

# **The Effect of Rehabilitative Exercises in Improving Range of Motion and Muscular Strength for ACL Patients after Surgical Intervention**

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## **Abstract**

The importance of the research the importance of the research lies in seeking to adopt development and modernity when using rehabilitation exercises in a manner appropriate to the type and extent of injury to the muscle groups working on the knee joint.

Either the research problem: After looking at a lot of studies and research, as well as visiting many hospitals and physiotherapy centers, it was found that there are a large number of people with cruciate ligament severing and the restriction in the movement of the knee joint and a feeling of instability in the joint caused by this injury. To the inability to move the joint and engage in normal activities, it is obvious that such an injury that needs surgical intervention in turn needs a rehabilitation process to restore the normal position of the knee joint, it is necessary to study the effect of rehabilitation exercises that have an impact on the range of movement and muscular strength.

## **Research aims**

1. Preparing rehabilitation exercises to improve range of motion and muscle strength for patients with anterior cruciate ligament rupture after surgical intervention
2. Knowing the effect of rehabilitation exercises for patients with anterior cruciate ligament rupture after surgical intervention

## **Research hypotheses**

1. There are statistically significant differences between the results of the pre and post tests for both the experimental and control groups.
2. There are statistically significant differences in the post tests between the experimental and control groups.

## **Research areas**

**Human field:** Patients with anterior cruciate ligament rupture in the knee joint in Al Wasta Teaching Hospital.

**The time frame:** for the period from (1/30/2021) to (5/4/2021).

**Spatial domain:** Al-Wasiti Teaching Hospital.

## **Research methodology and field procedures:**

### **Research Methodology**

The experimental approach was used to design the experimental and control groups because it is the best in obtaining accurate results and allows direct and accurate observation of the research sample.

### **Research community and sample**

The research community was represented by patients with an anterior cruciate ligament cut in Al-Wasiti Teaching Hospital for Reconstructive Surgery (50%) of the community of origin.

### **Research tools**

- ✓ A camera for photography.
- ✓ Electronic balance.
- ✓ Record
- ✓ Pencil
- ✓ Tape measure
- ✓ Dynamo meter
- ✓ Laptop
- ✓ Bed
- ✓ Table

### **Field Research Procedures:**

#### **Define search variables:**

To determine the variables of the research, the researcher made field visits to some hospitals and rehabilitation centers and conducted interviews with several doctors with experience and specialization \* and approved the diagnosis of the improvement of the morbid condition, the doctors' experience, and obtained statistical results for the research that depend on the numbers and for the purpose of choosing what suits the condition of the injured To be the focus of the rehabilitation program to improve the condition of the injured and to know the differences resulting from the application of the rehabilitation approach, and after asking them, the researcher found that the most important thing the injured needs in the rehabilitation stage is to improve strength and range of motion for such an injury, and therefore the prepared rehabilitation program contains tests to measure strength and The range was presented to a group of experts with expertise and experience \*\* and confirmed the validity of the work.

#### **Muscular strength tests:**

**First position:** sitting - bending the leg

**Objective:** To measure the strength of the anterior thigh muscles from a flexion position.

**Devices used:** dynamo meter - paper - pen.

**Description of the test:** The laboratory sits on a bench with a height of (1) meter, where the back is straight, the arms are on the side of the body, and the injured leg is in a natural flexion position. From the injured person pulls the injured leg up while it is bent and as hard as possible while tightening the quadriceps muscle and the reading of the device is recorded. The test is repeated three times and the best reading is taken.

**Recording:** The best reading of the device is taken.

**The second position: sitting - stretching the leg.**

**Objective:** To measure the strength of the anterior thigh muscles from the tide position.

**Devices used:** dynamo meter - paper - pen.

**Description of the test:** The laboratory sits on a bench with a height of (1) meter. The back is straight, the arms are on the side of the body, and the injured leg is in the natural flexion position. The ring connected to the device is fixed in the affected leg in the knee joint area, and the device is firmly attached to the ground and asks From the injured, the injured leg is pulled up and in front of the body, with an emphasis on that the leg is fully extended and with the maximum force possible, while the thigh muscle is tightened, and the reading of the device is recorded. The information is repeated three times and the best reading is taken.

