



**RESEARCH ARTICLE**

**COMPARISON BETWEEN EFFICACY OF TWO DIFFERENT ACCELERATED REHABILITATION PROTOCOLS ON MUSCULAR STRENGTH AND FUNCTIONAL STATUS OF THE PATIENT AFTER ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION: A RANDOMIZED CONTROLLED TRIAL**

**Sutantar Singh, Rajesh Paul, Reena Arora, Lalit Arora, Aseem Khajuria**

University College of Physiotherapy, Faridkot, Punjab

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**ABSTRACT**

The anterior cruciate ligament (ACL) injury is more frequent in athletes, particularly in females. Most ACL ruptures occur during sports activities in the age group of 15 to 25 year old athletes. The injury mechanism is a valgus/external rotation trauma with a slightly bend knee. The prevalence is 48 per 1,000 patients per year. In 9% of these cases, there is damage to one or more ligaments, of which the anterior cruciate ligament is the most commonly injured. The aim of the study was to compare the efficacy of two different accelerated rehabilitation protocols on muscular strength and functional status of the patient after anterior cruciate ligament reconstruction.

Twenty subjects undergone to ACL reconstruction using a patellar tendon auto-graft (bone-tendon-bone) participated in this study. The subjects were randomly assigned into two groups. Each group received a different accelerated rehabilitation protocol for 6 months. Muscular strength was measured using manual muscle testing technique and Knee functional status of the patient was measured using Cincinnati knee rating scale (CKRS). The group A showed more significant improvement in functional status with the mean value CKRS 229 at 2<sup>nd</sup> month as compared to 217 of group B, mean value 316 at 4<sup>th</sup> month as compared to 307 of group B and mean value at 6<sup>th</sup> month 412 as compared to 372 of group B. Group A also showed a significant improvement in range of motion. Both the groups showed a significant improvement in muscular strength but the clinically group A showed early improvement in muscular strength than the group B.

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**INTRODUCTION**

The ACL injury is more frequent in athletes, particularly in females. The relatively high rate of injury of the anterior cruciate ligaments in athletes and other active individuals has resulted in the anterior cruciate ligaments' being one of the most highly researched ligaments in the human body. The anterior cruciate ligament is vulnerable to injury because of the large moments that can be generated through the forces acting on the long lever arms of the femur and tibia (Beynon 2002).

The ACL is a primary stabilizer of the knee; a rupture can lead to functional instability i.e. giving-way episodes. Most ACL ruptures occur during sports activities in the age group of 15 to 25 year old athletes. The injury mechanism is a valgus/external rotation trauma with a slightly bend knee. The prevalence is 48 per 1,000 patients per year. In 9% of these cases, there is damage to one or more ligaments, of which the (ACL) is the most commonly injured (Van 2010). In many cases, an anterior cruciate ligament injury results in a premature end to a career in sports and observed that only

30% of soccer players were active in soccer 3 years after an anterior cruciate ligament injury (Kvist 2004).

Rehabilitation following anterior cruciate ligament reconstruction has undergone a relatively rapid and global evolution over the years. The current trend in rehabilitation after anterior cruciate ligament reconstruction has been towards an increasingly aggressive restoration of motion and strength, with an accelerated return to sporting activities at 4-6 months after surgery (Seide 2010). Common rehabilitation problems occurring following reconstruction include joint stiffness, lack of full knee extension, anterior knee pain, muscle weakness, and knee crepitus (Carlo 1997).

There is no current consensus regarding the content of a rehabilitation program for ACL reconstructed knee, hence we conduct a study to compare the effectiveness of two accelerated rehabilitation protocols on functional status and muscular strength in rehabilitation of anterior cruciate ligament reconstruction surgery. The purpose of this study was to design an optimal evidence-based accelerated rehabilitation protocol for returning to sport within 6 months

following anterior cruciate ligament reconstruction.

