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Enhancing Knee Flexion and Function After ACL Surgery in Hockey and Gymnastics Players: A Focus on Exercise and Swimming Therapy

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Abstract – One of these six ligaments that work on stabilizing the knee, is known as the anterior cruciate ligament (ACL). ACL injury therapy must be extensive to restore knee function and avert long-term consequences, such as osteoarthritis. This review provides an in-depth look into the post-operative rehabilitation process for athletes recovering from ACL surgery, specifically focusing on a five-phase recovery program. METHOD- This five-phase rehabilitation program was developed with the expertise of a multidisciplinary team, including orthopedic surgeons, physiotherapists, and sports conditioning coaches, and rehabilitation specialists, who work daily with ACL injury patients. The phases are designed to progressively restore knee function, with an emphasis on achieving full range of motion, strengthening, and sport-specific movements. The observation method used to improvement of angle of knee joint. PROCEDURE- The first phase, covering the focuses on pain management, swelling control, and early weight-bearing exercises. The second phase, aims to improve knee flexion and strengthen the knee with activities like squats and proprioception training. The third phase involves returning to more complex movements and light agility training. In the fourth phase focus shifts to sports-specific movements and agility drills. The final phase involves preparing for a full return to sport, with a focus on strength, flexibility, and sports-specific exercises. Rehabilitation milestones—such as knee range of motion, strength, and agility—proved to be essential in tracking progress and ensuring the athlete's readiness for return to sport. RESULT- The main goal of the rehabilitation program is for the player to return to full performance within 8 to 9 months. Rehabilitation milestones—such as knee range of motion, strength, and agility—proved to be essential in tracking progress and ensuring the athlete's readiness for return to sport. CONCLUSION- rehabilitation milestones—such as knee range of motion, strength, and agility—proved to be essential in tracking progress and ensuring the athlete's readiness for return to sport.

Keywords – cruciate, knee, rehabilitation, progression, guidelines, protocols.

I. INTRODUCTION

The ACL is an important ligament in the knee joint and can be injured by several mechanisms. The ACL, PCL, MCL and LCL are the four primary ligaments that support the knee joint—the knee as you know it. The anterior cruciate ligament (ACL) is located within the knee joint and stabilizes the knee, allowing for rapid changes of direction, twisting or pivoting. Its main jobs are to stabilize the knee and to restrain movement of a shinbone (tibia) in relation to the thigh bone (femur). Fast stops, sharp turns or collisions -- whatever the cause of your ACL knee injury, it's time to rise above it. Soccer, basketball, football and skiing are some of the most common sports that can lead to these types of injuries. Pain, swelling, instability and restricted knee range of motion are typical manifestations associated with anterior cruciate ligament (ACL) injury which can range from partial tears to complete ruptures. Treatment depends on how bad the ACL tear is and how active you are. Perhaps it contains:

Conservative treatment includes decreasing activity, strengthening the muscles of the knee through physical therapy and use of a brace to assist with stabilizing the knee.

Surgery: For some, particularly athletes or those who have more severe types of ACL injury, graft tissue from elsewhere in your body or a donor might be required for surgical repair. Arthroscopic device is mostly used for this surgery.

Healing: Whether the knee has been operated on or not, physical therapy and rehabilitation establish knee strength, motion and functional stability.

II. RELATED WORK

According to Recent study in India. The survey was completed by 135 surgeons. 35 percent of them have experience spanning more than 12 years. 35.5% of surgeons came from government - funded academic institutions. Clinical evaluation (94.8%) was the most frequently used factor in surgery decision-making.

Hamstring tendon was the most popular graft (94%), while the most popular fixation techniques were interference screws on the Tibia side (80%) and suspensory fixation on the femur side. According to this poll, almost two thirds of surgeons brace the ACL graft during the early healing process.

III. METHOD AND MATERIAL

In this research paper, the observational method was employed to study the rehabilitation progress of 10 to 12 athletes at the Kolkata NCOE Centre who have recently undergone rehabilitation for ACL injuries.

