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Effectiveness of Closed and Open Kinematic Chain Exercises in Improving Muscle Strength, Range of Motion and Balance in Subjects with Meniscal Injuries

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Design: Experimental study design

Study setting: Sri Venkateswara Ram Narayan RUIA Government General Hospital, Physiotherapy outpatient department.

Number of subjects
Thirty subjects between the age group of 17-25 years were taken.

Total number of subjects n=30 were divided based on simple random sampling and divided into two groups consisting of 15 subjects each and named as control group and experimental group 15 subjects were treated with open kinematic chain exercises and 15 subjects were treated with closed kinematic chain exercises.

1. Selection Criteria

A) Inclusion criteria
- Subjects between age of 17-25 years.
- Patients of both male and female sex.
- Patients with meniscal injury of Grade-I and Grade-II with the duration of sub- acute stage.
- Patients who were conformed with Grade-I and Grade-II meniscle injuries by "MC-MURRY'S" test.
- Patients who are willing to participate in the study.

B) Exclusion criteria
- Patients who are less than 17 years and more than 25 years of age.
- Patients with Grade-III meniscal injuries.
- Patients with acute stage of meniscal injuries.
- Patients who are contraindicated with exercise protocol.
- Patients with chronic instability of the joint.
- Patients with neurological disorders.
- Patients who are unaware of the joint position sense.
- Patients with malignancy.
- Patients with chronic infections of the joint.

Outcome Measures
- Universal Goniometer
- Spring balance test
- Standing stroke test

Duration of study
Two weeks

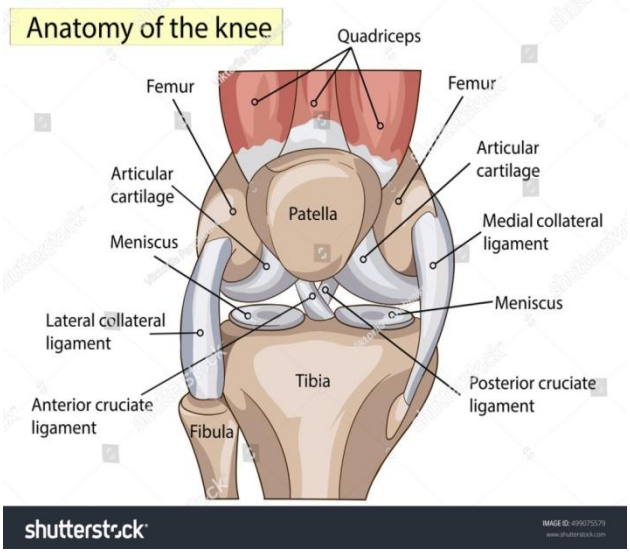
2. Results

Open kinematic chain exercises and closed kinematic chain exercises are effective in the improvement of strength, Range of motion and balance but closed kinematic chain exercises are more effective in improving strength and range of motion than open kinematic chain exercises in patients with meniscal injuries.

3. Conclusion

Both Open kinematic chain exercises and closed kinematic chain exercises are effective in the improvement of strength, Range of motion and balance but closed kinematic chain exercises are more effective in improving strength, range of motion and balance than open kinematic chain exercises.

General Introduction about Menisci



The articular disks of the knee joint are called menisci because they only partly divide the joint space (G.P.Mills).

There are medial and lateral meniscus consists of connective tissue with extensive collagen fibres containing cartilage like cells.

The menisci are flattered at the center of the knee joint, fused with the synovial membrane laterally and can move over the tibial surface.

Functions of MENISCI

The menisci serve to protect the joint ends from rubbing on each other and to effectively deepen the tibial socket into which the femur attaches. They act as a shock absorber (B.D.Chaurasia).

Meniscus tear and its Causes

The meniscus can be damage or torn during activitiesthat put pressure and rotate the knee joint. Taking the hard tackle on the football field or a sudden pivot on the basketball court can result in a meniscal tear.

Special Test for Meniscal Tear

- MC-MURRY'S TEST
- APLEY'S GRINDING TEST

Investigations

- Knee imaging, x-ray
- MRI
- Arthroscopy

Tips to Prevent Meniscal Tear

- Meniscal tear can be prevented by regular exercises that strengthen leg muscles which will stabilize the knee to protect it from injury.
- Knee can also be protected during sports or activities.
- Idea of warm-up and stretch before exercise use proper gear.

