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Comparison of effects of Mckenzie exercises and conventional therapy in ACL reconstruction on knee range of motion and functional ability

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Abstract
Background and Objectives: The stabilization of the knee joint derives largely from the support of the ligaments, ligaments in the knee joint includes the anterior cruciate and the posterior cruciate ligaments (ACL, PCL). When the ACL is torn, it can no longer function as a stabilizer of the knee joint. Valgus laxity, and rotatory and anterior instability of the joint are created. In an arthroscopically assisted approach only the intra-articular portions of the procedure, such as meniscus debridement or repair, enlargement of the intracondylar notch of the femur, or drilling the femoral and tibial bone tunnels, are performed arthroscopically. McKenzie (1981) suggested that the method of assessment was equally applicable and effective for the assessment and treatment of mechanical musculoskeletal disorders of the human extremities. The mckenzie system has also been proven as an effective treatment method for extremity injurie. This study is to determined to study and compare the effects of mckenzie exercises and conventional after ACL reconstruction.
Study Design: comparative study.
Study Setting: hospitals in and around pune.
Outcome Measures: knee range of motion and lysholm knee scoring scale.
Method: 30 subjects undergone ACL reconstruction were selected on the basis of inclusion and exclusion criteria and randomly assigned in two groups. Group A and Group B after taking informed consent. Group A received mckenzie exercises and Group B received conventional therapy for 3 weeks.
Result: Conventional therapy and Mckenzie exercises are both effective in ACL reconstruction. Conventional therapy showed a significant difference in improving knee flexion than Mckenzie exercises. There was no significant difference in comparison of the effects of both the techniques on knee extension and functional ability.

Keywords: Mckenzie exercises, knee, conventional therapy

1. Introduction
The knee joint is formed by the articulation of the bones of the lower and the upper leg, the tibia and the femur respectively, with a triangular sesamoid bone situated anterior to the leg, called the patella. The patella is a continuation of the quadriceps femoris tendon and articulates with the femur, while it attaches to the tibia through the patella ligament. Its main role is to facilitate the mechanics of the quadriceps and to shield the mechanism from any external forces acting on the joint [1].
The structure of the articulating surfaces of the tibia and fibula provides stability to the knee joint, as the ends of the two long bones are expanded. Flexion and extension are the primary actions of the knee, allowed by the articulation of the two convex condyles of the femur and the two concave condyles of the tibia. However, the lateral condyle of the tibia is shallow, or it is slightly convex, creating a greater range of motion laterally and therefore some rotation during flexion of the joint [1].
The stabilization of the knee joint derives largely from the support of the ligaments. One set of the main ligaments contained in the joint are the medial and the lateral collateral ligaments (MCL, LCL), the first connecting the medial sides of the femur and the tibia and the latter connecting the lateral sides of the femur and the fibula. The MCL resists some rotational and any medially oriented forces, while the LCL resists any laterally oriented forces acting upon the joint. Both of these ligaments are taut in extension.

The other set of main ligaments in the knee joint includes the anterior cruciate and the posterior cruciate ligaments (ACL, PCL). The ACL attaches to the anterior part of the tibia between the two condyles, and medially of the posterior part of the lateral femoral condyle. It primarily resists excessive anterior movement of the tibia in relation to the femur. The ACL also resists internal rotation of the joint from 90º through to full extension, and external rotation of the knee.

When the ACL is torn, it can no longer function as a stabilizer of the knee joint. Valgus laxity, and rotatory and anterior instability of the joint are created. Side-stepping and pivoting are affected by the increased instability of the knee joint. If not treated, the stress put by malfunction of the ACL, can damage the secondary stabilizers of the knee, such as the capsule, the iliotibial band or the other knee ligaments. It can even damage the cartilage and cause arthritis in the long run.

In an arthroscopically assisted approach only the intra-articular portions of the procedure, such as meniscus debridement or repair, enlargement of the intracondylar notch of the femur, or drilling the femoral and tibial bone tunnels, are performed arthroscopically.

The most common ACL reconstruction procedure today is an arthroscopically assisted or endoscopic procedure using an autograft. If a bone–patellar tendon–bone graft is selected, it is harvested through a small, longitudinal incision over the patellar tendon from the patient's involved knee or occasionally from the contralateral knee. The central one-third portion of the tendon is dissected along with small bone plugs attached to the tendon. If a semitendinosus–gracilis tendon autograft (hamstring tendon graft) is selected, it is harvested through an incision centered over the tibial insertion of the semitendinosus and gracilis tendons.