**MATERIAL AND METHODS**

This study was approved by Research and Ethical committee of University College of Physiotherapy, Faridkot. 20 subjects were taken from Orthopedics OPD, GGS Medical College & Hospital and OPD of University College of Physiotherapy, Faridkot. Informed consent was signed by each participant. A randomized controlled trial with equal randomization (1:1 for two groups) was done with 10 patients in each group, total (n=20). The inclusion criteria was the patients with age 18 and 35 years, ACL reconstruction surgery of ruptured ACL alone or along with medial meniscus and medial collateral ligament injury, Immediate post-operative patients. The patients with history of other lower limb injuries within the previous six months, concomitant tear of the posterior cruciate ligament, simultaneous collateral ligament repair during surgery, pathologies of the hip, knee, and ankle leading to knee pain were excluded from the study.

**Intervention**

The patients in Group A were given cryotherapy for 10 min, Continuous passive motion was given to the patients for 10 min and more as tolerable followed by patellar mobilization in all directions. The following exercises were given to the patient quadriceps isometrics, heel slides and leg elevation with a pillow, straight leg raises, mini squads, shifting body weight. As the pain was tolerable, walking was started from day 4. The patients were made to walk without crutches from day 4 to 10 followed by gait training. From week 3 onwards walking on treadmill, isometric and isotonic strength training of quadriceps, hamstrings, gastrocnemius and soleus was increased in intensity with increasing ROM followed by cycling. These exercises were continued till the 9<sup>th</sup> week. Then the patient was progressed to stepping on stair and stepping machine. The muscle strength and endurance with increased weights was started from week nine for open chain and closed chain exercises. The patients were progressed on two legged jumping and slowly progressed to one leg jumping. After that running with outdoor jogging was started by week 13 followed by running exercises, variations in

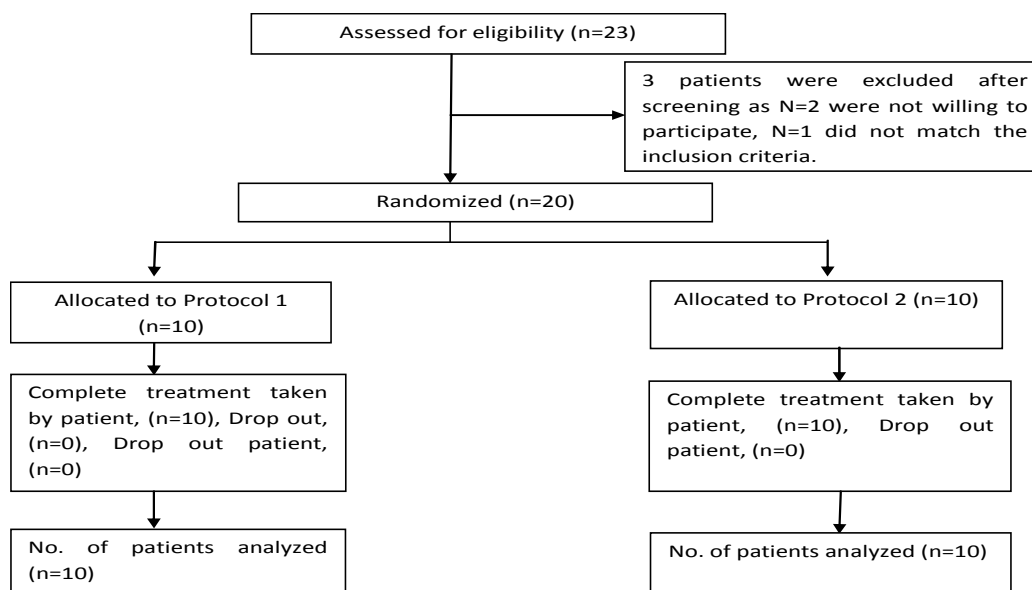
running, turning and cutting maneuvers, duration and speed was increased and maximized. These exercises were performed upto 6<sup>th</sup> month of post-surgery (Van 2010).