Characteristics of Open Kinematic Chain Exercises

- These exercises are primarily concentric.
- Motion occurs distal to joint axis.
- Greater distraction and rotator forces are required.
- Stabilization of joint occurs via outside means.
- These movements activate mechanoreceptors in moving joint.
- These are characteristics with non-weight bearing activities.

Characteristics of Closed Kinematic Exercises

- These movements are primary seen during eccentric contraction with dynamic stabilization via co-contraction.
- Motion occurs proximal to the joint axis.
- Greater compressive forces and less shearing.
- Enhanced proprioceptive feedback.

4. Aim of the Study

To compare the effectiveness of closed and open kinematic chain exercises in improving muscle strength, range of motion and balance in subjects with meniscal tear.

5. Review of Literature

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6. Materials and Methodology

Design

Comparative study of experimental design.

Study Setting

Sri Venkateswara Ram Narayan RUIA Government general hospital, Physiotherapy out -patient department.

Number of subjects

Out of 30 subjects, 15 subjects were treated with open kinematic chain exercises who are grouped under control group and 15 subjects were treated with closed kinematic chain exercises who are grouped under experimental group.

Methodology

30 patients with meniscal injuries were enrolled in this study with mean age of 17-25 years from orthopaedics department of SVRRGGH, Tirupati.

Control group methodology

- Control group exercise session consisted a duration of 30 min per session, 1 session per day and 5 session per week for total period of 2 weeks.
- 10 min of warm –up exercises were given prior to the actual session.
- Patients were monitored and instructed during the session.

Exercises

1) Hamstrings curls: Ask the patient to stand erect standing position with hand support. A weight lift of around 2.0-2.5kgs is tied at the ankle and patient is instructed to do knee flexion and extension.
2) Gravity assisted supine slide: Ask the patient to lie in supine lying,such that the legs are supported opposite the wall and ask the patient to perform slides and repeat for both lower limbs simultaneously.
3) Resisted step ups: Ask the patient to stand in erect standing position and affected knee must be placed on foot rest. A theraband is tied against the waist of the person. Ask the patients to drag the trunk against the theraband along with this step up on the foot rest such that resistance will be offered to step up.
4) Chair scoops: Ask the patient to sit in chair such that both feet are placed on the ground. In this position ask

the patient to drag the feet with calcaneal support with which supported knee flexion and knee extension curls.

Experimental group methodology

- Experimental group exercises session consisted a duration of 30 min per session. 1 session per day and 5 sessions per week for a period of 2 weeks.
- 10 min warm up is given in the form of walking prior to session.

Exercises

1) Unilateral closed chain extension
2) Resisted Mini Squats

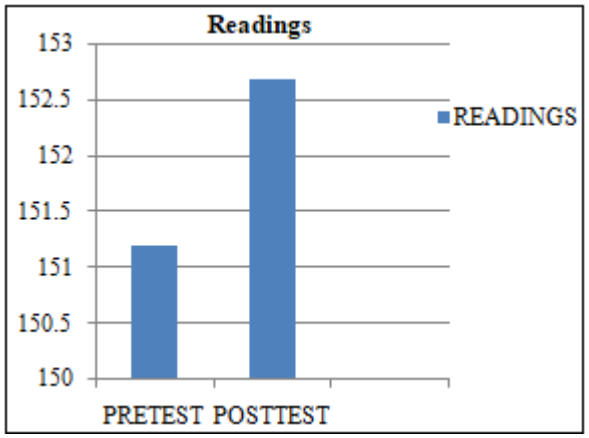
Data Analysis

N= Number of patients
M= Median
S.D= Standard deviation

Pre and Post Test Comparison of Knee Flexion Rom in Control Group

	N	M	S.D.	p value	t value
Pre test	15	151.20	93.45	6.20	0.01
post test	15	15.267	88.38		

