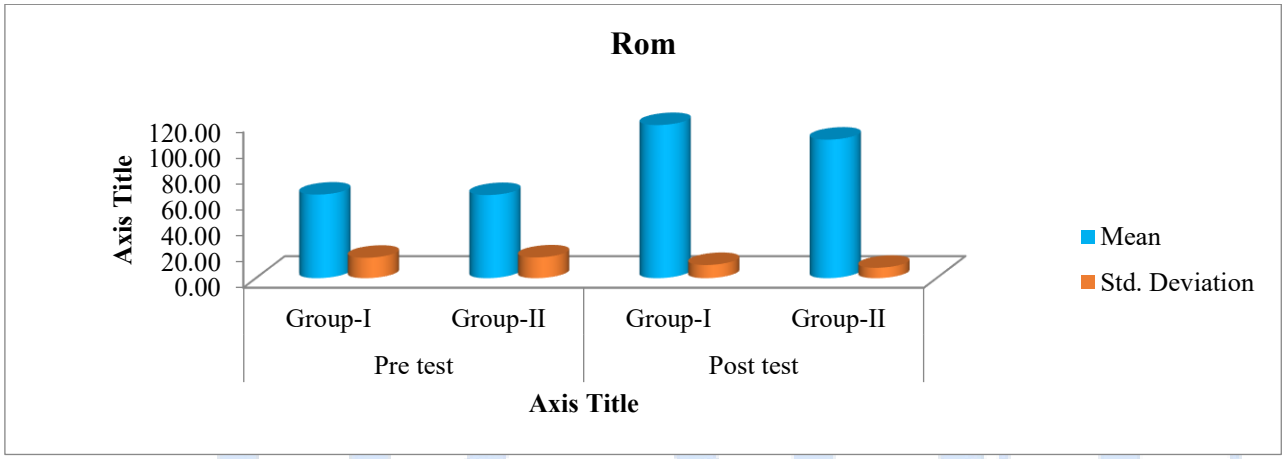
Group	KAKP	Mean	N	Std. Deviation	Std. Error Mean	Mean Differences	Paired-t	df	P-value
Group-I	Pre test	37.10	20	7.497	1.676	49.950	41.408	19	.000
	Post test	87.05	20	5.443	1.217				
Group-II	Pre test	37.00	20	8.297	1.855	46.450	29.425	19	.000
	Post test	83.45	20	5.010	1.120				



Graph 5 – KAKP scores pre and post test values

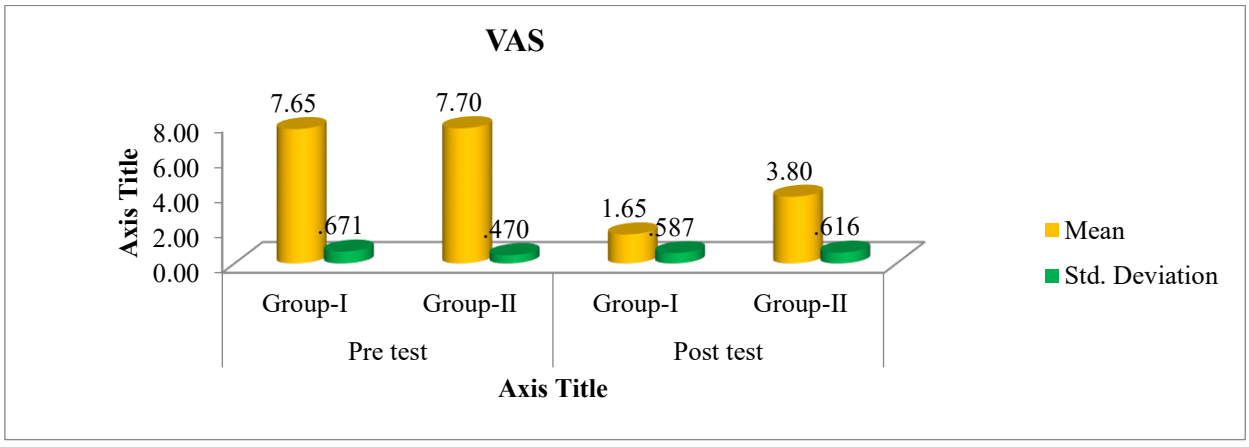
Table 6 : ROM values of pre and post test with Paired T tests
Pre and Post t tests scores of 0.070 and 3.887 , pre test P = 0.945 ,post test P= 0.000

Rom	Group	N	Mean	Std. Deviation	Std. Error Mean	t-test for Equality of Means		
						t	df	P-value
Pre test	Group-I	20	64.55	15.753	3.522	.070	38	.945
	Group-II	20	64.20	16.018	3.582			
Post test	Group-I	20	118.25	10.166	2.273	3.887	38	.000
	Group-II	20	107.00	8.013	1.792			



Graph 6 – ROM values illustrating between two groups
Table 7 – VAS Scores in Pre and Posttests difference and P values with paired t –tests
Pretest P =0.786 , post test P =0.000
T-Test

VAS	Group	N	Mean	Std. Deviation	Std. Error Mean	t-test for Equality of Means		
						t	df	P-value
Pre test	Group-I	20	7.65	.671	.150	.273	38	.786
	Group-II	20	7.70	.470	.105			
Post test	Group-I	20	1.65	.587	.131	11.303	38	.000
	Group-II	20	3.80	.616	.138			