**Recording:** The best reading is taken by the device

**Knee joint range of motion test:**

**The first position:** measuring the range of motion from the lying position - flexion.

**Objective:** To measure the range of motion of the knee towards the front.

**Tools used:** laptop - Kinova program - camera - paper - pen - bed.

Description of the test: The laboratory lies on the bed with both legs extended, and the selector renews the phosphorous points on the affected leg, and the first point is in the pelvic articulation area. The second point is on the knee joint, and the third point is on the side of the torso, which the specialist determines, and all these points are on the side of the joint. The patient pulls the injured leg by bending it and trying to put it to the closest distance to the chest and one of his arms with the thigh straight, and The reading is recorded to the nearest angle degree, noting that “the test was in two stages (before me 0 after it)”, as the researcher will adopt this test to find out the development in the range of motion of the knee joint, as the greater the angle Significant evidence of low range of motion of the knee joint and vice versa.

**Recording:** The angle between the injured leg's thigh and the torso is calculated.

**The second position:** measuring the range of motion from the position of prone - flexion.

**Objective:** To measure the range of motion of the knee towards the back.

**Tools used:** laptop - Kinova program - camera - paper - pen - rug.

**Description of performance:** The casualty lies on the ground with both legs extended, and the tester determines the phosphorous points on the affected leg and the first point is in the pelvic articulation area. The second point is on the knee joint, and the third point is on the ankle joint, and the specialist determines it, and all these points are on the side of the joint, then the affected leg is bent towards the back muscle of the thigh and the second leg is extended, and one of the arms is extended with the leg straight The right one and the other with the amount of back-leg that the casualty can reach. One axis of the knee joint is measured, which is flexion. In addition, the injury of the cruciate ligament affects the flexion movement of the knee joint, as well as the working muscles, especially the quadriceps.

**Recording:** The angle between the thigh of the injured leg and the leg is calculated.

### **Survey experience:**

An exploratory experiment was conducted on (1/1/30/2021) on a sample of (2) patients with anterior cruciate ligament severing and aimed at the following:

- 1- Identify the obstacles that may appear during work and try to avoid them.
- 2- Ensure the validity of the tools and devices used in the research.
- 3- Ensure that the exercises are appropriate to the level of injury of the research sample.

### **Scientific foundations:**

#### **1- Test stability:**

Stability is one of the basic components of a good test, as (the test is supposed to give almost the same results, if it is reused again at different times)

The test was conducted on (Sunday), which falls on (7/2/2021) on the sample of the reconnaissance experiment, and to ensure the stability of the test. Pearson's correlation The results showed that all correlation coefficients are good and reliable.

#### **2- The validity of the test:**

Defines honesty (it is the ability of the test to measure what it was designed for or the characteristic to be measured) and the researcher used the subjective honesty that is extracted from the square root of the reliability coefficient.

#### **3- The objectivity of the test:**

Objectivity means (improving the collection of personal, subjective, or external factors that affect the test results, as an objective test gives one result, regardless of the number of judges because it is made up of specific units or questions, and its answers do not differ by two)

### **Tribal tests:**

The researcher, with the help of the assistant team, conducted the tribal tests in the physical therapy hall at Al-Wasiti Hospital on (15/2/2021) corresponding to (Monday) at (10 am) for the experimental and control groups.

### Main experience:

A test of the range of motion of the knee joint was conducted on (20) patients with anterior cruciate ligament rupture, and imaging was performed, in addition to that, an explanation was given of the exercise to be performed before starting to perform, and after that each injured made only one attempt in a day. (Sunday) on (2/21/202). The sample was chosen by the intentional method, and data was collected for the grades of the raw tests, because the units of measurement of the tests were different, and they were processed statistically.

### Statistical processors:

The statistical bag (SPSS) was used in treating the results statistically.

### View and analyze the results:

Table No. (1) Between the arithmetic means, standard deviations, and the calculated t value between the pre-test and the post-test of the muscular strength variable of the experimental group in the studied variables.

| Statistical significance | Calculated<br>v*value | A F   | S F  | distance test |       | pretest |       | the exams                          |
|--------------------------|-----------------------|-------|------|---------------|-------|---------|-------|------------------------------------|
|                          |                       |       |      | P             | S     | A       | S     |                                    |
| moral                    | 4,306                 | 1,861 | 2,67 | 0,708         | 16    | 3,122   | 13,33 | muscle strength<br>sitting-flexing |
| moral                    | 5,821                 | 1,315 | 2,55 | 0.868         | 15,77 | 4,790   | 13,22 | muscle strength<br>sit-down        |

\* The value of the tabular TA amounted to (1,860), below the significance level (0.05) and the degree of freedom (8).

Table No. (1) Shows the values of the arithmetic mean and standard deviations in the pre and post tests to measure the strength of the muscles working on the knee joint represented by the quadriceps muscle.

