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THE EFFECT OF INTENSIVE PHYSICAL THERAPY ON THE RECOVERY OF CRUCIATE LIGAMENT INJURIES IN PROFESSIONAL ATHLETES

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ABSTRACT

Anterior cruciate ligament (ACL) injuries represent a significant challenge for professional athletes due to their intense physical activities. Intensive physical therapy is an essential part of the rehabilitation program after surgery for cruciate ligament injuries. This research aims to study the effect of intensive physical therapy on the speed and efficiency of recovery in professional athletes with cruciate ligament injuries.

We explore how an intensive physical therapy program can improve recovery rates and enhance athletic performance after injury.

The research will show that intensive physical therapy is an effective tool in treating cruciate ligament injuries, and I emphasize the importance of including it as part of a comprehensive rehabilitation protocol for athletes.

When this strategy is applied in sports rehabilitation programs, better results and a faster return to sports activity are achieved.

KEYWORDS

Physical Therapy, Anterior cruciate ligament (ACL), athletic performance after injury.

INTRODUCTION

Chapter One

Introduction and the Importance of the Research

This research is one of the modern scientific attempts to emphasize the importance of intensive physical therapy on recovery and the impact of various rehabilitation movements aimed at prevention and rehabilitation for professionals.

In the world of competitive sports, cruciate ligament injuries are among the most dangerous injuries that professional athletes can face.

Intensive physical therapy for athletes: The scientific field that deals with the treatment of sports injuries, returning the player to his position and the injured part to the condition before the injury that he was practicing and reducing the occurrence of new injuries.

The impact of intensive physical therapy for athletes is that the doctor and paramedic can now know the injury and warn him so that he does not get it.

Physiotherapist: A person experienced in medical sciences, mechanical movement of the body in addition to the physiology of the body, sports anatomy, and first aid, and all of these sciences are based on a foundation and global studies.

The physical therapist must have sufficient information about the cruciate ligament injury to be able to have a

strong foundation and base in order to treat the injured person with confidence.

These injuries occur as a result of sudden, forceful movements that exceed the ligaments' ability to withstand, such as twisting, incorrect landings, and jumps.

The anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) are among the most important ligaments that support the stability of the knee joint, and any damage to them can lead to a loss of functional stability of the knee and a negative impact on athletic performance (1).

Intensive physical therapy has become a mainstay in the rehabilitation of athletes with these injuries, as it aims to achieve a complete and rapid recovery that enables players to return to competition at their best.

This treatment includes a series of exercises and rehabilitation programs specifically designed to enhance muscle strength, improve flexibility, and restore the normal function of the damaged joint.

In this context, the current research aims to explore the positive effects of intensive physical therapy on the recovery of cruciate ligament injuries in professional athletes.

By reviewing the available scientific studies and analyzing clinical studies, the tangible benefits of this therapeutic approach will be highlighted, including

reducing periods of absence from the stadiums, improving athletic performance, and reducing the risk of recurrent injuries.

The effect of physical therapy plays an important role in treating athletes' injuries until they recover:

The therapist is based on knowing the causes, as he determines the defect in the mechanical relationships of the body that lead to the injury, and through exercises and applying them to the injured person, the player returns to his original function. These exercises are post-operative.

Moving a lot after the injury or operation does not benefit the player and does not help him recover because the injured ligament is due to swelling or scars resulting from the operation, and the patient feels severe pain and an inability to move the limb and use it from the pain.

This is why exercises play a fundamental role in avoiding this problem, as they start with low intensity, then we increase the intensity of the exercises to help move the injured area, and strengthen the surrounding muscles without too much so that the pain is not felt.

Physiotherapy plays an important role in the healing process. It is actually performed before surgery and continues for a year after the operation. It helps strengthen the muscles around the injury to give the

organ greater stability and restore its normal movement.

The research will also address the challenges that may face the application of intensive physiotherapy, such as athletes' commitment to treatment programs, providing the necessary resources and equipment, and coordination between the medical and athletic teams to achieve the best possible results.

Ultimately, this research aims to provide practical, evidence-based recommendations to improve intensive physiotherapy strategies and enhance their effectiveness in the recovery of cruciate ligament injuries, which contributes to improving the health and performance of professional athletes.

The Research Problem

It may be to achieve a deep understanding of how intensive physiotherapy affects the recovery period and its effectiveness in treating cruciate ligaments in professional athletes, and to test whether intensive physiotherapy protocols actually contribute to improving recovery outcomes in a significant way compared to traditional protocols.

