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The Effect of Rehabilitation Exercises with Paraffin Wax on Improving the Strength and Range of Motion of Wrist Joint Patients in Handball Players

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ABSTRACT

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The world is witnessing vast progress in all fields and various sciences, especially those sciences that are closely related to the sciences of physical education, especially physiotherapy and preparation for sports injuries of all types and types. More than normal, most of the injuries were in the ligaments of the joint, as the researcher had data about rehabilitation, as the occurrence of this sports injury is one of the important problems that limit the functional efficiency of the wrist joint and the abilities of the athlete or the loss of his future, to identify the effect of rehabilitation exercises in improving the strength and range of motion of those with wrist joint injuries in handball players, and the researcher used the experimental method to suit the research problem, where the After the completion of the pre- and post-tests and the application of rehabilitative exercises, the researcher reached the following results that the rehabilitation exercises positively affected the rehabilitation of the wrist joint patients in the research sample in improving both muscle strength and range of motion

Research Introduction

The scientific progress that the world is witnessing in the field of sports medicine and the rehabilitation of sports injuries and its connection with other sciences did not come by chance, but came as a result of scientific research and studies as a result of many studies on how and how injuries occur to athletes, and sports injuries are considered one of the main problems facing athletes in progressing at the required level, and it is worth mentioning that practicing sports activities and physical exercises may cause stress for the player in different games, whether these games are individual or group. They vary according to the nature of the performance of the game, the importance of the competition, as well as the player's functional efficiency physically, skillfully, and psychologically, and this stress may be for the whole body or only part of it, which leads to injuries. Injuries such as falling on the hand or sudden movements can cause the ligaments of the wrist joint to tear or tighten, as there are common injuries on the field and often occur in team games such as goalkeepers in football, and in players of handball, basketball, volleyball and other team and individual games, as "as a result of the pressure exerted on the wrist joint during the practice of these sports, Especially when you are exposed to direct contact with a fellow player or opponent or with the devices and tools used for these games, or a sudden and unexpected fall, the injury may occur due to it, and one of its symptoms is small tears in the ligaments and the capsule between the articular bones, accompanied by swelling and severe pain, with limitation in the movement of the joint (6:205), and since the wrist joint is a synovial joint that connects the bones of the palm. The basic functional efficiency of the wrist joint lies in helping the palm and forearm to move and regulate its direction, and the strength of the supporting muscles to resist external forces, and from injuries that occur during any sporting activity in most sports events, the athlete is exposed to high exertion when the ligaments of the hands become torn or stretched. More than normal, we point out that the wrist joint is one of the joints that is complex in structure and has an importance in weight bearing, as its injury can lead to great danger if it is ignored and not treated and rehabilitated early. "Wrist injuries are common injuries in sports in children, adults and young adults and are more susceptible to wrist injuries such as ligament ruptures, especially fractures, and athletes whose bones have completed are usually less likely to suffer acute injury (5:102). Physical rehabilitation is considered as the restoration of functional efficiency of the injured part of the body so that the person performs his physical and motor needs easily and easily (34:13), thermal rehabilitation is used with paraffin wax baths in certain areas of the body, namely the hands, wrists, elbows, feet, and wrists to prepare them and perform rehabilitation exercises on them, as we start by preparing the injured part to be rehabilitated by washing it with warm water Soap to remove the fatty layer and dirt stuck to the skin, which can lead to reducing the speed of heat conduction, as well as to prevent the transfer of dirt and dust stuck to the skin to the wax, which affects its effectiveness, validity, and the duration of its use in the treatment. Banu Dilek (2013) emphasizes how to use paraffin wax, we pour liquid wax on the part to be treated or insert it under the wax until a thick layer of wax forms on the surface of the skin, wrapping the affected area. Treat it with a wax plate with a bag

and then with a cloth or cotton cloth for (10-20) minutes, then remove the layer of wax and the temperature of the mixture is (50° to 58°) degrees Celsius equivalent to (125.6 to 136.4 F) Fahrenheit (644:11). It is the normal function and natural shape of the injured organ after the injury, which are those anthropometric variables of the injured joint and the decrease in the return of the injured person to exercise normally as it was before the injury, by improving the range of motion, motor flexibility, and the development of the muscular strength of the muscles working on it (8:2). There are many reasons for the occurrence of sports injuries, but they vary according to the type of sport, whether it is individual or collective, and it also varies according to the nature of the performance of the game and the importance of the competition, and according to the player's functional and physical competence or the wrong unstudied training, and sometimes it is due to the inintegration of the training of all the muscle groups involved in the performance, and accordingly, practical scientific rehabilitation programs or sessions must be developed. Studied and comprehensive physical exercises to develop muscular abilities, physical fitness, harmonic movements, as well as the functional effectiveness of the body's systems, and to undergo continuous evaluation to reach structured programs that fulfill the purpose (6:12).

Research Methodology.

The researcher used the experimental method, by designing one group with two pre- and post-tests to suit the nature of the research.

