



NMUSING AN INNOVATIVE DEVICE TO IMPROVE THE EFFICIENCY OF THE ANTERIOR QUADRICEPS MUSCLE OF THE INJURED KNEE JOINT AFTER SURGICAL INTERVENTION OF THE ANTERIOR CRUCIATE LIGAMENT IN ADVANCED SOCCER PLAYERS

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Abstract

This study aimed to manufacture an innovative device that enables the player to walk after the operation and improves the functional efficiency through the improvement in the range of motion as well as the improvement in the size of the muscles working on the knee joint. The research, the study population consisted of players with severing the anterior cruciate ligament of the advanced soccer players, and the number of the research sample was (5) injured for the control sample and (5) for the experimental sample in Abu Ghraib Hospital and some rehabilitation centers for a period of six months, and the pre-tests were conducted after two weeks of The cruciate ligament surgery was performed, and the innovative device was used for the experimental group, within the limits of pain. The number of steps and body weight were calculated every week, and the most important results were that the use of the innovative device showed good results in accelerating the rehabilitation process, and the development of body parts was in line with the progress of flexion and extension in the innovative device. There is no delay for one part of the body at the expense of another.

Keywords: Innovative , quadriceps, muscle and knee joint.

Introduction

In recent decades, the world has witnessed an era of scientific theories, and the development of these theories has become an obligation on society to keep pace with this development. It should be known that the rehabilitation process varies between individuals in terms of performance, due to the lack of use of therapeutic devices and exercises in an accurate manner and according to the degree of injury. This depends on the data of the mechanics of the injury and the experience and intelligence of the sports therapist. (Easa et al., 2022) Therefore, the assimilation of the sports rehabilitation procedure before and after sports injuries, especially knee surgery, by the sports therapist in an accurate scientific way leads to the speedy return of the athlete to the normal state before the injury. You need people with extensive experience in this field that enables them to carry out their duties in the correct manner that achieves healing for them. (Kzar & Kadhim, 2020)

This study aimed to design an innovative device that the researcher called the mobile support device that works to accelerate the process of returning the athlete to the stadiums as quickly as possible. Therefore, the researcher chose the advanced football players who

underwent anterior cruciate ligament surgery, because it is one of the most common injuries that contribute to the advancement of sports reality through Development and rehabilitation of the athlete and full recovery from injury. The research community consisted of players who underwent anterior cruciate ligament surgery in Baghdad.

Football players face great difficulties in returning to the stadiums as quickly as possible, and the anterior cruciate ligament injuries are among the frequent injuries of football players. In severe injuries to the knee joint, the player needs surgical intervention, and after the surgery, the sports rehabilitation process begins, which is the subject of the study and is one of the important reasons for completing and accelerating the player's return to the normal position before the injury or to the semi-normal position (Servant & Tr, 2023). Sports rehabilitation combines exercises, devices, and other means such as hydrotherapy that are used in rehabilitation and others (Kadhim, 2012). The researcher uses an innovative device that improves the functional efficiency of the injured knee joint after cruciate ligament surgery for advanced football players (Prof. Dr. Mohammed Jawad Kadhim, Prof. Dr. Ghadah Muayad Shihab, 2021). Increasing the strength of the muscles working on the knee joint through the possibility of walking two weeks after the surgery.

Methodology and tools

The researcher used the experimental method, in the manner of two equal groups, which are the experimental group and the control group, for its suitability to achieve the objectives of the study. The research community was chosen, represented by advanced players who had cut the anterior cruciate ligament after surgery. The sample was deliberately selected from patients registered in the joints consultation of Abu Ghraib General Hospital and some rehabilitation centers Of the players who underwent anterior cruciate ligament surgery from Baghdad Governorate, and there were (12) injured players, with (5) injured in the control group and (5) injured in the experimental group. (2) injured were chosen to conduct the exploratory experiment, as they were excluded from The main experiment and the proposed special tests were applied to the experimental group after using the mobile support device.

Test measuring the circumference of the thigh muscles

- The purpose of the measurement: Measuring the circumference of the thigh muscles
- Devices and tools used: (a tool for measuring digital muscle circumference in inches, a pen, and a paper form for recording data)
- Measurement procedures: The injured player sits on the bench in a comfortable position while wearing short shorts. Then we measure the length of the thigh with a regular measuring tape from the beginning of the knee to the end of the thigh bone (hip joint). The thigh area is divided into three equal areas and we measure its circumference.
- Recording: The reading is taken by tape measure of the circumference of the quadriceps femurs muscle
- Unit of measurement: centimeters.

