VOLUME - 15, ISSUE - 11, NOVEMBER - 2026 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper | Physiotherapy & Rehabilitation

TO COMPARE THE EFFECT OF STATIC BALANCE EXERCISE USING VISUAL FEEDBACK WITH LASER POINTER ON BALANCE AND FUNCTIONAL ACTIVITY IN POST ACL-RECONSTRUCTION

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KEYWORDS :

INTRODUCTION

The Anterior cruciate ligament (ACL) is One of two cruciate ligaments that help stabilize the knee joint. It is a robust band composed of collagenous fibers and connective tissue that extends postero-laterally from the anteromedial aspect of the tibial plateau's intercondylar region to attach to the medial aspect of the lateral femoral condyle. Here are two key landmarks: the lateral intercondylar ridge, which defines the anterior boundary of the ACL, and the bifurcate ridge, which divides the two ACL bundles. The ACL is 32 mm long and 7 to 12 mm wide, with two bundles: an anteromedial and a posterolateral bundle with more variable length changes.[1]

Rehabilitation following ACL reconstruction plays a crucial role in determining functional outcomes and return-to-sport rates. Modern rehabilitation programs emphasize early mobilization, progressive weight- bearing, neuromuscular training, and sport-specific conditioning. Despite advances in surgical and rehabilitation approaches, return-to-sport rates vary, with studies indicating that only about 60–80% of patients successfully return to their pre-injury level of activity. Furthermore, reinjury rates, including graft rupture and contralateral ACL injury, remain a concern, particularly among younger athletes[21]

Preoperative rehabilitation has the potential to boost quadriceps strength, improve knee mobility, and reduce the duration needed to resume regular activities. It is advisable to have at least one consultation to verify adequate voluntary muscle activation and to identify any flexion contractures that may require further preoperative interventions. Additionally, this meeting will provide the patient with essential information about the postoperative rehabilitation plan.[21]

The anterior cruciate ligament (ACL) is one of the two cruciate ligaments that stabilize the knee joint. It connects the tibia to the femur, running from the front of the tibial plateau to the lateral femoral condyle. The ACL is about 32 mm long and 7–12 mm wide, consisting of two bundles: the anteromedial and the posterolateral. It plays a crucial role in knee stability by preventing excessive forward movement and rotation of the tibia. After ACL reconstruction, balance is affected due to proprioceptive loss, muscle weakness, and altered neuromuscular control.

Visual feedback with Laser pointer improves balance by enhancing proprioception, coordination, and neuromuscular control. By attaching a laser pointer to the foot, knee, or waist and tracing patterns on a wall or floor, the brain learns to control movements more precisely. This exercise strengthens stabilizing muscles, improves joint awareness, and challenges dynamic balance by engaging visual feedback. Over time, it helps retrain the body to maintain stability, especially after ACL reconstruction.

Objectives of the Study

- To find the effectiveness of the static balance exercise with LASER pointer on improving balance and functional activity after ACL-Reconstruction
- To find the effectiveness of the visual feedback with LASER pointer on improving balance and functional activity after ACL-Reconstruction.
- To compare the effectiveness of the static balance exercise versus visual feedback with Laser pointer on improving balance and functional activity after ACL-Reconstruction

Methodology

Study Design: Pre- and Post Comparative Study
Study Subject: Subjects with ACL-Reconstruction
Sample Size: The calculated sample size was 17 participants per group. To account for a potential attrition rate of 10%, the final required sample size was adjusted to 19 participants per group.
Source of Data: Florence College of physiotherapy and rehabilitation center
Sampling Method: Simple Random sampling method
Study Duration: Six months

Sample Selection

Inclusion Criteria

- Age between 14 and 45 years[36]
- Subjects who could understand and follow the instructions.[37]
- Both Genders are involved[27]
- Subjects with post ACL surgery[24]

Exclusion Criteria

- Previous surgery or treatment for knee[27]
- taking sedative medication[26]
- cardiovascular, neurologic, or pulmonarydisease[38]
- rheumatoid disease, fracture and contracture[50]

Methods of Data Collection

The simple random sampling method will be used to randomly assign participants into groups two groups: 19 Participants of Group A will be Receiving Rehabilitation by using visual feedback with Laser pointer, while 19 participants of Group B will be receiving Rehabilitation with static balance exercises for Post ACL Rehabilitation. After grouping, the participants' medical history, assessment, and baseline data will be collected. Before and after the treatment

Procedure

Subjects will be divided into two groups. Group A and Group B.

Group A- This group will undergo visual feedback with Laser pointer.