The patients in Group B were given cryotherapy for 10 minutes. Continuous passive motion was given to the patients for 10 min. The following exercises were given to the patient ankle ROM exercises, active hamstring curl and isometric exercises of quadriceps, straight leg raises of 10 repeats, 3 sets of exercise, prone leg hang, leg elevation, patellar mobilization active hamstring curl and isometric exercises of quadriceps. Wall sliding was also done when the patients achieved 80-90° knee flexion. The brace was locked in full extension and the patient was brought to partial weight-bearing with crutches. Prone and standing hamstring curls with weights were performed followed by closed kinetic chain exercises, stationary bicycle, proprioceptive strengthening and lateral step up exercise. Full weight bearing without crutches was started by week 3-4. The brace was discontinued at 4<sup>th</sup> week, full ROM was achieved at 6<sup>th</sup> week. Strengthening program was started with closed kinetic chain exercises as wall-squats and lunge followed by lateral strengthening and agility exercises from week 8, progression in proprioceptive exercises, plyometric exercises was done. Then the patient was preceded with jogging program from week 12. All the exercises were continued and progressed in plyometric exercises. The sport specific training was started from week 16 and continued upto 6<sup>th</sup> month of post-surgery (Seidein 2010)

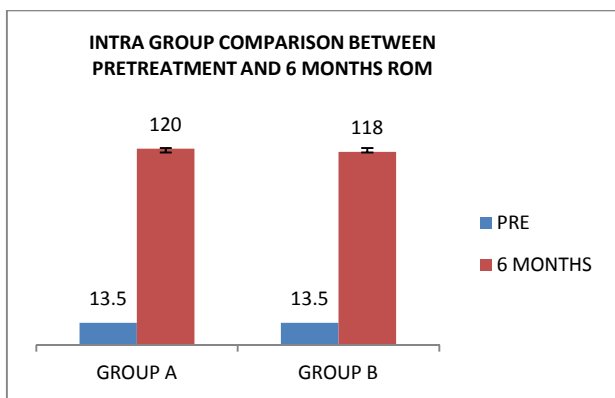
Each exercise was of 10 repetitions of each exercise were performed and hold for 10 seconds in both the protocols. The patients were assessed for functional status and muscular strength using Cincinnati knee rating scale and range of motion at baseline, 2<sup>nd</sup> month, 4<sup>th</sup> month and 6<sup>th</sup> month.

**Data analysis**

Result was analyzed using SPSS, paired t-test, unpaired t-test, ANOVA and post hoc tests were used to analyze the data. The result was considered significant with p<0.05.



Flow Chart of treatment program



## RESULTS

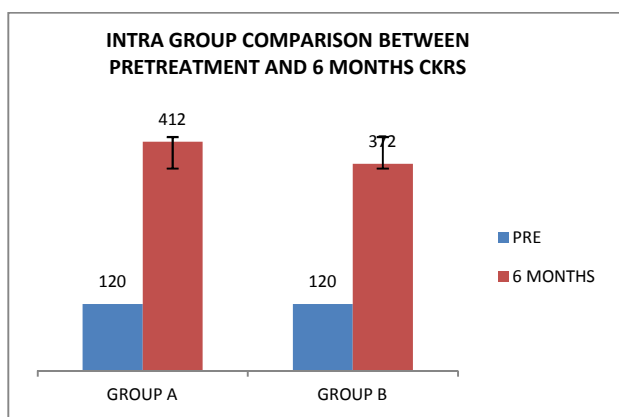
Total 20 subjects participated in this study with age group of 16-35 years in both groups. t test was performed to test significant difference in variables. The  $p=0.05$  was considered as level of significance. The mean age of subjects in group A was 27.05 and that of group B was 25.05.

Analysis was done between the pre-test and post-test values within group A and group B to determine the changes within the variables Cincinnati knee rating scale, manual muscle testing and range of motion. There was a significant improvement in values of Cincinnati knee rating scale, manual muscle testing and range of motion with  $p<0.05$ . The results showed that there was a significant improvement in functional status and muscular strength of the patient.

