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The effect of sport exercises and a specific ankle joint rehabilitation device on the flexibility of the joint and the degree of pain for injured athletes

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Abstract

Most athletes suffer from injuries to the ankle joint, which results in limited movement of the ankle joint. The interest in the process of rehabilitating injured players aims to bring them back as quickly as possible to participate with their teams in training and competitions. Therefore, the research aims to prepare sports exercises and identify the effect of these exercises. In determining the ankle joint for injured athletes, the research also aims to know the effect of the device used in rehabilitating the affected ankle joint. The research sample included (8) athletes who had ankle joint loss and who were officially registered in the physical therapy centers in Babylon Governorate, and the sample was male. They were 20-25 years old, and they were chosen intentionally. The researchers used the experimental method by designing one group with two pre- and post-tests. The researcher used statistical methods (arithmetic mean, standard deviation, and T-value for correlated samples), and the most important conclusions that the researchers reached were: An improvement was achieved in the results of the investigated variables (flexibility and degree of pain) for the research sample.

Keywords | **Rehabilitation device, Ankle joint, Degree of pain.**

Introduction:

Sports injuries to athletes are constantly increasing despite the scientific progress that the world has witnessed in various fields, including the field of sports rehabilitation science, which uses modern scientific methods in the field of rehabilitation and treatment. Ankle joint injury is considered one of the most common sports injuries, because the joint is the foundation and axis of all movement. Parts of the human body. The ankle joint is considered one of the large joints and bears the heavy responsibility of carrying the weight of the body, as well as the process of transferring movement from the feet to the upper limbs and controlling the forces necessary for athletic performance. Sports injuries often occur during competition and training and increase with the intensity of competition. Because of the pressure placed on the body, movements determine the damage resulting from ankle injuries. Scientific equipment is one of the modern methods of rehabilitation that helps, in addition to exercise, to allow injured athletes to recover as quickly as possible, with the least effort and cost, and with the highest technology, to participate in training and competitions with the team. Rehabilitation equipment works to control injuries at all stages from pain to recovery, improving and increasing muscle flexibility and strength in the injured limb, allowing injured athletes to return to normal training or competition in the shortest possible time. Rehabilitation exercises can treat sports injuries by treating weakness in some muscles and ligaments. They can also eliminate dysfunction in the affected area, develop muscle strength and joint flexibility, improve coordination between muscles and nerves, and thus improve athletic performance ability. Rehabilitation exercises also contribute to speed. Healing tissues and accelerating the elimination of adhesions and blood calcification accumulated in the joint capsule, he confirms. (Beynnon). (Controlling pain and swelling and continuing treatment during the recovery phase

can help in the transition to the subacute phase, and the advantages of this phase include reducing pain and swelling and increasing range of motion in the affected joint (5). Thus, the importance of research lies in the use of motor exercises and scientific devices with advanced rehabilitation techniques to treat the movement of the ankle joint and return it to its normal or near-normal function. The high effort that is not regulated in terms of training loads, as well as the incorrect performance of sports skills, leads to a large number of sports injuries, which result in limited joint movement. The lack of use of exercise and special medical equipment in rehabilitating the ankle joint and relying on the hands of rehabilitation therapists to move the limited joint may It leads to complications in the injury, and the reason for this is the high pressure that the physical therapist applies to the joint for the purpose of restoring its movement, which leads to the occurrence of additional tears. Therefore, it requires the use of modern devices and methods for rehabilitation that limit movement, as these devices do not apply more pressure than the joint needs to move, and on this basis. The researchers made an attempt to study this problem and find a scientific formula that would be explained by using exercise exercises with a scientific rehabilitation device to contribute to the rehabilitation of the ankle joint in a way that benefits athletes and therapists in the field of sports rehabilitation.

The research aimed to prepare exercises that contribute to the treatment of limited mobility of the ankle joint, and to identify the effect of these exercises and the rehabilitation device in rehabilitating the limited movement of the ankle joint.

Method and procedures:

Research methodology and field procedures:

Research Methodology:

The researchers used the experimental approach with a single group design with two pre- and post-tests. Comparisons are made between the pre- and post-tests to ensure improvement in the specific tests.

Community and sample research:

The research community was represented by players who had osteoarthritis of the ankle joint resulting from various injuries and aged between 20-25 years. The research sample was chosen and it numbered (8) injured people who were dealt with in the form of one group. Research procedures were applied to players in centers Sports rehabilitation in Babylon. The sample was selected according to the following conditions: (they must have osteoarthritis of the ankle, not undergo any other rehabilitation program during the trial period, they must have the desire to participate in the research experiment, and they do not have any drug treatment) and Table (1). shows the homogeneity of the sample in terms of age, height, weight, and time of infection.