Range of motion test

- Purpose of measurement: The test aims to measure the range of motion in the case of tide.
- Tools used: ruler and protractor, pen, paper form for recording data

- Measurement procedures: The person conducting the measurement stands next to the tested player while he is sitting on the bench, then asks the player to extend the injured leg forward. The range of motion of the knee joint is measured by means of a ruler and protractor device.
- Recording: The protractor and ruler refer to the measurement of range of motion in degrees.

Study variables

- The extent of elongation and flexion of the knee joint.
- Circumference of the quadriceps muscle of the affected leg.

Field procedures

Pilot study

The researcher, with the help of the assistant work team, conducted the exploratory experiment on (2) of the sample in the rehabilitation center at Abu Ghraib Hospital a week before conducting the main experiment to know the interaction of the sample and the validity of the supportive device, and to adjust the mechanism of work on it, as well as the software for the device, and to know Efficiency of the support team

Main experience

The researcher conducted the pre-tests for the control and experimental groups. Appendix (7), which includes measuring the circumference of the muscles and the range of motion of the knee joint in the sports hall on 11/15/2022. The researcher took into account the conditions of the test in terms of place and time, and the method of implementing the test in order to find the same conditions in the post-tests, and after conducting the pre-tests directly, the device was used The innovator was created by the experimental research sample, and then the researcher, with the assistance of the assistant work team, conducted the post-tests, Appendix (8) mentioned above, after two months of the pre-tests had passed.

Results and discussions

Table 1. Shows the (T) value calculated for the research sample in the pre and post tests For the experimental and control sample in the circumference test of the injured muscle

Variables		Average variances	Deviation of variances	Standard error of the differences	(t) calculated	df	Sig. (2-tailed)
Experimental group	Measuring the circumference of the quadriceps before - measuring the circumference	5.200	1.788	0.8	6.500	4	.003

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	ce of the quadriceps muscle after						
Control group	Measuring the circumference of the quadriceps before - measuring the circumference of the quadriceps muscle after	2.600	.894	0.4	6.500	4	.003

The researcher attributes that the prepared device has contributed to the stabilization of the knee, as it contains corsets that prevent the knee from moving in any direction other than the anatomical direction of the joint, and this enhanced the prevention of the joint sliding in any direction that might affect it and prevent the development of its healing, and this led to greater cohesion of the bones and a better ability to restore tendon healing. The bones do not rub against each other inside the joint, and the foot becomes short, which increases the burden on the muscles surrounding the joint. (Mbala et al., 2021) and thus rehabilitation is achieved (Schilaty et al., 2023)

The device contributed to the player's ability to walk without feeling pain, and this increased muscle strength and gave confidence to the injured and the feeling of gradual improvement and improvement in the functional efficiency of the joint according to the increase in the range of motion (tide and flexion) of the injured leg. The ligaments, muscles and their tendons affect the stability of the joint by holding the ends of the bones together. The ligaments and muscles increase the stability and strength of the joint (Majid, S., & Jawad, 2023). The researcher attributes that wearing the equipment has contributed to the development of muscle strength for the injured leg due to During the practice of walking without pain and fear of a recurrence or aggravation of the injury, the device gave confidence to the injured person to move without hesitation or fear of recurrence of the injury and the continuous feeling of healing progress and increased strength for the continuous joint muscles, as strength is the basis of every movement performed by the injured, as well as it has a direct relationship in improving Other physical attributes such as flexibility, agility, speed, and the device gave this possibility to the injured person to include all these attributes.

Table 2. Shows the value of (t) calculated for the research sample in the pre and post tests for the experimental and control samples in the motor range test of the injured muscle

Variables	Average variances	Deviation of variances	Standard error of the differences	(t) calculated	df	Sig. (2-tailed)
Experimental group Measuring the range of motion of the legs in a pre-extension - Measuring the range of motion of the legs in a post-extension	29.600	4.159	1.860	15.913	4	0.000
Control group Measuring the range of motion of the legs in a pre-extension - Measuring the range of motion of the legs in a post-extension	16.600	3.646	1.631	10.178	4	0.001