McKenzie (1981) suggested that the method of assessment was equally applicable and effective for the assessment and treatment of mechanical musculoskeletal disorders of the human extremities. The mckenzie system has also been proven as an effective treatment method for extremity injuries [2-4].

Physiotherapy rehabilitation begins immediately after surgery is completed. Cryotherapy reduces pain and edema. Exercises such as heel slides/wall slides /assisted knee flexion,ankle pumps,isometrics quadriceps and hamstrings, straight leg raise, squatting improves knee range of motion and strength [5, 6].

2. AIM

The aim of this study is to compare the effect of mckenzie exercises and conventional therapy in ACL reconstruction.

3. Objective

a. To study the effect of mckenzie exercises in ACL reconstruction in knee range of motion and functional ability.
b. To study the effect of conventional therapy in ACL reconstruction in knee range of motion and functional ability.
c. To compare the effect of mckenzie exercise and conventional therapy in ACL reconstruction in knee range of motion and functional ability.

4. Hypothesis

a. Null hypothesis (H0)- mckenzie exercises and conventional therapy will show no significant effect in knee range of motion and functional ability.
b. Alternate hypothesis (H1) - mckenzie exercises will show a significant effect over conventional exercises.
c. Alternate hypothesis (H2) – conventional exercises will show significant effect over mckenzie exercises.

5. Review of Literature

- Directional preference at the knee: a case report using mechanical diagnosis and therapy (J Man Manip Ther. 2013 Feb) [7]
- This case study details the examination of a patient referred to physiotherapy with the diagnosis of lateral meniscal tear, based on the reproduction of pain during McMurray's meniscal test. Following a structured assessment according to principles of MDT, the patient was diagnosed with a 'derangement'. Self-management strategies were prescribed that reduced pain and improved mobility and function. The case study demonstrates the benefits of the MDT assessment in the extremities, and the problems with placing too much reliance on individual Orthopaedic special test.
- Richard Rosedale et.al in Journal of sports physical therapy, January 2014.
  Efficacy of Exercise Intervention as Determined by the McKenzie System of Mechanical Diagnosis and Therapy for Knee Osteoarthritis: A Randomized Controlled Trial [8].

Results: The exercise intervention group had significantly improved P4 scores (mean difference, –6; 95% CI: –8, –3), KOOS pain scores (mean difference, 9; 95% CI: 5, 13), and KOOS function scores (mean difference, 11; 95% CI: 7, 15) compared to those of the control group at 2 weeks. At 3 months, the exercise intervention group had significantly improved KOOS pain scores (mean difference, 7; 95% CI: 3, 11) and KOOS function scores (mean difference, 5; 95% CI: 1, 9) compared to controls.

- **Mark C perry *et.al,* Knee surg sports Traumatol Arthosc, date january 2005 [9]**

Effects of closed versus open kinetic chain knee extensor resistance training on knee laxity and leg function in patients during the 8- to 14-week post-operative period after anterior cruciate ligament reconstruction

Result: Results from this study indicate that the OKC and CKC training programmes described do not differ significantly in their effects on knee laxity in the 8- to 14-week period after ACLR surgery. Significant associations were found in this study between some of the function indices and confounding factors.

- **Stephen J may and Richard Rosedale, Journal of the American physical therapy association, Date 24, 2012 [10]**

A Survey of the McKenzie Classification System in the Extremities: Prevalence of Mechanical Syndromes and Preferred Loading Strategies.

This study demonstrates that trained clinicians can classify patients with extremity problems into MDT classifications and that these classifications remain stable during the

treatment episode. Further work is needed to test the efficacy of this system compared with other approaches, but if derangements are as common as this survey suggests, the findings have important prognostic implications because this syndrome is defined by its rapid response to repeated movements.

6. Methodology
- Sample size: 30
- Study design: comparitive study
- Sampling method: purposive
- Study population: young adults undergone ACL reconstruction, post-operative day 2
- Study setting: hospitals in and around pune
- Study duration: 6 months
- Interventional period: 3 weeks, 6 days per week for 45 minutes.

