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# Effect of rehabilitation of partial rupture of the lateral collateral ligament of the ankle joint on the development of range of motion

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**Abstract**

Because of its critical role in treating injuries that could endanger players on the one hand and in preventing and treating athletes from those injuries on the other, as well as the need to find scientific ways to reduce injuries or treatment and rehabilitation as quickly as possible, this research is important in the correlation of sports education with sports science medicine.

As a result, the researcher thought about solving the issue and creating an integrated rehabilitation program that included weightlifting, hydrotherapy, rubber tapes, rehabilitation exercises with varying repetitions, and therapeutic equipment. These methods were crucial and successful in eliminating cases of muscle and joint dysfunction and determining the most efficient means of achieving complete ankle joint recovery and a speedy return of players to the stadiums.

One of the most important foundations of the development of societies is their interest in science through qualitative shifts in the fields of science in order to serve scientific research as a result of technological progress and its transition from one stage to a more advanced stage for all of humanity( Zhou et al.,2024 ). Sports injuries have recently become the main concern of most workers in the sports field, especially in the field of medical treatment and rehabilitation. Since the number of sports injuries has been increasing continuously as a result of the high effort in training and competitions, as well as the effort in repeating certain movements in some sports activities that require high speed in frequency and repetition and incorrect technical performance which causes high effort when performing a certain movement leads to the axis of force deviating from its correct path, (Hafez& D.L, 2021) leading to the occurrence of injury.

As a result of the unsuitability of the floors of the stadiums and sports halls and the misuse of other sports equipment and supplies, it leads to an injury in the lower extremities, including ankle ligament rupture which is considered one of the most common injuries, reaching 55% of all joint injuries, as indicated by the latest studies of the International Society of Orthopedics, Joints and Fractures, because the ankle is one of the most complex joints, and rupture occurs as a result of various body movements that are not proportional to the amount of pressure exerted on this area and the size of the ankle.The injury resulting from a blow or twisting, which may reach the severe sprain, which becomes more dangerous, and the level and degree of pain varies as a result of the different degree of injury, which may be simple, moderate or severe, so special care must be taken to avoid the injury worsening (Kaiser et al., 2021).

We note the importance of linking physical education and sports sciences with sports medicine science because of their important role in treating those injuries that may expose the player to danger on the one hand or rehabilitating and protecting athletes from those injuries on the other hand. Therefore, many doctors, experts and specialists in the field of sports medicine have turned to studying and researching to find scientific means to reduce injury, treat it and rehabilitate it as quickly as possible, as it stands as an obstacle to developing the levels of athletes, so solutions must be found for it. However, sports

games and their percentage and severity vary from one game to another depending on the injury occurs in all types of specialized activity in various events.

Hence, the importance of this research emerges in developing a proposed rehabilitation approach to treat partial rupture of the lateral ligament of the ankle joint and rehabilitating the muscles working on the affected joint, which makes it capable of performing the specific activity of this joint and leading the movement and making it focus naturally on inputs that enable it to return the joint movement naturally and in a short period(Mobaraket al., 2024) since the movement of the lower limb depends primarily on the safety and effectiveness of this important vital joint.

Materials and Methods

Participants: Seven of athletes aged of (25-30) years with partial tear of the lateral ligament of the ankle joint of moderate severity were designated.

Toll measurement:

The researcher employed the Risometer gadget, a stand that is placed on a wooden edge, for this purpose. The zero level is at the level of the wooden base because the stand is 250 cm long. The stand has a holder that allows it to move up and down. In order for the number facing the holder to accurately represent the tester's length to the closest centimeter, the holder is then lowered until the upper edge of the stand contacts the upper edge of the tester's head horizontally.

Wight measurement

A medical scale was employed, in which the subject's weight is uniformly distributed over his feet while standing erect and without athletic shoes. The indicator's reading is then taken to the closest kilogram.

Ankle joint range of motion test in extension

When the patient is lying on a bench, the genometer is positioned on the side of the injured ankle. The patient is then instructed to extend the injured foot forward, and the

device's arm moves with the axial line mediating the injured foot. The other leg stays in its initial position, and the angle between the genometer's arms is measured. This angle indicates the injured ankle joint's extension angle.

Flexion test of the ankle joint

While the test participant is laying on the bench, the person taking the measurements stands next to him. The wounded individual is then instructed to flex the ankle, which is the afflicted joint, inward. While the other arm stays fixed in its initial position, the moving arm travels inward with the joint's movement and parallel to the affected joint's longitudinal median line. The flexion angle of the injured ankle joint is represented by the angle that is read between the device's arms. The laboratory's genometer index, which measures the damaged ankle joint's range of motion, is expressed in degrees $(0-55)$.