In detail, it may include:

1. Evaluating the time period required for recovery among athletes who receive intensive physiotherapy versus athletes who receive traditional physiotherapy.

2. Studying the rates of relapse or re-injury after recovery.
3. Measuring the level of athletic performance after returning to sports following treatment.

Objectives of the research The aim will be to develop a comprehensive understanding of how physical therapy protocols enhance optimal rehabilitation for ACL injuries and to help health professionals make informed decisions about the best treatment methods and practices for athletes. Evaluate the effectiveness of intensive physical therapy programs in improving knee function after ACL injury. Measure the speed of recovery of professional athletes and their return to sports activity after intensive physical therapy. Identify factors affecting the success of intensive physical therapy in cases of ACL injuries. Research hypotheses the research will be implemented using a quasi-experimental methodology that includes a sample of professional athletes who have suffered ACL injuries. Participants will be divided into two groups: Sample division: Participants were divided into two groups: Experimental group: Underwent an intensive physical therapy program for six months. Control group: Underwent a traditional physical therapy program for six months.1- Therapeutic programs, intensive physical therapy programs: Intensive: Includes daily sessions ranging from 60-90 minutes, including strengthening exercises, flexibility exercises, balance exercises, and aquatic therapy. Strength and flexibility training:

exercises to improve strength and flexibility in the thigh and leg muscles. Electrotherapy: using electrical stimulation techniques to improve healing and relieve pain. Manual therapy: massage and manipulation techniques to improve movement and reduce stiffness. Balance and coordination exercises: exercises to improve balance and prevent future injuries.2- Traditional: involves weekly sessions of 30-45 minutes, focusing on core exercises and flexibility. Research areas:

Study sample: 50 professional athletes who suffered cruciate ligament injuries and underwent ligament repair surgery were selected.

1. Spatial scope: Isfahan Sports Club / Islamic Republic of Iran.
2. Temporal scope: From 2/1/2023 to 8/1/2023.

Chapter Three

The research will be implemented using a quasi-experimental methodology that includes a sample of professional athletes who suffered cruciate ligament injuries. The group consists of (50) players, (40) intensive physiotherapy, (10) traditional physiotherapy, and the duration is (8) weeks. The participants will be divided into two groups:

Experimental group: will receive an intensive physiotherapy program.

Control group: will receive a traditional physiotherapy program.

The treatment is divided into therapeutic programs:

1. Intensive physical therapy:

Strength and flexibility training: Exercises to improve strength and flexibility in the thigh and leg muscles.

Electrotherapy: Use of electrical stimulation techniques to improve healing and relieve pain.

Manual therapy: Massage and manipulation techniques to improve movement and reduce stiffness.

Balance and coordination exercises: Exercises to improve balance and prevent future injuries.

2. Traditional physical therapy:

General training: Light exercises to improve general movement and strength.

Ice therapy: To reduce swelling and pain after surgery.

Home exercises: Simple exercises that the patient can do at home to improve movement and healing

First: Intensive physical therapy

Strength and flexibility training:

Physical therapy aims to improve muscle strength, flexibility, and balance and improve movement and daily vital functions.

It also helps reduce pain and improve overall quality of life.

A comprehensive approach to improving the patient's quality of life, increasing their independence and improving their overall well-being.

Training the exercise of raising the legs together to the side is more effective for strengthening the thigh muscles, and this method is the best way to achieve complete balance for the body.

The exercise begins by standing straight, then lifting one of the legs straight forward, then backwards or to one side of the body.

To improve these exercises, we lift the legs while standing, from the movement of the hip joint, and flexibility increases in this method more than other methods by recovering in this exercise.

When doing the leg lift exercise in the case of recovery or treatment, if you have been exposed to an injury to one of the cruciate ligaments or have undergone surgery in the thigh, knee, or ankle, you benefit from the leg lift exercise as one of the physical therapy procedures to help recover completely and improve the strength of the lower limbs and thus help improve the ability to walk.

This treatment aims to rebuild the anterior cruciate ligament and the strength of the thigh muscles to a large extent. Finding a solution to prevent energy is of great importance.