Referring to the schedule of the pre and posttests of the range of motion of the injured leg in the two cases of extension and flexion contained in the previous tables, it is found that the injured in the two control research groups who applied the rehabilitation exercises used in the center, and the experimental groups who applied the rehabilitation exercises associated with the equipment, had a positive improvement in the angles of the range of motion measured by the goniometric device in the post-tests compared to what it was in the pre-tests, and from reviewing the table of post-tests (6) for these two groups in both of these measurements, it is clear that the patients in the experimental group outperformed those in the control group, and the researcher attributes the result of the improvement and superiority achieved For the injured in the experimental group in these two motor ranges, to the use of the prepared device that enabled the patient to increase the stretching of his muscles and according to the muscular work in each movement of the rehabilitation exercises, which led to a better stretching of the knee joint and a better bending of the ability of the device to maintain the joint and not to allow lateral movements to interfere (Mahmood et al., 2023).

As it gave a greater opportunity to allow the joint to extend and then flex and with continuous gradation in extension and flexion and indeterminacy to not feel fear and increase confidence in the device, as the researcher intended to use this device from the ability to work and achieve more than one purpose in one muscular work in order to allow the main muscles and the auxiliary muscles to perform Its role is in a way that serves the independent motor duty of each of them (Moayed, A., Moayed, G., & Jawad, 2019) and helps the injured so that the approved device is an effective contributor to the preventive support of the sensory organs in the muscle, especially the muscle spindles responsible for stretching and reducing Suppressing tension sensors such as Golgi bodies scattered in muscle tendons, which inform the brain that

an increase in muscle tension, which may lead to limitation of movement and thus damage to the tissue and its inability to stretch due to the intervention of local pain sensors that impede expansion (Jawad Kadhim, M., & Salman Ahmed, 2016) The role of movement in the presence of resistance and the number of repetitions through walking without pain had a clear effect on increasing the elasticity of the muscles and the ability of the tendons to abduct and adduct in the movement of the joint and its natural range, as the increase in the angle of extension of the knee joint and the decrease in the amount of the angle of flexion is an indication of the increase in the elasticity and flexibility of the muscles and the capacity of the tendons to Bearing this stretch, and this positive effect was due to continuing to move the joint naturally and free from the effects resulting from the surgical operation, which was included in the rehabilitative exercises accompanying the prepared device in overcoming the resistance of the main muscles, the auxiliary muscles, and the muscles supporting the joint, which unite their work in an integrated manner and protect the joint from the phenomenon of calcification Which may accompany the injury and result from continuous motor limitation, and this is what helped the injured in developing the level of muscle strength and flexibility of the joint. As for the injured in the control group, the effectiveness of the rehabilitative exercises used in the rehabilitation center and the surrounding better use of tools (Fadel & Kadem, 2021) helped to Their motor range also improved, but they were not as developed as the experimental group, and the researcher attributes this to their limitation to the rehabilitative approach in the center and their inability to continue working on the joint outside the center, which delayed their development process.

The researcher explains that the increase in the elasticity of the muscles and ligaments improves through the gradual increase in the range of motion (extension and flexion). Within the limits of pain, it led to an improvement in the functional efficiency of the affected joint in general, and an increase in the improvement of the muscles working on the knee joint (Jawad, M., & Jabbar Shinen, 2016). The increase in the range of motion means an improvement in the elasticity of the muscles and ligaments surrounding the joint, as well as an improvement in nerve work. Muscles to this level of strength must be elastic in order to be able to stretch and elongate and perform any kinetic duty that is required of them. Susan Hill mentions that “move the joint freely and within its natural extent, as the ligaments, muscles and their tendons affect the stability of the joint through the coherence of the end of the articular bones with each other. Ligaments and muscles Strength increases joint stability and strength.

Conclusions

The researchers concluded that continuing to move the joint with the presence of partial fixators improved the range of motion (extension and flexion) and that the use of partial braces for the affected knee joint had a great effect in reducing the feeling of pain during the rehabilitation period among the research sample. The use of the device during the rehabilitation period has a positive effect. In giving confidence to the injured and reducing the feeling of fear of using the foot, moving it and pressing it, and that the innovative cushion has a major role in accelerating the rehabilitation of the joint and the muscles working on it and returning to the normal state before the injury. The researcher recommends conducting research similar to the development of the innovative device, and the researcher recommends conducting studies and research similar to the posterior cruciate ligament injury. The researcher recommends conducting similar research for different samples and ages.

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