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A Study to Compare the Effectiveness of Ultrasound Therapy with Plyometric Exercise versus Ultrasound Therapy with Neuromuscular Training for Grade 1 Anterior Cruciate Ligament (ACL) Injury for Athletes

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Abstract: ***ACL tears typically present with acute injury, sometimes with a loud "pop" a sensation of tearing the immediate onset of effusion. ACL plays a crucial role in knee joint stability. The fibers of the ligaments are stretched but didn't quite tear, little tenderness and swelling may present and the pattern of injury is twisting and hyperextension its an important factor in sports performance especially in young athletes. Ultrasound reduce a inflammation of the joint and increased tissue blood flow and reduced viscosity of fluid elements in the tissues and the plyometric training leads to strengthen the muscle growth by proprioception reaction enhancement and inhibitory function debilitation of Golgi tendon organs. neuromuscular training aims to improve neuromuscular control, thus increasing functional joint stability, which may have a protective effect against injury. However, the NMT has efficiency in improving the joint control and stability. The purpose of the study is to compare the effect of ultrasound therapy with plyometric exercise versus ultrasound therapy with neuromuscular training for grade 1ACL injury. Materials Used and Methodology: An experimental study was done to compare the effect of ultrasound therapy with plyometric exercise versus ultrasound therapy with neuromuscular training for grade 1ACL injury for young athletes (18-24 yrs).Group A consist of 15 subjects with plyometric exercise and Group B consist of 15 subjects with NMT. outcome measures is KUJALA scale, ROM, VAS. it is based on inclusion and exclusion criteria. Ultrasound, Couch, Plyometric box sets , Plyometric hurdles, Jump rope these are the materials were required during the treatment. Result: On comparing pre test and post value within Group A and Group B and post test value between the groups on KUJALA scale, ROM, VAS shows a highly significant difference in mean value at P <0.0001. Conclusion: The study resulted in statistically significant improvements in NMT program in overall lower limb alignment hamstrings and quadriceps strength. The trained athletes had a significant reduction in the noncontact grade 1 ACL injury incidence rate compared with group. The neuromuscular retraining program was effective in reducing noncontact ACL injury rate and improving athletic performance indicators.***

Keywords: Anterior cruciate ligament, plyometric exercise, neuromuscular training, Kujala scale, Rrange of motion, Visual analogue scale.

1. Introduction

The Anterior Cruciate Ligament (ACL) is a band – like structure of dense connective tissue. Its Femoral attachment displays a shape comparable to a vertically disposed semicircle[(1)]. The bony attachment is located at the posterior part of the inner surface of the lateral femoral condyle and not, as sometimes presumed, at the roof of the intercondylar notch[(2)].The anterior cruciate ligament(ACL) is attached to a fossa on the posterior aspects of the medial surface of the lateral femoral condyle. The femoral attachment is in the form of a segment of a circle, with its anterior border straight and its posterior border convex. It's long axis is tilted slightly forward from the vertical, and the posterior convexity is parallel to the posterior articular margin of the lateral femoral condyle[(3)].

Injury to the ACL can cause damage to the meniscus and articular cartilage, which in turn leads to osteoarthritis[(4)]. The predominant cause of ACL injury is a sudden change in the direction of movement, which causes partial fiber bundle damage.

The anterior cruciate ligament is attached to a fossa in front of and lateral to the anterior tibial spine. At this attachment the ACL passes beneath the transverse meniscal ligament, and a few fascicles of the ACL may blent with the anterior attachment of the lateral meniscus. The anterior cruciate ligaments are important parts of the knee joint, and have key roles in maintaing the stability of the knee joint. The first major knee stabilizer is the ACL, which is comprised of an anteromedial, intermediate, and posterolateral band twisted together. The purpose of the ACL is to prevent posterior movement of the femur on the tibia. It also stabilizes the tibia against excessive internal rotation, valgus and varus motion.

Objective of the Study

The objective of the study was to find this comparative effect of ultrasound therapy with plyometric exercise versus ultrasound therapy with neuromuscular training for grade I ACL injury

Procedure

The plyometric training is to improve the power of subsequent movements using both the natural elastic components of the muscles and tendon as well as stretch reflex. It is designed to decrease the kneeling force and to increase the knee joint stability by reorganizing the lower extremity and increasing the knee muscle strength.