7. Criteria

Inclusion criteria
- Young adults
- Primary ACL injury
- ACL injury associated with meniscal injury
- Age -20 to 30 years
- Both male and female
- Post operative day- 2

Exclusion criteria
- Fractures of lower limb
- Multiple traumatic injuries
- No history of previous ACL reconstruction

8. Materials Used
- Consent Form
- Pen
- Paper
- Goniometer
- Lysholm Knee Scoring Scale

9. Outcome Measures
- Knee range of motion
- Lysholm knee scoring scale [(11)] score (/100)
- <65 poor, 65-83 fair, 84-90 good, >90 excellent.

10. Procedure
- Study began with presentation of synopsis to the ethical committee and clearance will be obtained .
- Various hospitals in and around pune were visited
- Subjects were selected for the study based on the inclusion and exclusion criteria.
- consent form were taken from the subjects. procedure to be explained to them.
- In the sequence of enrolment of the subject, even numbered i.e half of the subjects are categorized to group 'A' The other half, odd numbered subjects are categorized as group 'B'.
- Pre intervention evaluation was done and outcome measures were taken.
- Group 'A' was given mckenzie exercises
- Group 'B' was be given conventional therapy.
- Subjective assessment of range of motion and functional ability were done.
- Comparison improvement in knee range of motion and functional ability and thereby effect of conventional therapy and mckenzie exercises in the subjects was established.
- Duration- 3 weeks
- Both the groups were advised icing for pain relief and relaxation.

❖ **Mckenzie exercises**

Exercise 1: Knee Extension while Sitting

Once again, sit in a chair and position the heel of the problematic knee on another chair or stool that has the same height with your painful knee. Keep the knee slightly bent and toes straight. Keep this position for about two seconds and after that return to the initial position. Repeat this procedure for ten times. [(7)]

Exercise 2: Active Knee Extension while Sitting

Begin this exercise in an upright position while sitting in a chair and keep your feet flat on the ground. Gently lift the of your problematic knee and start straightening your leg until you notice contraction in the quadriceps muscle.

Keep this position for about two seconds and slowly return to the initial position. Repeat this exercise for 10 times.

Exercise 3: Knee Flexion in Sitting position

Start this exercise in a sitting position, but keep your body upright. Bend your knee and pull your leg up in your chest's position. Use your hands on your ankle as a support. At the same time pull your heel in the direction of your buttocks and stay like that for two seconds. After that, return the knee in the initial position. Do this for 10 times.

Exercise 4: Knee Extension in Standing Position

Stand upright and put the heel of your problematic knee on a stool, low step or on the ground. Reach forward with your hands and place them right above the knee.

Push down and straighten the knees with both of your hands until the moment you feel stretch.

Keep this position for about two seconds and return to the initial position. Perform 10 repetitions [7].

Exercise 5: Knee Flexion in Standing position.
- Stand upright and put the heel of the problematic knee on a stool or chair. In case you lack balance, hold onto the stool/chair. Carefully lean forward and push the buttock in direction of your heel until you get a knee stretch.
- Keep this position for two seconds and repeat ten times.

❖ **Conventional therapy** [5]

From week 1 to 3
1. Active range of motion for knee flexion and extension - 10 reps
2. Muscle setting isometrics : quadriceps, hamstrings, adductors- 5 seconds hold with 10 repetitions
3. straight leg raise (SLR) in all four planes 10 repetitions.

11. Analysis

Data and statistical analysis

Statistical analysis was conducted using INSTAT™ for Windows.

The difference in pre and post treatment values of knee flexion, knee extension and functional ability was compared within the groups by paired t test.

The post treatment comparison between the two groups was done by using unpaired t test.