The purpose of this study was to investigate the effect of eight weeks of cross-training on quadriceps strength in professionals after anterior cruciate ligament reconstruction. Methods: 16 patients with a mean age of 28.02 ± 1.55 years and a mean weight of 71.7 ± 7.15 kg who suffered from anterior cruciate ligament rupture were selected and divided into two groups, experimental and control. In addition to physical therapy exercises, the experimental group performed cross-training with the healthy leg for eight weeks, three sessions per week, each session lasting 20 minutes, and the control group performed their own physical therapy exercises only. Three days before ligament reconstruction and after nine weeks and 24 sessions of cross-training, the quadriceps strength of both legs of patients at a 60-degree angle was measured using the Biodex isokinetic device. Data were tested using the Student's T-test at a significance level of $p < 0.05$. Results: The results showed that after eight weeks of intensive cross-training, the strength of the quadriceps muscle of the healthy leg in the subjects in the experimental group was high. Significantly ($p = 0.002$). Also, the rate of reduction in the strength of the quadriceps muscles after ACL reconstruction was significantly lower in the experimental group

compared to the control group ($p = 0.001$). Conclusion: These therapeutic exercises can increase the strength of a healthy body and also prevent a significant decrease in the strength of the body that underwent surgery.

Electrotherapy: Using electrical stimulation techniques to improve healing and relieve pain:

People mistakenly think that the therapist is still using the traditional method such as (exercises - manual equipment - the therapist's experience only) because, with the advancement of science and technology, there are benefits of electrotherapy that you did not know about due to the amazing development witnessed by physical therapy in the use of the latest technologies in treatment (2)

The importance of electrotherapy becomes in its ability to stimulate paralyzed limbs by stimulating specific electrical impulses, and when this technique is linked to intensive physical therapy, the effects of treatment appear good and vary on those suffering from paralysis injuries throughout the body (3)

Applying electrotherapy aims to eliminate pain and muscle weakness and improve body functions. Physical therapy and rehabilitation, the most important branch of medicine, is concerned with the whole body. Physiotherapy and rehabilitation is a branch that is directly related to areas such as back and neck pain, joint pain, stroke, stroke paralysis, spinal cord injury,

Parkinson's disease and multiple sclerosis rehabilitation, rheumatic rehabilitation, orthopedic rehabilitation, professional sports health, and cruciate ligament regeneration.

Electrotherapy is not a standalone treatment. It operates in harmony with other branches of medicine, providing support and complementing their efforts. This collaborative approach ensures that patients receive comprehensive care that is tailored to their specific conditions and physical abilities.

Intensive rehabilitation physiotherapy, with its focus on electrotherapy, is designed to alleviate patients' pain, restore the function of impaired ligaments, and expedite recovery post-surgery. This approach instills hope and optimism in patients, assuring them that their condition is manageable and their recovery is within reach.

Electrotherapy is a vital healing method in physiotherapy and rehabilitation applications (4).

What is electrotherapy how much is it used in physical therapy, and how beneficial is it in the cruciate ligament:

Electrotherapy, which is a very common treatment, is used to increase blood circulation in chronic or acute painful diseases, to relieve muscle spasms, reduce and eliminate edema, and to create a pain-relieving effect in the knee joint.

A low-intensity current is given directly to the area of the body (knee) to be treated with electrotherapy, which stimulates the sensory nerves and prevents them from bearing pain.

Usually taking 20-30 minutes, electrotherapy, which must certainly be applied by a specialist doctor and a physiotherapist, is used for muscles that do not work at all, muscles that work but cannot work fully, and pains that occur in different parts of the body.

The purpose of applying electrotherapy is to eliminate pain and muscle weakness and improve body functions.

For this purpose, electric currents of different and different frequencies are used.

The difference in the electrical potential of the ions, which tends to move from high intensity to low intensity, again creates electrical energy that allows the ions to move.

Considering the conductive properties of biological muscles and nerves, the resulting electrical energy gives vitality to the area applied with electrotherapy.

However, due to the presence of many variable variables, the electrotherapy method must be applied by specialists to obtain the correct result.

Simple electrical currents and complex functional simulation (simulation) applications are performed with electrotherapy devices.

Dozens of current and muscle simulation applications that stop pain are performed with electrotherapy devices.

The therapeutic use of ultrasound and laser increases the success of the treatment.

Whirlpool baths added to electrotherapy, sound waves and magnetic field treatments can also be used in physical therapy and rehabilitation applications.

Functional electrical stimulation:

FES: is electrical stimulation of the nerve that is treated through the skin using electrical currents from a nerve stimulator for therapeutic purposes.

The TENS device delivers the full range of currents delivered to the skin to stimulate nerves, although the term is often used with a narrower intent to describe the type of pulses produced by portable stimulators used to relieve pain.

The device usually delivers the pulse to the skin using two or more electrodes of conductive gel.