Ankle joint range of motion test with inward foot movement

The patient (the test subject) lies on the bench, and the person taking the measurements stands next to him. Next, the patient is instructed to move the foot inward by flexing the ankle, which is the afflicted joint. While the other arm stays fixed in its initial position, the moving arm travels inward with the joint's movement and parallel to the affected joint's longitudinal median line. The angle at which the foot moves inward toward the injured ankle joint is represented by the measurement of the angle between the device's two arms. The genometer shows the tester's range of motion in degrees $(0-40)$ for the afflicted ankle joint (foot inward movement).

Testing the range of motion of the ankle joint in the case of outward movement of the foot

The patient (the test subject) lies on the bench, and the person taking the measurements stands next to them. The patient is then instructed to move the foot outwards, or flex the injured ankle outwards (the lateral side of the afflicted ankle joint). While the other arm stays fixed in its initial position, the moving arm goes outwardly with the joint and parallel to the longitudinal median line of the damaged joint. The angle of movement of the foot outward for the injured ankle joint is represented by the measurement of the angle

between the device's arms. The genometer shows the tester's range of motion in degrees (0–20) for the afflicted ankle joint, or outward foot movement.

Free Jump test

Jump's upcoming Power-Free gadget the tester's (the wounded person's) body is bound with a belt beneath the abdomen. After attaching the device to a computer running a program that measures vertical distance, maximum height, flying time, and maximum force measurement, the device is turned on. After entering all of the wounded player's details (name, height, weight, and gender), the signals are received. Additionally, the type of jump—one or many jumps—is identified. A ringing sound signals the beginning of the jump to begin the show. All of the measurements and information are received over Bluetooth through the computer application.

Results

For the range of motion tests (flexion, extension, inward foot movement, and outward foot movement), (Table 1) displays the arithmetic means, standard deviations, computed and significant (t) values, and development rates. Because the range of motion tests' values (for flexion movement) were as follows. The arithmetic mean was 35.857 with a standard deviation of 0.899 in the pre-test and 44.285 with a standard deviation of 0.755 in the post-test. The development rate was 19.031%, the value of t was 19.667, and the significance level was 0.000. The arithmetic mean for (extension) was 13.714 with a standard deviation of 0.899 in the pre-test, and 19.571 with a standard deviation of 0.534 (0.404) in the post-test. The value of (t) was 14.496, the significance level was 0.000 and the development rate was 29.926%. Regarding inward foot movement, the pre-test arithmetic mean was (30.571) with a standard deviation of (0.786) and the post-test arithmetic mean was (39.714) with a standard deviation of (0.487). The development rate was (23.19%), and the value of (t) was 19.909 with a significance of (0.000). The arithmetic mean, however, was 14 (outward foot movement). The arithmetic mean in the post-test was 19.714, with a standard deviation of (0.487 and the value of (t) was (12.060) and the significance was 0.000), and the development rate was 28.984%. In the pre-test, the standard deviation was 1.154.

| Evolution Rates | Probability Value | T value | Post-test | | Pre-test | | Variables |
|---|---|---|---|---|---|---|---|
| | | | Standard deviation | Arithmetic mean | Standard deviation | Arithmetic mean | |
| 19.031 | 0.000 | 19.667 | 0.755 | 44.285 | 0.899 | 35.857 | Flexion |
| 29.926 | 0.000 | 14.496 | 0.534 | 19.571 | 1.380 | 13.714 | Extension |
| 23.019 | 0.000 | 19.909 | 0.487 | 39.714 | 0.786 | 30.571 | Foot Movement Inward |
| 28.984 | 0.000 | 12.060 | 0.487 | 19.714 | 1.154 | 14 | Outward Foot Movement |

Table (1) It shows the arithmetic means, pre- and post-test standard deviations, the calculated t-value, the probability value, and the development rates of the motor range of the research sample (infected patients).

The values of the arithmetic means, standard deviations, value of (t), significance, and development rates of the test variables are displayed in Table (2). For the maximum height, the arithmetic mean and standard deviation for Free Jump were 15.857 and 4.525 in the pre-test, while in the post-test, the arithmetic mean and standard deviation were 47.857 and 6.466, respectively, and the value of (t) was 9.165. The significance level was set at 0.000, and the development rate was 66.865%. The pre-test arithmetic mean for the flight time was 22.714 with a standard deviation of 3.199, whereas the post-test arithmetic mean was 55 with a standard deviation of 10.132, the value of (t) was 9.804, the significance was 0.000, and the development rate was 58.70%. The pre-test arithmetic mean of the maximum foot pressure was 12.225 with a standard deviation of 2.477, and the post-test arithmetic mean was 18.035 with a standard deviation of 3.073. The development rate was 32.215 percent, the value of (t) was 4.236, and the significance was 0.005. In the pre-test, the propulsion force's arithmetic mean was