Table 1: demographic data of both the groups

	GROUP A (n=15)	GROUP B (n=15)
AGE	25.067±2.314	25.000±0.000
GENDER	MALES-13 FEMALES 2	MALES-13 FEMALES -2

Demographic Data

Age and gender distribution

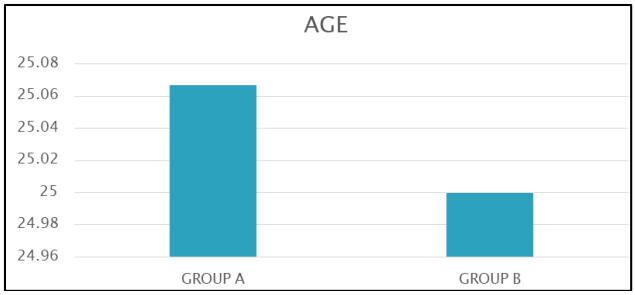

Fig 1: age of both the groups

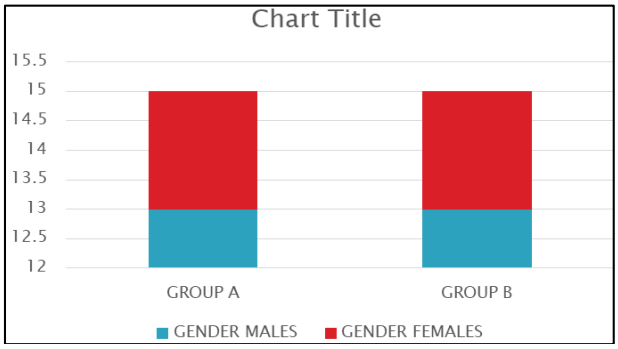

Fig 2: gender distribution

The intra group comparison between the values obtained on knee flexion in both the groups shows a significant reduction in means of knee flexon range(93.133±4.518 from 39.467±5.513 in group A and 97.600±4.501 from 39.867±4.658 in group B) after the treatments of both the groups

Table 2: knee flexion of both the groups

	Group A	GROUP B
Pre treatment	39.467±5.513	39.867±4.658
Post treatment	93.133±4.518	97.600±4.501
P value	0.0001	0.001
t value	32.884	30.450
significance	Significant	significant

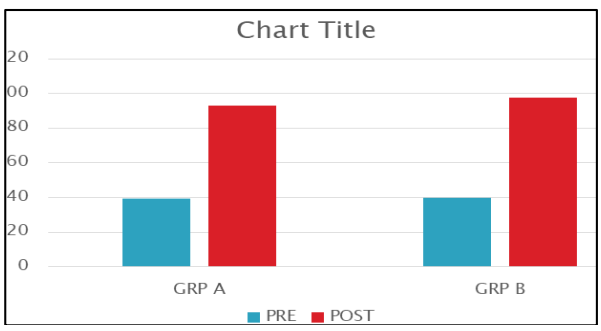

Fig 3: knee flexion of both the groups

The inter group comparison of knee flexion ranges of both the groups after treatment did not show a significant difference. The mean value of post treatment knee flexion range in group A(93.133±4.518) is lesser than group B(97.600±4.501) indicating more improvement in knee flexion range of motion in group B than g

Table 3: comparing knee flexion of both the groups.

	Group A	Group B	P value	T value	significance
MEAN	93.133±4.518	97.600±4.501	0.0056	2.713	Very significant

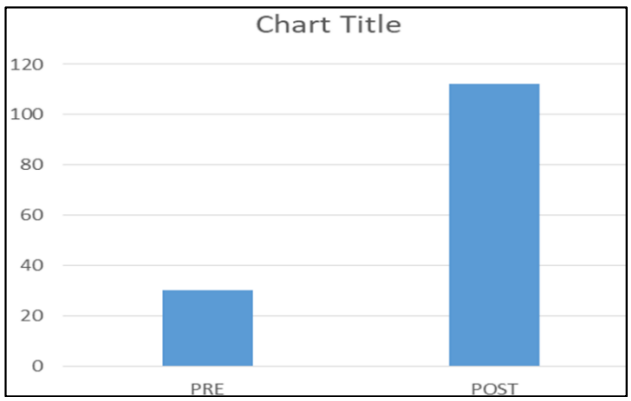

Fig 4: comparing knee flexion of both the groups

- The intra group comparison between the values obtained on knee extension in both the groups did not show a significant change in means of knee extension range(2.067±2.890 from 4.600±4.881 in group A and 1.333±2.554 from 3.400±4.339 in group B) after the treatments of both the groups.