CKRS values of both the groups were compared. There was not much difference in pre values of both the groups with mean value of 120 for both the groups. But the post values of CKRS showed a significant difference in both the groups with mean values of 412 of group A and 372 of group B. Hence group A showed more significant improvement in functional status than group B.

Comparison of the values of ROM was done. The pre range of motion of group A and group B was 13.5 degrees. But the post values of both the groups showed a significant improvement in range of motion with mean value of 120 of group A and 118 of group B. Hence the group A showed more significant improvement in range of motion than group B.

Comparison of muscular strength was done using manual muscle testing which shows a significant improvement in both groups.



## DISCUSSION

The findings of the study showed that both the rehabilitation protocols are effective but the rehabilitation protocol 1 received by group A is better than the rehabilitation protocol 2 received by group B and is effective in improving muscular strength and functional status of the patient following ACL reconstruction surgery. The study done by Kvist in 2004 also showed that accelerated program with an early return to sports have a significant effect in rehabilitation. Weight bearing within the first week after an ACL reconstruction allowed to return to light sporting activities such as running at 2–3 months after surgery and to contact sports, including cutting and jumping, after 6 months. Rehabilitation after ACL injury and reconstruction by heading towards accelerated programs with an early return to sports has a significant effect in rehabilitation. The more and early improvement shown in group A gives the results of early return to sport after ACL reconstruction surgery. Another study done by Seide et.al in 2010 showed satisfactory clinical, proprioceptive, and functional results in achieving dynamic and static stability of the knee with the modified accelerated rehabilitation program after ACL reconstruction with a PT graft. This study has a few limitations such as number of the subjects taken was very less, other techniques to measure muscular strength might be used. Future studies can focus on more number of patients, other techniques to measure muscle strength may take to attain better results and other knee rating scales can be taken to see the effectiveness.

## CONCLUSION

Based on our study both the groups showed a significant improvement in functional status and muscular strength of ACL reconstructed knee joint but the group A showed a more significant improvement in functional status and muscular strength than the group B.

## References

- Beynon BD, Good L, Risberg A 2002, "The effect of bracing on proprioception of knees with anterior cruciate ligament injury, Journal of Orthopaedic & Sports Physical Therapy, vol.32 pp.11–15.
- Carlo DM, Klootwyk TE, Shelbourne KD 1997, "ACL Surgery and Accelerated Rehabilitation: Revisited", Journal of sport Rehabilitation, vol.6, pp.144-156.
- Heijne A, Werner S 2007, "Early versus late start of open kinetic chain quadriceps exercises after ACL reconstruction with patellar tendon or hamstring grafts: a prospective randomized outcome study", journal of Knee Surgery and Sports Traumatology Arthroscopy, no.15, pp.402–414.
- Hohmann E, Tetsworth K 2011, "Physiotherapy-guided versus home-based, unsupervised rehabilitation in isolated anterior cruciate injuries following surgical reconstruction", Knee Surgery and Sports Traumatology Arthroscopy, vol.19, pp.1158–1167
- Kvist J 2004, "Rehabilitation Following Anterior Cruciate Ligament Injury Current Recommendations for Sports Participation", Journal of Sports Medicine, vol.34, no.4, pp.269-280.
- Risberg MA, Moksnes H 2009, "Rehabilitation after anterior cruciate ligament injury influences joint

- loading during walking or not.” British Journal of Sports Medicine, vol.43, pp.423–428
- Seide K, Berrin A, Selmin G, meltemB,halit P 2010,
  - “Clinical and functional outcomes and proprioception after a modified accelerated rehabilitation program following anterior cruciate ligament reconstruction with patellar tendon autograft”, ActaOrthopTraumatolTurc ;
- vol.44, no.3, pp.220-228.
- Van GS, Cingel RE. van, Holla CJM, Loon CJM 2010, “Evidence-based rehabilitation following anterior cruciate ligament reconstruction”, journal of Knee Surgery and Sports Traumatology Arthroscopy vol.18, pp.1128–1144.

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