Table .1 shows the homogeneity of the sample members

Variables	Measuring unit	Mean	Std. Deviations	Skewness
Age	Year	22.87	4.64	0.06
Height	Meter	1.63	0.07	0.18
Weight	Kg	65.23	8.79	0.11
Age of injury	Day	30.01	5.73	0.23

Table (1) shows the values of the skewness coefficient for sample homogeneity, which were less than (-1 to +1), which indicates that the distribution was moderate and that the sample members were homogeneous.

Tests and measurements:

Determine tests and measurements:

Tests and measurements were determined based on theoretical studies and previous scientific research, as well as the experience of researchers in rehabilitation, which included the following:

1- Degree of flexibility of the ankle joint.
2- Degree of pain.

Description of tests and measurements:

Measuring the flexibility of the ankle joint using a gynecometer and agencies:

1. Measure the flexibility of the ankle joint upwards using a Goniometer:

The injured person lies on his back and the leg muscles are relaxed. The fixed arm of the goniometer is placed on the longitudinal axis of the tibia and the moving arm of the goniometer is placed on the medial end of the foot from the side of the big toe. We move the ankle joint to its maximum range of motion upwards, and then the goniometer is read from the side position. Note that the flexibility of the joint is 90 degrees.

2- Measure the flexibility of the ankle joint downwards using a Goniometer:

The injured person lies on his back and the leg muscles are relaxed. The fixed arm of the goniometer is placed on the longitudinal axis of the tibia and the moving arm of the goniometer is placed on the medial end of the foot from the side of the big toe. We work to move the ankle joint to its maximum range of motion downward, and then the goniometer is read from the side position. Note that the flexibility of the joint is 90 degrees.

3- Measure the flexibility of the ankle joint to the medial side (inward) using a Goniometer:

The injured person lies on his back and the foot is free on the edge of the bed. We place marks that bisect the upper and lower sides of the heel bone, where the axis of the goniometer is the midpoint of the upper side of the heel bone. The fixed arm of the goniometer is on the longitudinal axis of the leg and the moving arm is on the axis of the midline of the heel and there is a movement. The joint inwards to the medial side and the maximum possible range of motion.

4- Measure the flexibility of the ankle joint to the lateral side (outward) using a Goniometer:

The injured person lies on his back and the foot is free on the edge of the bed. We place marks that bisect the upper and lower sides of the heel bone, where the axis of the goniometer is the midpoint of the heel bone. The fixed arm of the goniometer is on the longitudinal axis of the leg and the moving arm is on the axis of the midline of the heel, and the movement of the joint is to externally, that is, to the lateral side and with the maximum possible range of motion.

Measuring the degree of pain:

A special form was used to measure the degree of pain, which was designed by researcher (Abdullah Abbas) (3), which includes the following.

1- Pain during upward movement (1-10 degrees) according to angles (10, 15, 20, 25, 30) degrees.
2- Pain during downward movement (1 - 10 degrees) according to angles (45, 50, 55, 60, 65) degrees.
3- Pain during inward movement (1-10 degrees) according to angles (30, 35, 40, 45, 50) degrees.
4- Pain during outward movement (1-10 degrees) according to angles (15, 20, 25, 30) degrees.

Rehabilitation device used in the current research:

The structure of the device consists of iron, shaped like a square U, and the base is made of iron with a width of 62 cm a mold that takes the shape of the foot and moves in all directions, up and down, out and in.

The third section is a cylindrical tube with a width of 2 cm that rises to the top and the infrared device is mounted on it, and the fourth section consists of a square-shaped tube on which the control board rests.

Figure (1) shows the rehabilitation device used in the current study

Pre and post-tests:
Pre- and post-tests for the research were conducted on (1/9/2023-1/12/2023) before and after the start of the main experiment to determine the level of flexibility of the ankle joint and the degree of pain before and after rehabilitation.

Main experience:
The exercise exercises and rehabilitation device were applied to the research sample on 2/9/2023, through weekly sessions on days (Saturday, Monday, Wednesday), where the researchers supervised the exercise exercises that were applied by them to the individuals of the research sample who had limited ankle joint movement. The number of them was (12) patients. The exercises took a period of (8) weeks at a rate of (3) units per week, for a total of (24) rehabilitation units. The patients performed eight repetitions of one exercise, which gradually increased with the improvement in the joint. As for the rest periods, they depended. On the injured person himself.

Statistical methods: The search data was processed through the Statistical Package for the Social Sciences (SPSS).

Results:
The results were presented after being statistically processed using the T-test for correlated samples and arranged in the form of tables for all research variables.

Presentation and analysis of the results of the differences between the pre- and post-tests for the variable degree of flexibility of the ankle joint.