Table 4: knee extension in both the groups

	Group A	Group B
PRE	4.600±4.88	3.400±4.339
POST	2.067±2.890	1.333±2.554
P VALUE	0.0014	0.0023
T VALUE	3.604	3.371
SIGNIFICANCE	significant	significant

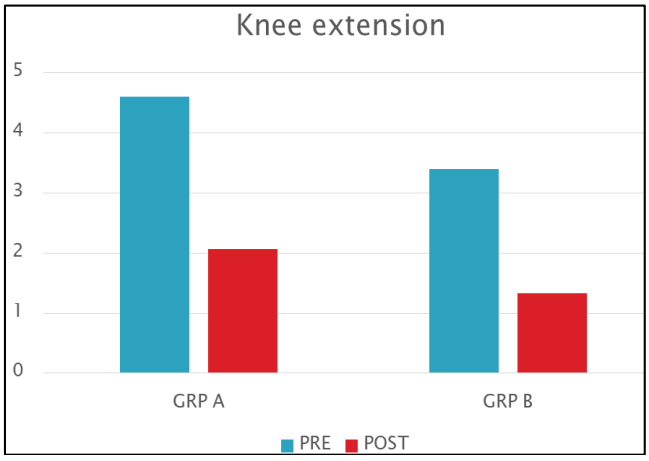

Fig 5: knee extension in both the groups

- The inter group comparison of knee extension ranges of both the groups after treatment did not show a

significant difference. The mean value of post treatment knee flexion range in group A(2.067±2.890) is lesser than group B(1.333±2.554) indicating more improvement in knee extension range of motion in group B than group A.

Table 4: knee extension between the groups

	Group	Group B	P value	T value	Result
MEANS	2.067±2.890	1.333±2.554	0.2338	0.7364	Not significant

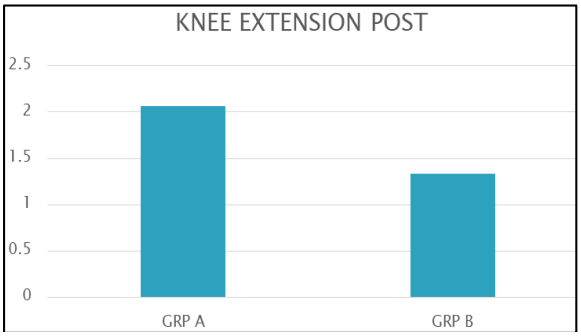

Fig 6: knee extension between the groups

- The intra group comparison of pre and post values of functional ability of both the groups measured with lysholm knee scoring scale shows a significant change (86.267±2.219 from 45.33±1.676 in group A and 86.133±1.885 from 45.667±1.447 in group B) after the treatment of both the groups.

Table 5: functional ability in both the groups

	Group A	Group B
pre	45.33±1.676	45.667±1.447
post	86.267±2.219	86.133±1.885
P value	0.0001	0.0001
T value	50.325	53.150
significance	Highly significant	Highly significant

Fig 7: functional ability in both the groups

The inter group comparison of knee functional ability scores of both the groups did not show any significant difference. The mean values of post treatment in group A(86.267±2.219) and group B(86.133±1.885) indicating no significant difference.

Table 6: functional ability between the groups

	Group A	Group	P value	T value	Result
MEANS	86.267±2.219	86.133±1.885	0.4302	0.1774	Not significant

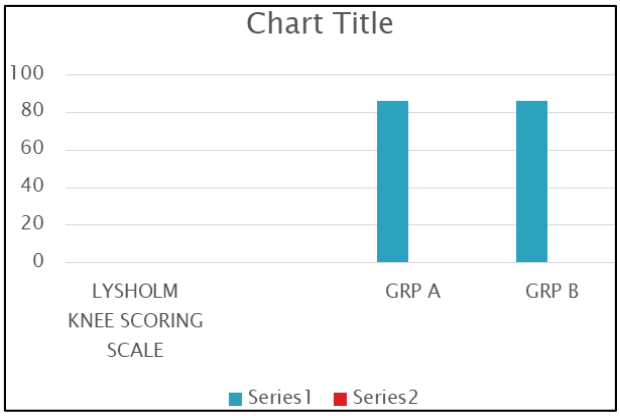

Fig 8: functional ability between the groups

12. Result

Within and between the groups comparison of knee range of motion and lysholm knee scoring scale mean values (T and P values)

Table 7: t and p values of both the groups (within and between the groups)