Control group



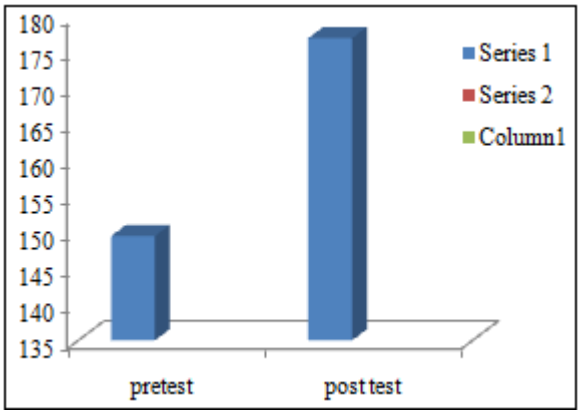
Graph 1

Experimental group

Pre and post comparison of knee flexion ROM in experimental group

	N	M	S.D.	t value	p value
Pre test	15	149.47	40.69	18.17	0.01

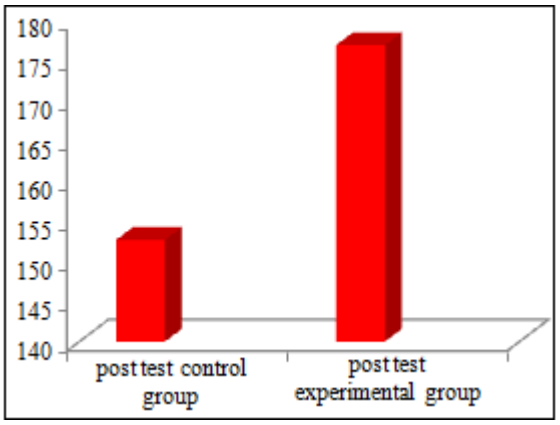
7. Experimental Group



Graph 2

Post comparison of knee flexion ROM between control and experimental groups

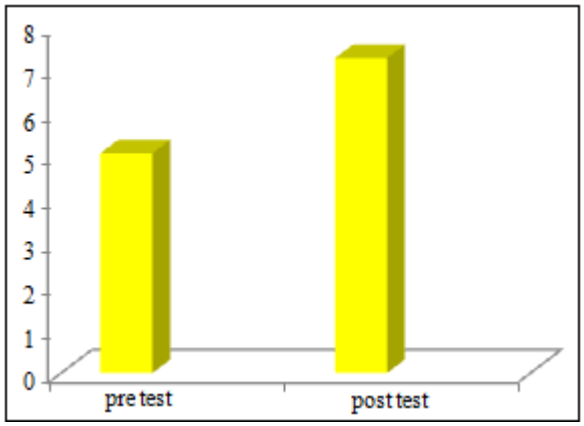
	N	M	S.D.	t value	p value
Post- test control group	15	152.67	88.38	16.14	0.01
Post –test experimental group	15	176.93	11.49	18.17	



Graph 3

Pre and post- test comparison of strength of hamstrings in control group

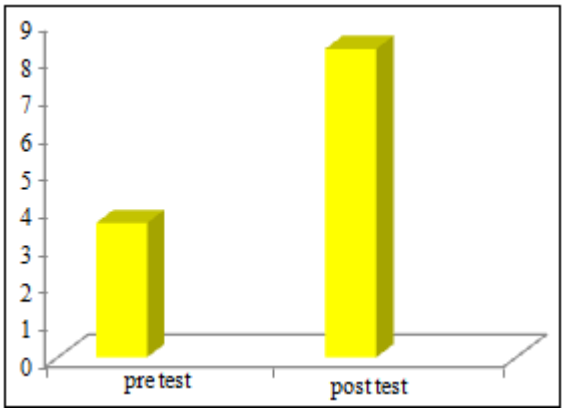
	N	M	S.D.	t value	p value
Pre test	15	5.066	1.279	12.850	0.01
Post test	15	7.6	1.55		



Graph 4

Pre and post -test comparison of hamstrings in experimental group

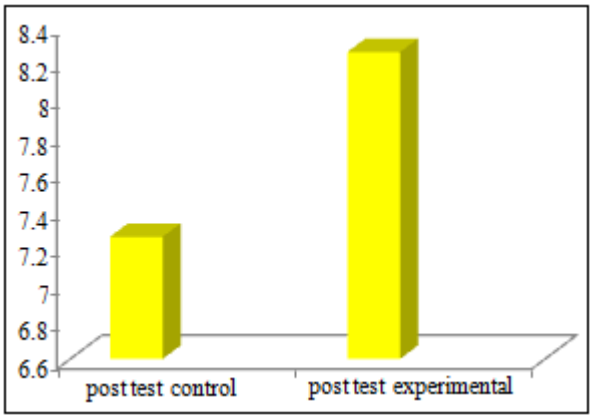
	N	M	S.D.	t value	p value
Pre test	15	3.60	0.91	9.49	0.01
Post test	15	8.26	1.48		