Table .2 shows the arithmetic means, standard deviations, and T-value for the pre- and post-tests variable degree of flexibility of the ankle joint

No.	Angle	Pre-test		Post-test		T value	Level sig	Type sig
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
1	Upward	7.5	0.31	26.5	4.03	2.31	0.005	Sig
2	Downward	33.6	5.80	54.6	5.13	2.43	0.008	Sig
3	Inward	24.0	4.74	43.0	2.10	2.34	0.006	Sig
4	Outward	11.0	3.60	24.8	2.23	2.30	0.004	Sig

It is clear from Table (2) that the significance level values for the ankle joint flexibility test are smaller than the statistical significance level (0.05). This means that there are significant differences between the pre- and post-tests in the variables investigated, as follows:

Measure the flexibility of the ankle joint upwards:

The calculated T value (2.31) is at the significance level (0.005), which is smaller than the statistical significance level (0.05). This means that there is a significant difference between the pre- and post-tests, in favor of the post-test.

Measure the flexibility of the ankle joint downward:

The calculated T value (.432) is at the significance level (0.008), which is smaller than the statistical significance level (0.05). This means that there is a significant difference between the pre- and post-tests and in favor of the post-test.

Measure the flexibility of the ankle joint inward:

The calculated T value (2.34) is at the significance level (0.006), which is smaller than the statistical significance level (0.05). This means that there is a significant difference between the pre- and post-tests and in favor of the post-test.

Measuring the flexibility of the ankle joint outward:

The calculated T value (2.30) is at the significance level (0.004), which is smaller than the statistical significance level (0.05). This means that there is a significant difference between the pre- and post-tests, in favor of the post-test.

Presenting and analyzing the results of the differences between the pre- and post-tests regarding the variable degree of pain at each angle.

Table .3 shows the arithmetic means, standard deviations, and T-value for the pre- and post-tests variable degree of pain at each angle

No.	Angle	Pre-test		Post-test		T value	Level sig	Type sig
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation			
1	Upward	7.13	1.03	2.06	1.06	2.72	0.03	Sig
2	Downward	7.23	1.04	3.06	1.01	2.33	0.01	Sig
3	Inward	8.43	1.08	2.10	0.44	2.52	0.03	Sig
4	Outward	8.36	1.07	3.05	0.39	2.63	0.02	Sig

It is clear from Table (3) that the values of the level of significance for the test of the degree of pain at each angle are smaller than the level of statistical significance (0.05). This means that there are significant differences between the pre- and post-tests in the variables investigated, as follows:

Measuring the degree of pain when the ankle joint moves upward:

The calculated T value (2.72) is at the significance level (0.03), which is smaller than the statistical significance level (0.05). This means that there is a significant difference between the pre- and post-tests and in favor of the post-test.

Measuring the degree of pain when the ankle joint moves downward:

The calculated (T) value (2.33) is at the significance level (01.0), which is smaller than the statistical significance level (0.05). This means that there is a significant difference between the pre- and post-tests and in favor of the post-test.

Measuring the degree of pain when the ankle joint moves inward:

The calculated T value (2.52) is at the significance level (0.03), which is smaller than the statistical significance level (0.05). This means that there is a significant difference between the pre- and post-tests and in favor of the post-test.

Measuring the degree of pain when the ankle joint moves outward:

The calculated T value (2.63) is at the significance level (0.02), which is smaller than the statistical significance level (0.05). This means that there is a significant difference between the pre- and post-tests and in favor of the post-test.

Discussion:

Tables (2, 3) show that there are significant differences between the values of the results of the pre- and post-tests in the variables (flexibility of the ankle joint and degree of pain). The reason for this is that the researchers believe that the use of exercise and rehabilitation equipment helps in improving the above-mentioned variables, because they contribute to increasing Ranges of motion for the angles of the ankle joint. The