The exercise sessions will be conducted for 30 minutes long using a laser pointer five times a week for 4 weeks.[36]

Group B – This group will undergo static balance exercise.

After completing the sessions of treatment, all of assessments will be measured. The treatment will be conducted for 30 minutes, five times a week, for 4 weeks.[27]

Conventional Treatment for Both Groups Includes:

This rehabilitation program included several exercises aimed at improving knee function, muscle strength, and joint stability after injury or surgery. It began with warm-up and knee mobility exercises to increase blood circulation, reduce stiffness, and improve range of motion. The exercises were performed for 30 minutes per session, 5 times per week, for 4 weeks.[3]

DATA ANALYSIS & RESULTS

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using statistical package for social science (SPSS) version 24, with a significance level of p value less than 0.05 and a 95% confidence interval set for all analysis.

Table – 5 Comparison of Y – Balance Test Score Within Group – A and Group - B Between Pre Test and Post Test

Groups	Pre Test		Post Test		t - test	Significance
	Mean	S.D	Mean	S.D		
Group- A	68.78	4.54	93.78	3.75	-19.13	.001**
Group- B	70.21	4.03	80.42	3.86	-14.51	.001**

(**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B.

There is a statistically significant difference between the pretest and posttest values within Group A and Group B at P ≤ 0.05.

Table – 6 Comparison of Lysholm Knee Score Within Group – A and Group - B Between Pre Test and Post Test

Groups	Pre Test		Post Test		t - test	Significance
	Mean	S.D	Mean	S.D		
Group- A	70.47	4.86	89.63	3.46	-18.92	.001**
Group- B	71.89	4.39	81.68	4.44	-22.78	.001**

(**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value and p-value between pre-test and post-test within Group – A & Group – B.

There is a statistically significant difference between the pretest and posttest values within Group A and Group B at P ≤ 0.05.

On comparing the Mean Values of Group A & Group B on Stork Balance Test Score, it shows a significant increase in the post test mean values in both groups, but (Group A) shows 50.05 ± 5.08 which has the higher mean value is more effective than (Group B) 39.42 ± 2.94 at P ≤ 0.05. Hence the null hypothesis is rejected.

On comparing the Mean Values of Group A & Group B on Y-Balance Test Score, it shows a significant increase in the post test mean values in both groups, but (Group A) shows 93.78 ± 3.75 which has the higher mean value is more effective than (Group B) 80.42 ± 3.86 at P ≤ 0.05. Hence the null hypothesis is rejected.

On comparing the Mean Values of Group A & Group B on Lysholm Knee Score, it shows a significant increase in the post test mean values in both groups, but (Group A) shows 89.63 ± 3.46 which has the higher mean value is more effective than (Group B) 81.68 ± 4.44 at P ≤ 0.05. Hence the null hypothesis is rejected.

On comparing Pret est and Post test within Group A & Group B on Stork Balance Test, Y-Balance Test score & Lysholm Knee Score shows significant difference in the mean values at P ≤ 0.05.

DISCUSSION

The present study was conducted to compare the effectiveness of static balance exercise and visual feedback using laser pointer on balance and functional activity in subjects following anterior cruciate ligament reconstruction.

At baseline, both groups showed no statistically significant difference in pre-test values of Stork Balance Test, Y-Balance Test, and Lysholm Knee Score, indicating that both groups were homogeneous before intervention. Overall, the findings of the present study indicate that both static balance exercises and visual feedback using laser pointer significantly improve static balance, dynamic balance, and functional activity following ACL reconstruction. However, visual feedback using laser pointer demonstrated comparatively greater improvement and may be considered a more effective rehabilitation approach for enhancing postural control, movement accuracy, and functional recovery in post ACL-reconstruction subjects.

The present study aimed to compare the effectiveness of static balance exercises and visual feedback using a laser pointer on balance and functional activity in subjects following anterior cruciate ligament (ACL) reconstruction. Both interventions demonstrated statistically significant improvements in balance and functional outcomes, as assessed using the Stork Balance Test, Y- Balance Test, and Lysholm Knee Score.

The results showed that both groups demonstrated significant improvement in balance and functional activity after the intervention. However, Group A showed greater improvement compared to Group B. Post-test mean values for Stork Balance Test, Y-Balance Test, and Lysholm Knee Score were higher in Group A, indicating better outcomes. All results were statistically significant at P ≤ 0.05.

In conclusion, both static balance exercises and visual feedback using a laser pointer are effective in improving balance and functional activity following ACL reconstruction. However, visual feedback with a laser pointer was found to be more effective than static balance exercises alone and can be recommended as part of rehabilitation programs for better recovery outcomes.

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