The total number of individuals involved in the rehabilitation period of 8-9 months for an ACL injury includes:

- Doctor
- Physiotherapist
- Strength and Conditioning Coach
- Senior Coach
- Biomechanics Specialist

Post operation 1st week treatment of the acyl knee injury

Figure 1: No movement

"After the surgery, there is no movement of the knee; only medication, dietary restrictions, and icing are recommended to reduce knee swelling."

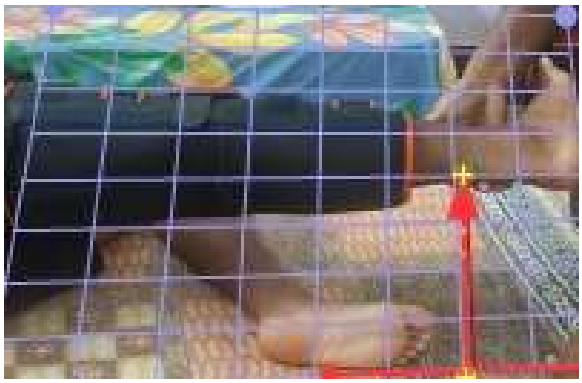

Figure 2: Elevation of Leg

"After 2-3 days, attempt leg elevation in different directions: forward, sideways, and gently press a towel below the ankle and after 2 weeks below the back side of knee also."

IV. DESCRIPTION

Post Operation Time Period Divided in **Five phases** for full rehabilitation.

4.1 Third to eight Weeks (3rd – 8th weeks)

Target of 1st phase-

- Achieve knee flexion Range of motion 0° degree to 90° degree.
  - Full passive extension
  - Control post-operative pain/swelling
  - Early progressive weight bearing
  - Active therapeutic exercise program

Treatment –

- Leg raises 30 repetitions
- Leg raise right and left 30 repetitions
- Hip abduction movement (12 inches leg raise) 10 repetition
- Active flexibility/ active-assisted 45° degree exercise
- Less use of brace locked at 0° degree
- Bilateral weight bearing
- Upper extremity cardiovascular exercise included
- Cryotherapy (quarter in a day)
- Progressive weight bearing

4.2 Nine to fifteen weeks (9th -15th weeks)

Target of 2nd phase –

- Achieve knee flexion Range of motion 0° degree to 140° degree
  - Full active flexion and extension
  - Ameliorate the pain/swelling
  - Full body weight bearing without brace
  - Patella mobility exercises
  - Active therapeutic exercise program

Treatment –

- leg curl and leg extension with 500 gm weight
- Half squats (only 90°)
- Proprioception training with the help of (BOSU ball/Therapeutic band/prop board)
- Hip, Hamstring and Calf flexibility exercise
- 10 min jogging on treadmill (6 level)/cycling/running on grass

4.3 Sixteen to Twenty-four weeks (16th -24th weeks)

Target of 3rd phase –

- come back to full range of movement
  - Improve lower normal balance and flexibility movement
  - Mild lower strength with light weight
  - Ascending and descending movement with fine leg control without pain
  - Light Agility movement

Treatment-

- From this week will GYM will be added
- Half squats (up to140°) with pain free movement
- Leg flexion and leg extension on machine with gradual increase weight
- 15 min running
- 20 min Swimming
- Balancing exercises on BOSU ball/Therapeutic band/prop board i.e. stand for a min both leg, one leg, squat with balancing etc.
- Use swill ball for core stability

- Light to medium agility training on grass field

4.4 Twenty-five to thirty first weeks (25th - 31st weeks)

Target of 4th Phase-

- achieve basic movement in the individual's sports
  - Lower leg balance and flexibility movement with Thera band/resistance band
  - Maximize strength and flexibility as to meet demands of activities of daily living
  - Unconscious Ascending and descending movement without pain
  - Agility movement in drill

Treatment-

- Unconscious fine movement on field
- Half squats with full range of movement pain free
- Leg exercises in Gym i.e. leg curl, leg extension etc.
- 20 min slow continuous running / 30 min swimming
- Agility training & movement exercise (shuttle run, zig-zag run, high knee and back kick run etc.)
- Core stability exercise with Swiss ball (free core exercise plank, V-hold etc.)
- Balancing exercises on BOSU ball/Therapeutic band/prop board three day in a week

4.5 Thirty second to thirty-nine weeks (32nd to 39th weeks)

Target of 5th phase-

- Return to Sports with fine movement
  - Absence of apprehension during sports-specific movement
  - Isokinetic exercise with game specific
  - Optimize Strength and flexibility to meet the demands of an individual's sporting activity.