VARIABLES	GROUP	PRE	POST	P VALUE	T VALUE
KNEE FLEXION	A	39.467±5.513	93.133±4.518	0.0056	2.713
	B	39.867±4.658	97.6±4.501		
		P- 0.001 T-32.884	P-0.001 T-30.450		
KNEE EXTENSION	A	4.600±4.881	2.067±2.890	0.2338	0.7364
	B	3.400±4.339	1.333±2.554		
		P-0.0014 T-3.604	P-0.0023 T-3.371		
LYSHOLM KNEE SCORING SCALE	A	45.33±1.676	86.267±2.219	0.4302	0.1774
	B	45.667±1.447	86.133±1.885		
		P-0.0001 T-50.325	P-0.0001 T-53.150		

13. Discussion

- In this study we compared the effectiveness of mckenzie exercises and conventional therapy after ACL reconstruction between the age group 20-30 years. The result shows that both mckenzie exercises and conventional therapy shows significant improvement in knee range of motion and functional ability but there was no significant change when both the groups were compared for knee extension and functional ability.
- There was a significant change seen in knee flexion range of motion with p=0.0056 and mean value 93.133±4.518 of group A and 97.600±4.501 of group B.
- Hence post treatment mean value of group B being more than that of group A indicates more improvement in knee flexion with conventional therapy
- McKenzie is a philosophy of active patient involvement and education that is trusted and used by clinicians and

patients all over the world for back, neck and extremity problems. The range of motion and functional ability significantly improved in the individuals receiving mckenzie exercises.

- Directional preference at the knee: a case report using mechanical diagnosis and therapy (J Man Manip Ther. 2013 Feb) [4] This case study details the examination of a patient referred to physiotherapy with the diagnosis of lateral meniscal tear, based on the reproduction of pain during McMurray's meniscal test. Following a structured assessment according to principles of MDT, the patient was diagnosed with a 'derangement'. Self-management strategies were prescribed that reduced pain and improved mobility and function this supports the findings of the study, mckenzie can be a useful intervention in knee derangement syndrome including ACL injuries treated surgically.
- Conventional exercises showed a significant improvement in knee flexion over mckenzie. The conventional exercises are universally applied in improving range and function after ACL reconstruction. They showed a significant effect on the study subjects.

14. Limitations

- The study was conducted on small population of 30 individuals
- Subjects could not followed up after the study duration

15. Future Scope

- It can be further studied on a larger population
- The study can be specified on a particular gender
- The study can include other age group

16. Conclusion

Conventional therapy and Mckenzie exercises are both effective in ACL reconstruction. Conventional therapy showed a significant difference in improving knee flexion than Mckenzie exercises. There was no significant difference in comparison of the effects of both the techniques on knee extension and functional ability.

17. References

1. Georgia Pelengari. Rehabilitation program after Anterior Cruciate Ligament Reconstruction Date: January, 2007
2. Overview of supportive studies : Mckenzie method of mechanical diagnosis and therapy by Richard Rosedale.
3. Mckenzie treatment for extremity injuries by capital physical therapy Walter Larson
4. Robin Mckenzie, Stephen. May The Human Extremities Mechanical Diagnosis And Therapy August 2000.
5. Brent S, Brotzman MD. Clinical orthopaedic rehabilitation and evidence- based approach, 3rd Edition, Mosby 2011
6. Carolyn Kisner, Lynn Allen. Colby Therapeutic Exercise, Edition 5th FA davis company 2002.
7. Journal of manual and manipulative therapy J Man Manip Ther. 2013; 21(1):60–66.
8. Richard Rosedale Stephen May Shawn M Robbins Efficacy of exercise intervention as determined by the Mckenzie system of mechanical diagnosis and therapy for knee osteoarthritis, 2016; 44:173-181
9. Mark C perry. Knee surg sports Traumatol Arthosc, 2005, 357-369
10. Stephen J may and Richard Rosedale, Journal of the American physical therapy association, 2012.
11. Karen K, Briggs. American Journal of Sports Medicine Vol. 37, No. 5 DOI: 10.1177/0363546508330143 © 2009 American Orthopaedic Society for Sports Medicine
12. Marks De carlo. Traditional versus Accelerated Rehabilitation following ACL Reconstruction: 1992; 15:6
13. Journal of the American physical therapy association