Battery-operated TENS units can modify the pulse width, frequency, and intensity. In general, TENS is delivered at a high frequency (>50 Hz) with an intensity less than the intensity of muscle contraction or at a low

frequency (<10 Hz) with an intensity that produces muscle contraction.

The use of TENS has been shown to be effective in clinical studies, but there is controversy over the conditions for the device's use for therapeutic purposes (5).

Also known as: The application of electrical stimulation to create functional movement in muscles that lack neural control.

In FES systems, the nerves that supply the muscles are stimulated, not the muscles.

In which cases should electrotherapy not be used?

The treatment cannot be applied in patients who do not show sufficient cooperation and in cases where skin sensitivity is lost, as the effectiveness cannot be determined and the dose adjusted.

It can also not be applied in case of loss of skin continuity in the application area.

Manual therapy: Massage and manipulation techniques to improve movement and reduce stiffness

What is Manual Physiotherapy?

The duration of treatment for a cruciate ligament tear is usually 6-9 months after surgery, and sometimes the patient needs 12 months to fully recover.

Manual physiotherapy must be used for recovery, strengthening the movements of the patient's joints, and relieving muscle tension to enable the patient to move freely and without pain.

Reciprocal treatment so that it can provide relief to patients in treating joint problems such as (knee joint weakness, chronic back pain, acute back pain resulting from soft tissue injuries, back muscle tension, and ligament contracture (6).

When starting intensive clinical manual physical therapy after drug treatment for the ACL, it is with continuous rehabilitation therapy for up to weeks, and the physical therapist performs exercises, which you do under continuous supervision or at home.

Rehabilitation works to reduce pain, swelling, restore full range of motion to your knee, and strengthen your muscles.

This course of physical therapy may help successfully treat an ACL injury for individuals who are relatively inactive, or people who participate in moderate exercise and recreational activities, or who play sports that put less stress on the knees.

Some massage techniques can be part of the rehabilitation program after an ACL injury:

1- Lymphatic massage helps reduce swelling and inflammation around the injured area.

2- Deep tissue massage: aims to relieve tissue adhesions and improves blood circulation to promote healing.

3-Quadriceps and calf muscle massage: This helps maintain the flexibility of the muscles surrounding the knee and supports the recovery of the ACL.

4- Gentle stretching exercises are not massage exercises in themselves, but they help maintain the flexibility of the surrounding tissues and prevent the knee from stiffening. These exercises are for (8) weeks at a rate of (30) minutes per day in the form of (3) minutes and a minute of rest for the experimental group, and it is essential to rehabilitate under the supervision of a specialist to ensure that the exercises and massage are performed correctly and safely.

Balance and coordination exercises: exercises to improve balance and prevent future injuries: Physical therapy is an element of rehabilitation consisting of sports exercises and massage of body parts with a focus on (back-upper arms-legs). Physical therapy strengthens the function of joints and muscles in general and helps injured people recover (standing, balancing, walking, climbing stairs better). Physical therapy techniques consist of the following:

1- General range of motion exercises.

2- Exercises to strengthen the body's muscles, especially the injured part, to help recovery.

3- Exercises to coordinate and balance the body and stand correctly.

4- Exercises to stroll (walking) and then speed up a little.

5- Exercises to adapt to the body in general.

6- Movement training (mobility) (6).

We take from them coordination and balance exercises: These exercises help people who suffer from problems with imbalance, coordination of body movements, and balance, and motor coordination exercises aim to help people perform specific movements only. The exercise of repeating functional sports movements is used to move more than one joint and one muscle at a time, such as lifting things or holding a part of the body. Balance exercises are initially performed using parallel bars, with the therapist standing directly behind the patient. The patient moves his body by transferring his weight between the right and left legs in a swaying motion. When the patient safely completes this exercise, the weight can be transferred between the front and back.

The second control group:

This group receives traditional physical therapy:

Traditional physical therapy consists of some exercises, some of which are:

General training: light exercises to improve general movement and strength.

Ice therapy: to reduce swelling and pain after surgery.

Home exercises: simple exercises that the patient can do at home to improve movement and recovery

There are also some controls. The motor control theory refers to the organization of mechanisms attributed to movement.

Motor control theories include the traditional hierarchical theory.

This theory describes motor control as a rigid process in which the central nervous system acts as a command center, including the motor cortex, which inhibits lower centers and regulates movement.

In contrast, the dynamic, environmental, and systems theory focuses on motor control as a function of the interaction between multiple factors (7).