Graph 5

Post -test comparison of strength of Hamstrings between control and experimental groups

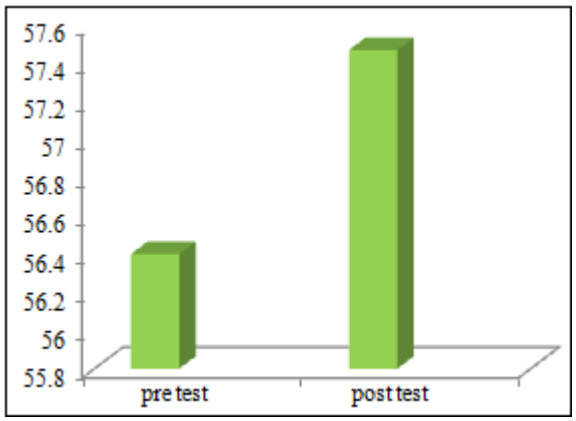
	N	M	S.D	t- value	p-value
Post -test control	15	7.26	1.55	12.850	0.01
Post- test experimental	15	8.26	1.48	9.49	



Graph 6

Pre and post- test comparison of balance of knee joint in control group

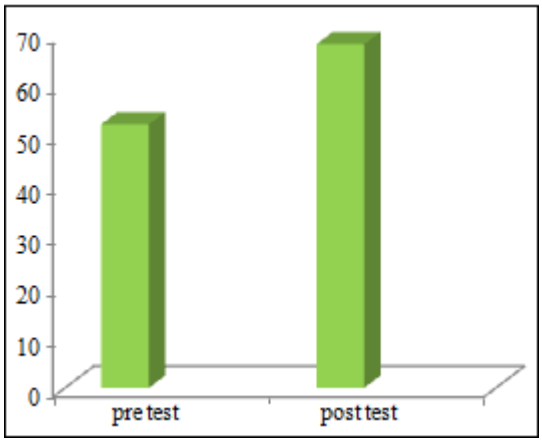
	N	M	S.D	t-value	p-value
Pre test	15	56.40	25.40	17.89	0.01
Post test	15	57.47	18.83		



Graph 7

Pre and post-test comparison of balance of knee joint in experimental group

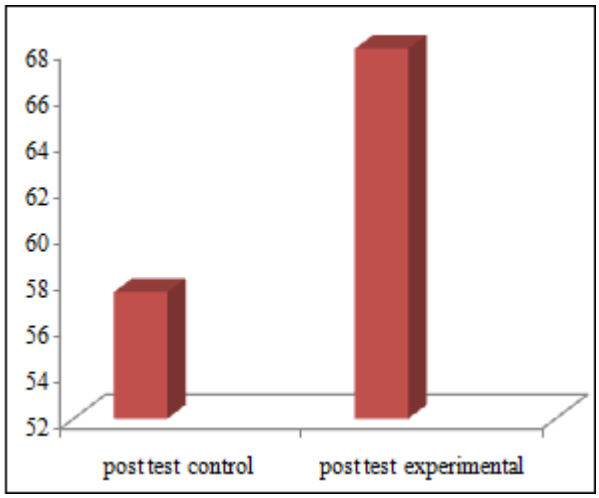
	N	M	S.D	t-value	p-value
Pre test	15	52.13	24.55	18.23	0.01
Post test	15	68.00	18.71		



Graph 8

Graph 9: Post –test comparison of balance of knee joint between control and experimental groups

	N	M	S.D	t-value	p-value
Post- test control	15	57.47	18.83	17.89	0.01
Post- test experimental	15	68.00	18.71	18.29	



Graph 9

8. Results

Closed kinematic chain exercises are effective in improving muscle strength, range of motion and balance over a course compared with group treated with open kinematic chain exercises in patients with meniscal injuries.

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