Plyometric training might be more effective for non – dominant limbs balance performance. It enhance the ability to show maximum force to the shortest time and the exercise loaded to rapid changes from eccentric contraction to concentric contraction of the movement. The plyometric training also decrease muscle reflex inhibition, increase the sensitivity of the golgi tendon organs, improves the sensitivity of the muscle spindle, increases muscle tension at the same time decrease the risk of injury.

Neuromuscular training, defined as training that enhances unconscious motor responses by stimulating sensory signals and central mechanisms, leads to dynamic joint stability. This training improved dynamic joint stability and fine motor control by strengthening the synchronization and synergy of the muscle activity. It is used to prevent injuries and improve the performance of athletes by regaining leg power, strength, and balance after an injury.

The neuromuscular training improves nerve-muscle control while increasing the stability of functioning joints. Neuromuscular training has been proven to influence the sensitivity and reactivity of the central nervous system and improves the power of athletes by targeting motor units and coordinating motor units and increasing muscle activation.

Neuromuscular training (NMT) programs have been shown to decrease ACL injury risk in adolescent female athletes by improving their neuromuscular control and dynamic knee stability. It appears that NMT programs inclusive of both resistance and plyometric training are most effective at reducing non-contact ACL injury risk in female athletes under the age of 18. These programs focus on improving neuromuscular strength and control, proprioception, motor control, fundamental movement patterns and functional biomechanics, with the aim of decreasing ACL injury risk.

Ultrasound therapy given for both group A and group B. (Before starting the exercises)
Duration: 10 mins
Intensity: 1.2 w/cm
Hertz: 3MHz
Session per day: 1 session
Total number of sessions: 20 days.
This study conducted for (n=30) young adults (n=15 members in each group). The subjects were divided into two groups.

Group A: Ultrasound therapy with plyometric exercises.
(n=15) membres/ consist of athletes those who received ultrasound therapy with plyometric exercises.
No of patients: 15
Study duration: 5weeks
Treatment sessions: 4 days/weeks
Treatment duration: 40 minutes (which includes break period)

Week	Types of Exercise	Intensity (Sets × reps)	Duration
1	•Two-foot ankle hop. •Bilateral squat jumps •Unilateral squat jump.	3 sets x 10 reps	Rest 30 seconds between sets and 2 minutes between exercise
2	•Side to side ankle hop. •Single leg hop. • wall jumps	3 sets x 15 reps	Rest 30 seconds between sets and 2 minutes between exercise
3-4	•Jumps truck • Squat jumps. • Scissor jumps	4 sets x 10 reps	Rest 30 seconds between sets and 2 minutes between exercise
5	•Two-foot ankle hop. •Bilateral squat jumps •Unilateral squat jump. •Side to side ankle hop. •Single leg hop. • wall jumps. • Jumps truck. • squat jumps. • scissor jumps.	5 sets x 10 reps	Rest 30 seconds between sets and 2 minutes between exercise

Group B: Ultrasound therapy with neuromuscular training
(n=15) members/ consist of athletes those who received ultrasound therapy with neuromuscular training.
No of patients: 15
Study duration: 5 weeks
Treatment sessions: 4 days/weeks
Treatment duration: 40 minutes

Week	Types of Exercise	Intensity (Sets× reps)	Duration
1	•Single Leg Balance •Mini Squats •Leg Raise	3 sets x 10 reps	Rest 30 seconds between sets and 2 minutes between exercises
2	•Clamshell •Heel Slides •Bridges	3 sets x 15 reps	Rest 30 seconds between sets and 2 minutes between exercises
3-4	•Step-Ups •Wall Sits	4 sets x 10 reps	Rest 30 seconds between sets and 2 minutes between

	•Quad Sets		exercises
5	•Single Leg Balance •Mini Squats •Leg Raise •Clamshells •Heel Slides •Bridges •Step-Ups •Wall Sits •Quad Sets	5 sets x 10 reps	Rest 30 seconds between sets and 2 minutes between exercises