13.910 with a standard deviation of 2.713; it was 50.672 with a standard deviation of 5.349 in the post-test, with a value of (t) of 22.078, a significance level of 0.000, and a development rate of 72.548 percent.

| Evolution Rates | Probability Value | T value | Post-test | | Pre-test | | Variables |
|---|---|---|---|---|---|---|---|
| | | | Standard deviation | Arithmetic mean | Standard deviation | Arithmetic mean | |
| 66.865 | 0.000 | 9.165 | 6.466 | 47.857 | 4.525 | 15.857 | Maximum height |
| 58.70 | 0.000 | 9.804 | 10.132 | 55 | 3.199 | 22.714 | Flight time |
| 32.215 | 0.005 | 4.236 | 3.073 | 18.035 | 2.477 | 12.225 | Maximum foot pressure |
| 72.548 | 0.000 | 22.078 | 5.349 | 50.672 | 2.713 | 13.910 | impetus |

Dissection:

The researchers believe that all the biomechanical variables that were identified in the rehabilitation curriculum showed significant differences in the post-tests. The reason for this is attributed to the rehabilitation curriculum that the researchers prepared according to scientific principles, as the curriculum focused on the exercises that work to develop all the variables related to the rehabilitation of the joints through focusing on the working organ and exploiting the elongation of this organ to produce mechanical work (Dibben, et al., 2023) in it and according to the terms of the rehabilitation curriculum, which made the differences in the values of these variables tend to the results of the post-tests and this was reflected in the improvement and tendency to recovery, and this is what appeared clearly through the level The qualification achieved by the research sample members in the test and the researcher attributes the reason for this to the special Italian strength

exercises that the researcher focused on, and which is the result of an effective European role in focusing on the muscular points specific to the ankle joint(Beldaet al., 2011).

The researcher believes that the development in the results of the post-tests indicates the impact of the rehabilitation approach in developing the general muscular conditions in the movements of the foot and flexion on the ankle joints related to these movements, so that this can affect the contraction and muscle flow times as much as possible, which includes a decrease in the weight of the tag for each foot, the weight of the tag on the walk, the internal weight on the foot, the weight of a part in the results of the outside of the foot and the weight on the heel, the flight phase and the percentage of support and its time and the total step time and the average flight time and the average support time (Hunter et al., 2004) .As it has been indicated with specialized studies that the increase in force is inversely proportional to the mass and speed, which means covering a distance in the least possible time, with stability We calculate the time and mass of the mass (Hinds et al., 2022).

Because some researchers believe that "muscle fibers have the ability to produce great force according to the type of resistance that these fibers encounter, and thus the number of global motor units will increase and increase accordingly," the two exercises that were applied to the objectivity of the research sample in the rehabilitation approach resulted in an increase in the maximum muscular strength and a rapid recovery to produce the highest muscular capacity according to the type of resistance used and to raise it gradually, which means increasing its kinetic energy represented by increasing the speed of muscular frequency (contraction and contraction).

(Cakmak& A, 2023).

The researcher believes that relaxation exercises have a major role in the development of the injured ankle joint, and thus led to the development of some of the biomechanical variables of the ankle. Relaxation exercises are characterized by a decrease in muscle activity when performing them and work to provide the working muscle with qualitative blood after contraction processes (Rowell& L.B, 2003).

The researcher believes that the results presented in the Table (8) indicate the progress of the research sample individuals (post-test) in the variable of support time, and this leads us to the extent of the effectiveness of the exercises used in the prepared rehabilitation curriculum in developing these special physical abilities and that they contributed directly to the development of special strength skills, and this is what led to the development of their support time, as (Stein House 1991) and (Wolki D 1998) stated "that there is a need to increase the intensity and amount of work required to develop muscle strength, while emphasizing the importance of the resistance materials used and paying attention to the amounts of this resistance and the amount of muscle contraction." Clearly, this is what the researcher achieved within her rehabilitation curriculum, which gives preference to the differences in the arithmetic means for the group of research sample individuals and in favor of the post-test.

Conclusions

By improving the strength and range of motion of the muscles affecting the ankle joint, the rehabilitation strategy helped the injured person return to their pre-injury state. Strengthening the working muscles, flexing the ankle upwards and downwards, and sliding the ankle sideways on the afflicted joint were all improved by the aquatic rehabilitation activities that the research sample members performed. The rehabilitation activities performed in the swimming pool (supporting the metatarsals, supporting the heels, and supporting the feet) were found to be effective in lowering the pain associated with the injury. According to the results of the pre- and post-tests, the use of rehabilitative activities resulted in a discernible increase in physical characteristics and range of motion.

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