The theory based on integrated systems describes that the execution of the motor task is determined by the characteristics of the task and the environmental characteristics.

The following are guidelines on the theory of movement for those with cruciate ligament injuries:

1. You should start after surgery by moving the knee directly a little, with the instructions given to you by the doctor after the operation. (8):

Not moving the knee does not reduce pain; on the contrary, it leads to muscle atrophy, slowing the recovery of normal knee function.

2 . Use weights initially (the first week) in a gradual, light, and controlled manner to the extent that each injured person can bear individually, taking into account any instructions the therapist gave regarding surgery.

3 . The injured person can perform open movement exercises to recover from the injury within a specific range of motion (90° - 45° of knee flexion) from the beginning of the fourth week after the surgery without compromising the knee's stability. It is necessary to be monitored by doctors, and the injured person should monitor the symptoms of pain in the front part of the knee, adjust the load and the weight on the knee, and progress in strengthening it within that.

4. It is necessary to use exercises for the thigh muscles that are equal in size (in the fixed contractions of the quadriceps muscle and exercises to raise the leg with it straight), which produces a slight effect on the recovery from knee flexion faster. This exercise does

not affect the strength of the quadriceps muscle; it is possible to start these exercises during the first two weeks after surgery without compromising the integrity of the patch. 5- The exercise begins with pressing the legs (the patient moves his body with an exercise by pushing his weight away from him using the legs together). Early can start (three weeks) after surgery for patients who have a patch of the hamstring muscles, using a functional pattern similar to the half squat (0° - 45°) to improve the strength of the quadriceps muscle, the hamstring muscles, functional activities, and self-function, you must monitor the pain in the front of the knee, with a gradual increase in the load on it according to the situation of the pain.

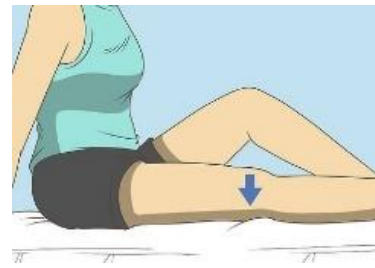
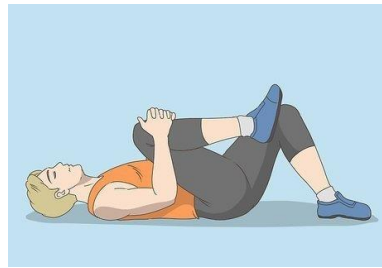
We start with traditional exercises.

First: General training

Light exercises to improve general movement and strength

1-Flexibility exercise: Lie on your bed, pull your knee towards your chest, clasp your hands behind your knee, relax your leg, and allow your heel to drop. You will feel the muscles stretching in front of your knee.

Stay in this position for a few minutes or as long as possible; repeat this exercise (5 times) a day.



2- Quadriceps strengthening and stretching exercise:
Sit on the bed and extend your leg.

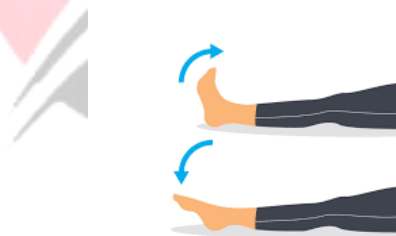
Tighten the thigh muscle by gently pushing the back of your knee into the bed.

Hold for 5 seconds, and then relax. Repeat this (10 times, three times) a day.

The same exercise can be performed with a towel rolled up in a cylindrical shape under the knee.

3- Ankle exercise: Move your foot up and down by contracting the shin and calf muscles. Repeat for (2 to 3 minutes) (2 to 3 times) per hour or more.

For another ankle exercise, place a towel rolled in a cylindrical shape under the ankle. Then, extend the leg, pull the foot up, and press down as much as possible until you feel tension in the muscles. Hold this position for 10 seconds, then relax and repeat the exercise 10 times.



4- Heel sliding exercise: Lying on your back, extend your leg on the bed. Then, slowly bend your knee as much as possible at an acceptable angle. Hold this position for a count of 3. Then, gently move the heel down and let it slide slowly, making sure that the knee returns to a completely straight position after each repetition. Repeat ten times, twice a day.

Second: Home exercises: The patient can do simple exercises at home to improve movement and recovery.