2. Data Analysis

Comparison of plyometric and neuromuscular training group A and B in post intervention

KUJALA scale	Mean	Median	SD	t value	P value
Post Test Group -A	87.9	87	4.0	2.428	0.0292
Post Test Group -B	91.0	91	2.8		

Group B- neuromuscular training for post intervention of Kujala scale

ROM	Mean	Median	SD	t value	P value
Post Test Group -A	100.3	95	9.5	0.4906	0.6313
Post Test Group -B	102.3	100	10.6		

3. Result

Anterior cruciate ligament injury is measured by using Kujala scale ROM and VAS. Total number of participants are (n=30). Group -A (n=15) Plyometric exercise and group –B (n=15) neuromuscular training. Before and after intervention were compared to both the groups pre and post values and it shows a significant difference. In group -B neuromuscular training (NMT) it increased and improve muscle strength, stability to enhance the athletic performances. Before started to give exercise to both the group ultrasound was given to 10 mins to subside the pain.The ultrasound was applied at 3MHz with an intensity of 1.0W/cm2 and a 100% duty cycle for 10 minutes.

Therefore, therapeutic ultrasound has been used with the aim of having both thermal and mechanical effects. Initially group -A doesn't show any improvement in range of motion the pre test value of mean is < 75 after doing a plyometric exercises In third weeks they may experienced a mild improvement in ROM of knee joint and the post value of mean is >96.3. In group – B there is a lots of improvement in range of motion within in one to two weeks itself by doing a Neuromuscular training according to the post mean value >105.3.

The KUJALA questionnaires were asked to both the groups and In group -B the pre test value of mean is <50.53. After giving a neuromuscular training it shows a moderate improvement and the post test mean value is >91.0 and the pain is reduced. When compared to group-B than the group-A and the post value of VAS and the mean is >2.8. The athletes felt free to walk. their won't be any buckling movement in knee. The plyometric training was designed to decrease the landing forces and to Increase the knee joint stability by reorganizing the lower extremity Neuromuscular control and increasing the Knee muscle strength.for grade 1 ACL injured athletes

We given a plyometric exercises and analyzed with KUJALA scale. The post test mean value is >87.93 and the standard deviations (SD) is ± 4.01. the study aimed to increase strength, power and the ability with the jump techniques.

The Study examined the effectiveness of a neuromuscular training program on increasing the flexibility and strength of athletes in order to improve biomechanical Properties related to ACL injury. According to post Intervention we comparing both the groups of ROM of knee joint is improved in neuromuscular training and the post intervention of the mean value is >105.3 The pain is reduced in group –B and the post mean value of VAS is >2.8. Following intervention, results showed a significant difference in knee flexion angles upon ($p < 0.0001$) And maximum knee flexion angles is increased ($p = 0.0275$). In addition, there was a decrease in maximum dynamic movements and recognized the importance of neuromuscular training in the modification of risk factors and supported the position.group showed an increase in strength and flexibility. The post intervention of KUJALA for both the groups ($p = .0292$).

References

[1] Duthon, Victoria Lysiane Agnes, Anatomy of the anterior cruciate ligament (research gate, Google scholar) October 2006, vol. 14, no. 3, p. 204-13.
[2] STEVEN PAUL ARNOCZKY, D. Anatomy of the Anterior cruciate ligament (Google scholar)1983.
[3] Dai Sugimoto, Gregory D. Myer, Compliance With Neuromuscular Training and Anterior Cruciate Ligament Injury Risk Reduction in Female Athletes.(research gate), December 2012;47(6):714–723.
[4] Volker musahl ,jonkarlesson Anterior cruciate ligament tear N ENGL J Med 380;24 NEJM.ORG June 13, 2019.
[5] KurtSpindler, MD and Rick W.Wright, Anterior Cruciate Ligament (ACL) Tear N Engl J Med. 2008 Nov 13; 359(20): 2135–2142.
[6] Deviandria ,Sectional adaptation and measurement properties of the KUJALA score for anterior cruciate ligament tear patient.(pubmed, research gate)November11,2021,Vol.16,No2
[7] Knee pain is totally reduced after doing a exercises (p= 0.0099).