The arithmetic mean of the pre-test of muscle strength from the position (sitting - bending) was (13.33) with a deviation of (3,122), while the arithmetic mean of the post-test was (16) with a deviation of (0.708), and the calculated t-value reached (4,306), which is the largest From the tabular t value of (1,860) and below the significance level (0.05) and the degree of freedom (8), the difference was significant, and the arithmetic mean of the muscle strength test (sitting - stretching) was (13.22) and with a deviation (4,790). ), while the arithmetic mean of the post-test was (0.868), and the calculated t-value was (5.821), which is greater than the tabular t-value of (1,860) and below the significance level (00,05) and the degree of freedom (8), which indicates that The differences are significant.

### Discussing the results of the muscular strength test:

It appeared from the results of Table No. (1) that there are significant differences between the two tests, pre and post tests for the muscular strength variable (sitting - bending) (sitting - flexing) for the research sample. Muscle as a result of their commitment to the vocabulary of the curriculum and their commitment to attend the rehabilitation units. Also, these exercises designed to improve muscle strength with regular and gradual repetitions and rest times between repetitions and between groups contributed to this improvement and the development of muscle strength for the injured leg, and the duration of the rehabilitation curriculum that was applied to the individuals of the research sample led to gaining strength for the muscle groups This was confirmed by Gamal Sabry, "to obtain moral gains in muscular strength, the training period must not be less than 8 weeks."

And the variety of exercises used in the prepared rehabilitation curriculum helped to improve this trait, and this was indicated by Raad Jaber, "The muscular applications of exercises depend on the type of training used, which gives them strength that is reflected in their development."

And the effectiveness of these exercises helped to develop the rapid response of the muscles and reflects the extent of good coordination within the muscle through the recruitment of motor units for muscle work, as indicated by Abul-Ela Abdel-Fattah "the participation of motor units and the unit timing of their work, where the more units involved in the contraction, the higher the level of strength muscle"

The researcher confirmed that there are many and varied benefits of muscular strength that must be preserved and returned to what it was before the injury, and this is done through the practice of regular muscular strength exercises that well increase muscular strength, muscle tone and strength of ligaments, and then increase the strength of Tendons and joints, and this was confirmed by Gamal Sabry, "Muscular strength helps improve health by increasing the stabilization of muscles and joints and gives the ability to face many life emergencies.

Table No. (2) Presents the results of the differences between the two tests, the pre and post tests for the experimental sample of the kinetic range variable (joints flexibility) and their analysis.

| Statistical significance | Calculated v*value | p      | QF    | control group |       | experimental group |       | the exams                    |
|--------------------------|--------------------|--------|-------|---------------|-------|--------------------|-------|------------------------------|
|                          |                    |        |       | G             | s     | p                  | s     |                              |
| moral                    | 9,110              | 9,879  | 30    | 7,949         | 42,22 | 14,601             | 72,22 | range of motion bend forward |
| moral                    | 7,249              | 11,265 | 27,22 | 8,660         | 40    | 16,223             | 67,22 | range of motion bend back    |

\* The value of the tabular T was (1,860) below the significance level (0.05) and the degree of freedom (8) between the aforementioned table between the arithmetic mean of the kinetic range test in the case of forward bending of the tribal news amounted to (72,22) and with a standard

deviation (14,601) While the arithmetic mean of the post-test was (42,22), with a standard deviation (7,949), and the calculated t-value was (9,110), which is greater than the tabular t-value of (1,860) and below the significance level (0.05) and the degree of freedom (8). This indicates that the difference is significant.

Also, it is evident from Table (2) that the arithmetic mean of the kinematic range test for back bending was (67,22) and with a standard deviation of (16,223), while the arithmetic mean of the distance test reached (40) and with a standard deviation (8,660) below the level of significance, and the value of The calculated t (7,249) is greater than the tabular t value of (1,860) under the significance level (0.05) and the degree of freedom (8), which indicates that the differences were significant.

### **Discussion of the results of the motor range tests (joint flexibility):**

From Table (2), which shows the arithmetic means, standard deviations, the calculated t value and the level of significance, it was found that there are significant differences between the two tests, the pre-test and the post-test, and in favor of the post-test for the experimental group in the flexibility test (flexing up) (flexing back).

The researcher attributes it to the exercises followed and applied to the individuals of the sample that contain exercises with rubber muscles for the muscles and that the improvement that occurred to the members of the experimental group in the strength tests is the reason for the improvement of flexibility and that these exercises had a "positive" effect on the characteristic (joint flexibility), so flexibility improves Through stretching exercises, and that these exercises gave effective results in improving the research variables in general and the range of motion, especially since the injury to the knee joint and the pain that accompanies it directly affects the movement, which leads to the weakening of the muscles surrounding the joint, which leads to the identification of Kinetic range.