Cruciate ligament exercises: They are essential in increasing the success rate of the operation by increasing muscle strength and increasing the range of motion of the cruciate ligament. Resistance exercises

can be added gradually; here are some home exercises that the injured person can perform:

1- Raise the heel of the foot: This exercise is done by focusing one hand on the back (back) of the chair to



increase balance, then slowly gradually raising the heel of the foot in place of the injured knee and standing on the tips of the toes while maintaining this position for a period ranging between (5-10 seconds), then return the heel of the leg to ground level.



2- Straight leg raising exercise: The exercise involves lying on the back completely, with the legs extended on the ground, raising the injured leg up for a few seconds, returning the leg to its position, and repeating the process several times.

3- Knee flexion exercise with stretching: This exercise is done by stretching on the abdomen and stretching the legs straight, then bending the knee, with the help of the therapist, moving the heel of the foot towards the buttocks, and maintaining the position for a period of (5 seconds), and repeating several times.



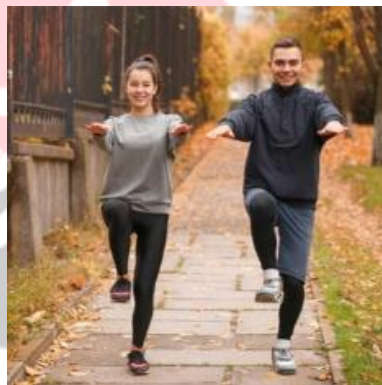
4- Single squat exercise: This exercise is started by standing straight with your feet shoulder-width apart, slowly bending your knees while lowering your hips to

form an angle of (54 degrees), maintaining this position for (5 seconds), and repeating this exercise several times.



5- Step climbing exercises: You should do this exercise using a step or chair to climb on, and this is done by raising the injured leg on the chair or step, then bending the knee, and going down.

6- Standing on one leg: This exercise is done by raising the uninjured leg to the ground and standing on the injured leg for (10 seconds).



RESULTS

The results indicate that intensive physical therapy plays a crucial role in the recovery from ACL injuries in professional athletes. The results showed that athletes receiving intensive physical therapy had greater improvements in muscle strength and joint stability and returned to sports faster than those receiving conventional treatment, and the rates of recurrence of injury were expected to be reduced due to the

improvements gained from intensive therapy. Improvement in physical performance: The experimental group showed greater improvement in the ability to return to full sports performance than the control group. Recovery duration: The average recovery period in the experimental group was four months compared to 6 months in the control group. Reduction in pain: The experimental group reported lower pain levels during and after rehabilitation.

Flexibility and strength: Significant improvements in knee flexibility and strength were observed in the experimental group. The study "The Effect of Intensive Physical Therapy on the Recovery of Cruciate Ligament Injuries in Professional Athletes" showed that the benefits in the field of sports medicine lie in the following points:

1. Improving recovery outcomes: Intensive physical therapy can reduce recovery time and improve knee functional outcomes, allowing athletes to return to their pre-injury athletic performance more quickly and safely.

2. Innovative treatment strategies: The study provides a deeper understanding of which therapeutic practices are effective, contributing to the development of new techniques or improvement of existing strategies in physical therapy.

3. Cost and efficiency: If intensive physical therapy is found to have positive effects, this could lead to a reduction in the overall costs of treatment by reducing the number of sessions required or shortening stays in medical facilities.

4. Quality of life for athletes: Since cruciate ligaments are common injuries among athletes and can significantly impact quality of life, improving recovery processes means improving the overall well-being of athletes.

5. Preventing future injuries: Understanding how intensive physical therapy affects the ligaments can lead to better strategies for preventing recurrent injuries.

6. Research and clinical application: Research enhances and supports clinical knowledge, leading to better training of medical professionals and improved quality of healthcare for athletes.

7. Mental health of athletes: ACL injuries can be frustrating and cause anxiety about the future of sport; rapid and effective recovery can help mitigate these negative psychological effects.

CONCLUSION

Last but not least, elite athletes who suffer cruciate ligament injuries fare much better after undergoing rigorous physical treatment. In addition to hastening recovery, the regimen's structure and rigor aid in restoring the damaged limb's strength and functionality. Researchers have shown that compared to athletes who adhere to conventional rehabilitation methods, individuals who undergo intense physical therapy recover more quickly and have a decreased chance of re-injury. Consequently, elite athletes with cruciate ligament injuries should consider intense physical therapy a crucial part of their recovery plan.

RECOMMENDATIONS

1- Encourage sports teams and treatment centers to adopt intensive physical therapy programs as part of rehabilitation protocols after ACL surgery.

2- Conduct further research to identify best practices and develop personalized treatment protocols that suit the different needs of athletes.

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