Treatment-

- Plyometric exercise i.e., box jump, single & double leg jump etc.
- Running, sprinting movement with different direction.
- Hockey and gymnastic sports specific movement with equipment.
- Playing the match up to 10 minutes in hockey
- Event Perform on beam and soft/balance landing in gymnastics
- Core stability exercise, Balancing exercises and strength exercise will continue simultaneously thrice in a week.

NOTE - *"In the 4th and 5th phases, muscle soreness is prevalent, necessitating the utilization of recovery techniques such as ice baths, massages, and stretching to achieve complete body recovery."*

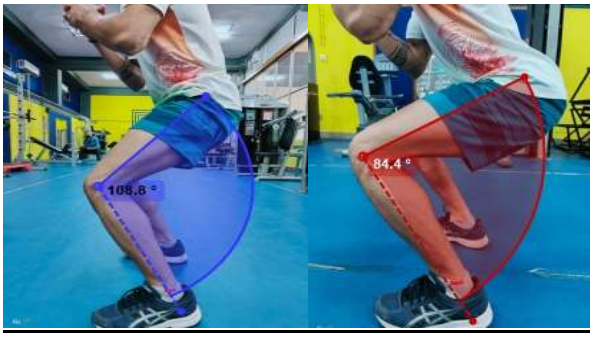

Figure 3: Free weight squat

Figure 4: Swiss ball for stability movements

Figure 5: Isokinetic movement in Gym

Figure 6: Leg curl with increasing load

V. RESULTS AND DISCUSSION

Following ACL reconstruction, emphasis on rehabilitation has moved from protocols to progression and incremental advances in difficulty. The rehabilitation specialist must consider the stresses applied on the healing ACL graft and patellofemoral contact pressures created by some exercises and activities. The early goal should be to minimize edoema, build up the quadriceps, and regain complete knee extension. Rehabilitation exercises should be conducted in

multiple locations and added to and made more difficult consistently. Neuromuscular training as a part of the rehabilitation protocol ought to be started when it is considered allowed. As a consequence, you must progress nicely during the treatment. Objective measures, rather than date of return to play, should be used in the evaluation of ACL rehabilitation. Rehabilitation interventions have to be frequently modified by the professional expert who works with the patient and only challenging exercises are selected for a particular patient's treatment. Achieving objective criteria at the time of RTP cannot only minimize risk of second injury, it would prevent other injuries. By now we all know that this change has been under way for more than nine months. The level and duration of sports participation should be decreased after rehabilitation. Although the program produced some promising results, it's also worth noting that everyone recovers from ACL surgery differently. Factors such as age, pre-accident fitness level and the extent of the injury might influence recovery time. This heterogeneity emphasizes the importance of regular monitoring of athletes in all stages of recovery to ensure they are progressing at the appropriate rate. Athletes had objective rehabilitation milestones such as knee mobility, strength and agility to track their progress and ensure they were ready to return to play.

VI. CONCLUSION

In conclusion, this review underscores the complex challenges and recent advancements in ACL injury management and treatment, with a particular focus on the importance of biomechanical understanding, graft material selection, and emerging techniques such as bridge-enhanced repair. It is clear that continued collaboration among researchers, medical professionals, physiotherapists, and sports conditioning coaches is crucial to improving the long-term outcomes of ACL injuries and rehabilitation protocols. To reduce the risk of re-injury, it is essential that objective rehabilitation milestones are met before an athlete returns to sport. More than eight months of recovery are typically required to achieve sufficient healing, with a structured return-to-sport progression necessary for minimizing further damage. In the post-rehabilitation phase, managing the volume and intensity of athletic activity is critical to avoid overloading the knee joint before full recovery is achieved. ACL injuries demand significant attention and a comprehensive rehabilitation approach to restore knee function, alleviate pain, and lower the risk of future complications, such as osteoarthritis. By adhering to tailored rehabilitation strategies, athletes can optimize their recovery and safely return to their sports activities.

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