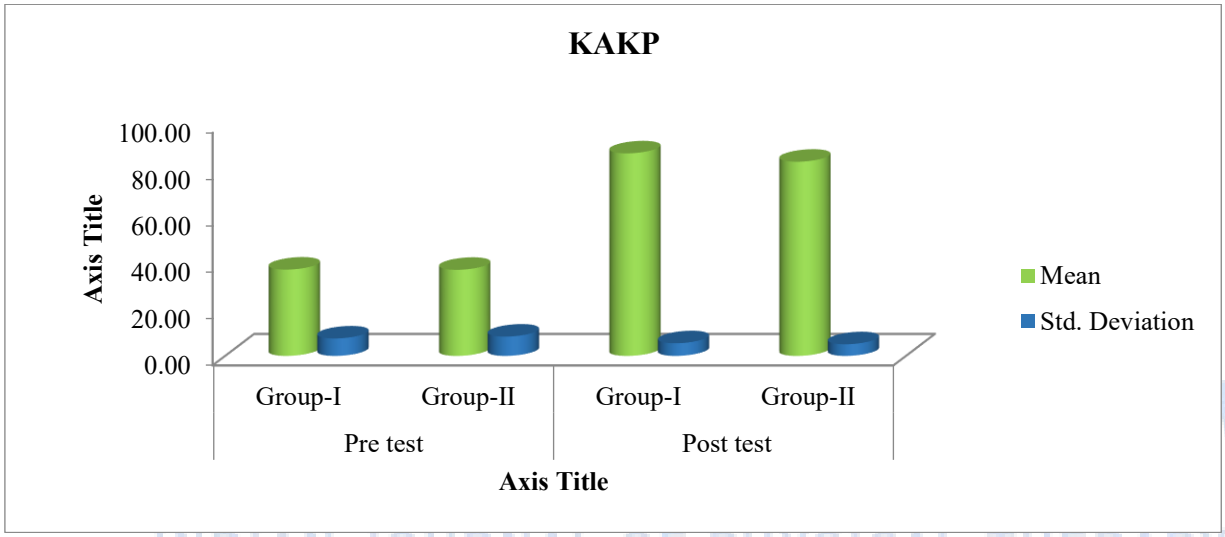


Graph 7 – VAS Scores illustrating between two groups
Table 8 – KAKP scores of pre and posttest values with Paired t tests
Pre and Post test t score (0.040) and Group 1 and 2 t score (0.036) ,

pretest P =0.968,post test P=0.036

T-Test

KAKP	Group	N	Mean	Std. Deviation	Std. Error Mean	t-test for Equality of Means		
						t	df	P-value
Pre test	Group-I	20	37.10	7.497	1.676	.040	38	.968
	Group-II	20	37.00	8.297	1.855			
Post test	Group-I	20	87.05	5.443	1.217	2.176	38	.036
	Group-II	20	83.45	5.010	1.120			



Graph -8 pre and post test values of KAKP values

DISCUSSION

The present study aimed to combine and compare the effectiveness of Manual Therapy (Group I) and Closed Kinematic Chain (CKC) exercises (Group II) in improving pain, range of motion (ROM), and functional performance (Kujala Anterior Knee Pain Scale – KAKP) in subjects with Chondromalacia Patella (CMP). Demographic analysis revealed comparable mean ages between groups (Group I = 47.20 ± 8.97 years; Group II = 47.30 ± 7.55 years; p = 0.970). Sex and age category distributions were statistically non-significant, confirming group homogeneity. Within-group analysis showed significant improvements in both groups. In Group I, ROM increased from 64.55° ± 15.75 to 118.25° ± 10.16 ($p < 0.001$), while in Group II it improved from 64.20° ± 16.01 to 107.00° ± 8.01 ($p < 0.001$). Between-group comparison revealed greater ROM gains in Group I ($p < 0.001$). Pain (VAS) scores decreased more in Group I (7.65 ± 0.67 to 1.65 ± 0.58) compared to Group II (7.70 ± 0.47 to 3.80 ± 0.61). Functional outcomes (KAKP) also improved significantly in both groups, with greater improvement in Group I ($p = 0.036$).

The findings align with previous studies emphasizing the effectiveness of manual therapy for patellofemoral pain. Crossley et al. (2008) and Piva et al. (2015) observed significant pain reduction and improved patellar mechanics following manual therapy. Petersen et al. (2014) highlighted the benefit of CKC exercises for long-term strengthening, though with slower pain relief. Sutlive et al. (2004) also reported that combined manual therapy approaches yield faster functional recovery. The current findings support these conclusions, attributing greater improvement to immediate biomechanical and neurophysiological effects of manual therapy.

Limitations of the Study

1. Small sample size (n = 40) limits generalizability.
2. Short-term follow-up prevents assessment of long-term outcomes.
3. Manual therapy outcomes may vary with therapist skill.
4. Absence of objective strength measurement tools (e.g., dynamometry) limits precision.

Clinical Implications:

Manual therapy techniques, including medial glide mobilization and deep friction massage, significantly reduce knee pain, improve ROM and function in chondromalacia patella. CKC exercises are valuable for long-term strength, but combining both manual therapy and closed chain exercises interventions may optimize rehabilitation. Early manual therapy may enhance patient compliance through quick symptom relief. Future research should include larger sample sizes, longer follow-ups for comprehensive CMP management.

CONCLUSION

Hence, these findings conclude that both manual therapy and CKC exercises are effective in improving knee pain, improving ROM, and functional performance in chondromalacia patella. However, manual therapy demonstrated superior results, supporting the hypothesis with statistical significant results as more effective than CKC exercises in reducing pain and improving knee function. However ,closed chain Exercises has been given statistical significant values in improving knee strength compared to Manual Therapy .The results supporting study to emphasize that combined management of manual therapy, CKC will improve anterior knee pain, knee strength, functional outcomes in chronic chondromalacia subjects .

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Conflict Of Interest : The authors declare no conflict of interest

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