sample begins by applying the exercises first, and then the injured person uses the device to perform movements in all directions according to their natural range. The exercises included many assistive tools, including an unstable medicine half ball to improve the balance of the ankle joint, and rubber bands made of strips. Multiple forms to strengthen ligaments and tendons, (Nahid Ahmed) (Exercise also works to achieve several purposes, including improving the mobility of the body's joints) (4)," (Ham , 2009) stated (that increasing joint flexibility means improving the elasticity of tendons and ligaments surrounding the joint, in addition to improving the neuromuscular work in controlling the work of the sensors responsible for this range) (7), while (Samia Khalil) stated (that exercise leads to increased flexibility of the joint, improves the strength of the ligaments and tendons surrounding the joint, and reduces the proportions of Calcifications and adhesions resulting from repeated injuries to the joint, which lead to joint deformity (1). Researchers believe that applying prepared exercises regularly and gradually with loads and resistances has a positive effect in improving the flexibility of the ankle joint (dorsiflexion of the foot, plantar flexion of the foot, medial flexion of the foot, and lateral flexion of the foot), which helped improve the functioning of the ligaments and tendons surrounding the ankle joint and its recovery. The rehabilitation device included variable intensities according to the angles of the ankle joint, in addition to an infrared device and a golf muscle massage device while the injured person was sitting on the device, which played a major role in stimulating blood circulation because the thermal rays are superficial and work to maintain temperature. The joint and contributes to alleviating the pain of the injured person and thus helps the device to complete its work better and without feeling the pain or reducing it to the lowest possible level when performing the greatest range of motion. (Suhad Hasib) confirms that the use of infrared rays contributes greatly to preparing the joint for movement and providing relief. Pain, increased blood circulation, metabolism, and tissue healing in the joint area) (2). As for the degree of pain, Table (3) showed a clear improvement in the degree of pain, which is an important indicator of recovery, as by decreasing it, the injured person can increase the flexibility of the joint to reach flexibility close to normal (Mattacola CG and Dwyer MK) (8), and the researchers attribute this to The significant improvement in the degree of pain resulted from concentrated exercise and the rehabilitation device, the repetitions and rest periods for which were based on elaborate scientific foundations. Researchers also believe that the exercise and rehabilitation device have an effective effect in improving the degree of pain, and the reason for this is due to the specialized and comprehensive exercises that were used, which included (Self-exercises, negative exercises, positive exercises), and taking into account the gradation of loads and the type of exercises from easy to difficult and within the limits of pain, all of this leads to a reduction in calcifications and adhesions and the gradual disappearance of pain in the joint (Ekim) (6). The improvement in the degree of pain of the sample is the best evidence for the effectiveness of exercise and rehabilitation equipment in increasing the strength of ligaments and tendons, which leads to raising the pressure that causes pain and increasing blood flow to the affected area, thus removing waste and remnants of the injury, which reduces resistance and thus reduces pain. The researchers also follow the rule of gradualism. Rehabilitation had a clear effect in improving pain, and the rule of gradualism is a preventive measure against internal disorders in the joints and muscle tendons, in other words, preventing ruptures and muscle spasms during rehabilitation (Qasim Al-Mandalawi) (9).

Conclusions:

The researchers concluded that exercise and rehabilitation equipment have an effective role in improving the definition of the ankle joint through improving the research variables (joint flexibility and degree of pain), and for this reason the researchers recommend the necessity of the use of exercise and rehabilitation equipment to treat movement of the body's joints, including the ankle joint.

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تأثير تمارين رياضية وجهاز تأهيل مفصل الكاحل المحدد في مرونة المفصل ودرجة الالم للرياضيين المصابين

عمار حمزة هادي 1 ، علي مظهر حسن 2 ، حسين علي خضير 3
1 جامعة بابل/ كلية التربية البدنية وعلوم الرياضة
2 &3 جامعة المستقبل / كلية التربية البدنية وعلوم الرياضة

ملخص البحث

أغلبْ الرياضيين يعانون من الإصابات في مفصل الكاحل والذي ينتج عنها تحدد في حركة مفصل الكاحل، إذ إنّ الاهتمام بعملية إعادة تأهيل اللاعبين المصابين يهدف إلى إعادتهم بأسرع وقت ممكن لمشاركتهم مع فرقهم في التدريب والمنافسات لهذا يهدف البحث الى إعداد تمارين رياضية، والتعرف على تأثير هذه التمارين في تحدد مفصل الكاحل للرياضيين المصابين كما يهدف البحث الى معرفة تأثير الجهاز المستخدم في تأهيل مفصل الكاحل المحدد، وقد اشتملتْ عينة البحث على (8) رياضي ممن لديهم تحدد بمفصل الكاحل والذين تم تسجيلهم رسمياً في مراكز العلاج الطبيعي في محافظة بابل، وكانت العينة من الذكور بعمر 20-25 سنة، وقد تم اختيارهم بالطريقة العمدية، واستعمل الباحثين المنهج التجريبي بتصميم المجموعة الواحدة ذات الاختبارين القبلي والبعدي، وقد استعان الباحث بالوسائل الإحصائية (الوسط الحسابي، الانحراف المعياري، وقيمة **T** للعينات المترابطة)، وكانت أهم الاستنتاجات التي توصل أليها الباحثين هي حصول تحسن في نتائج المتغيرات المبحوثة (المرونة، ودرجة الألم) لعينة البحث.

الكلمات المفتاحية | **جهاز تاهيل ، مفصل الكاحل ، درجة الالم.**