Mufti Ibrahim Hammad pointed out that "the joints always need" the movement used, as they need movement in a wide range in order to maintain their range of motion in an appropriate manner.

The researcher believes that the regular repetitions, rest times and the correct progression of the exercises placed within the curriculum led to the significant differences between the pre and posttests of the research sample, and this was confirmed by Naif Mudhdi Al-Jubouri. A muscle group, 2-4 times a week, for functional health.

The researcher adds that the exercises set and the commitment of the research sample to the application of the vocabulary of the program led to a clear improvement in the flexibility of the joint represented by testing the kinetic range of the situations (imam - behind), and this was indicated by Muhammad Hassan Allawi, "The development of flexibility is affected by the type of exercises and motor activity.

## Conclusions

1. The rehabilitation exercises used have a positive effect in improving the strength variables of the experimental group.
2. The rehabilitation approach used has a positive effect in improving the variables of motor range of the experimental group.
3. There was a clear improvement in reducing the level of pain for the experimental group, which resulted from their application of the established rehabilitation exercises.
4. The effect of the medical center curriculum on the control group in its post-tests on tribalism for all research variables.
5. The preparatory exercises used by the experimental group had a positive and effective effect in improving all the research variables for the control group, and this was explained by the dimensional results of the research variables.

## Recommendations

1. Adopting the rehabilitation exercises prepared by the researcher in the physical therapy centers.
2. The injury must be taken care of when it occurs in terms of the necessary treatment and adherence to it and given sufficient time to heal to avoid repeated cases of infection.
3. The private authorities should prepare booklets for the modern qualifying curricula and add all the new techniques and exercises.
4. Training the technical cadres working in physical therapy centers on the rehabilitation programs obtained in the research of specialists by specialized cadres.

## References

1. Ali Abdel-Hassan and others; Static study of the knee joint when bending with multiple angles, published research, Al-Qadisiyah Journal of Physical Education Sciences, Volume IX, Issue Three, 2009, p.53.
2. Muhammad Adel Rushdie; The Science of Athletes Injuries, (Alexandria, Dar Al Maaref, 2001), p. 44.
3. Abdul Azim Al-Awadli; The New in Sports Therapy and Sports Injuries, 1st Edition, (Cairo, Dar Al-Fikr Al-Arabi for Publishing and Printing, 2004), p. 298.
4. Ramadan Ramadan and Abd al-Fattah al-Taba'; The most important sports injuries and ways to treat them: (Damascus, Al-Sham Press, 2000) p. 58.
5. Bassam Sami and Mazen Abdel Hadi; Anatomy, (Al-Najaf Al-Ashraf, Dar Al-Diaa for Publishing and Distribution, 2010), pp. 146-147.
6. The Kamouna Team, The New in Sports Therapy and Sports Injuries, 2nd Edition (Cairo, published by Dar Al-Fikr Al-Arabi, 2000), p.
7. Marwan Abdul Majeed and Muhammad Jassim Al-Yasiri: Introduction to Educational Measurement and Evaluation and its Use in the Field of Classroom Training, (Amman, Dar Wael for Publishing and Distribution, 2002), p. 119.
8. Hassan Ahmed Al-Shafei and Suzan Ahmed Ali Musa: Principles of Scientific Research in Physical Education and Sports, (The Origin of Knowledge in Alexandria, 1999), p. 20.



9. Jamal Sabri Farag; Strength, ability and modern sports training, (Amman, Dijla Publishing House, 2012), p. 443.
10. Raad Jaber; The effect of strength training with speed on some physical and skill variables in basketball, PhD thesis (University of Baghdad, College of Physical Education), p. 95.
11. Abu El-Ala Ahmed Abdel-Fattah Mohamed Sobhi Hassanein: Mathematical physiology and morphology and methods of measurement and evaluation, i 1, (Cairo, Arab Thought House) pg. 206.
12. Mufti Ibrahim Hammad: Fitness for Health and Sports, 1st Edition (Cairo, Modern Book House, 2010) pg: 291.
13. Nayef Mufdi Al-Jubouri: Sports, Health, Fitness and Resilience, 1st Edition (Amman, Arab Society Library for Publishing and Distribution), p. 255.
14. Muhammad Hassan Allawi: The Science of Sports Training, 3rd Edition (Cairo, Dar Al Maaref, 1972) p. 50.