Research community and sample

The research population consisted of (7) handball players injured in the wrist joint in Baghdad, who were (7) injured for the 2025 season of the intermediate level, and they were selected in a deliberate way and according to the diagnosis of the specialized doctor, and their number reached (5) injured.

Table (1) shows the homogeneity of the sample

| Torsion coefficient | Standard deviation | Arithmetic mean | N | Unit of Measurement | Variable |
|----------------------------|---------------------------|------------------------|----------|----------------------------|--------------------------|
| 0.55 | 1.48 | 184.80 | 5 | Poison | Length |
| 0.05 | 1.78 | 81.20 | 5 | kg | Mass |
| 0.22 | 2.28 | 22.20 | 5 | Year | Chronological age |
| 0.54 | 1.48 | 9.80 | 5 | Year | Training Age |

It can be seen from Table (1) that the values of the torsion coefficient for the variables referred to in the table were confined between ($_ +1$), which indicates

that the research sample is homogeneous and that they are within the normal curve of distribution.

3 The means, tools, and devices used for research.

Arabic and foreign sources and references and the World Wide Web (Internet). Personal interviews with experts and specialists to gather information, rubber ropes of different resistances, plastic sticks with iron bar with handgrips of different sizes with light weights, special basin for paraffin wax, dumbbells with iron discs of different weights, Chinese-made electronic dynamometer, goniometer device German-made, Rehabilitation Preparation Assistant with Stopwatch, Medical Weighing Scale with Height Measurement.

Field Research Procedures

First: Measurement of the range of motion (bending and stretching) (approximation and distancing) of the wrist joint (14:323):

Objective of the test: To measure the range of motion of the wrist joint.

Instruments used: Goniometer.

Method of Performance: Fixing the goniometer device on the wrist joint, as one of the arms of the device is on the forearm bone and the other on the back of the palm and fingers, and the person with the wrist joint tries to approximate and distance the wrist joint of the affected hand, and the angle of the joint is measured to obtain the range of motion during the rounding and distancing, and to obtain the range of motion during flexion and extension, the goniometer device is fixed to the side of the wrist, as one of the arms is on the side of the forearm bone and the other arm is on the side of the palm, aligning the thumb fingers, and the angle is measured at Flexing, stretching, rounding and distancing the wrist joint of the affected hand.

Recording : Recording the angle on the device while doing the different positions.

Second: Measuring the muscle strength of the wrist joint flexion (gripping-extensive) (4:56):

The muscular strength of the wrist joint is measured using an electronic dynamometer.

Measurement Conditions:

(The test is performed on the special assist device for the forearm and palm muscles that is adopted in the gyms, the stability of the patient during the measurement to isolate the effect of other muscle groups that are not to be measured, taking into account the continuity and non-stopping of the performance during the test with no sensation of pain, the position of the body is the same for all the injured people when the test, and not to use any auxiliary force such as weighting or any excess movements, The muscle contraction lasts from 2 to 3 seconds)

A- Measuring the strength of the muscles that bend the wrist joint upwards (extensor muscles):

Measurement position: The injured person stands on a chair and holds the forearm on the platform, the palm downwards and one end of the dynamometer is fixed at the bottom of the assistive device. The second end of the dynamometer is fixed or held by the clamp in the ring with the injured palm, the injured person tries to bend the wrist joint slowly and forcefully upwards, so the indicator moves in a manner equivalent to the force exerted, taking into account the stability at the end of the measurement, and the indicator is read and the measurement is taken, taking into account that the forearm is not moved.

B- Measuring the strength of the muscles that bend the wrist joint downwards (holding muscles):

Measurement position: The injured person stands on a chair and fixes the forearm on the table, palms upwards, and fixes one end of the dynamometer device to the bottom of the assistive device. The second end of the dynamometer is fixed or held by the clamp in the ring of the injured person's palm, the injured person tries to bend the wrist joint slowly and forcefully upwards, so the indicator moves in a manner equivalent to the force exerted, taking into account the stability at the end of the measurement, and the indicator is read and the measurement is taken, taking into account that the forearm is not moved.

Third: Measuring the degree of pain of the wrist joint (9:48)

The purpose of the test is to measure the degree of pain of the sufferers.

Instruments used: Genometer painkiller, pen, chair.

Performance Description: The degree of pain is measured by the specialized therapist from several positions, (pain at rest, pain when pressing on the area) as well as the normal positions of the hip joint (flexion, stretching, rounding, distancing).

Registration : Recording the pain score in all positions mentioned in the pain score measurement form. Appendix 3

Exploratory Experiment

The exploratory experiment of the research was carried out on (2) athletes with wrist ligaments outside the research sample on Thursday, 10 a.m., at the Department of Sports Medicine, Ministry of Youth and Sports, Baghdad. Knowing the validity and safety of the devices and tools used in the research tests. Identify the problems that may be faced by the researcher or the core sample during the implementation of the tests. Identify the clarity of the instructions for the measurements and the extent to which the patients respond to them.

Pre-test

The researcher conducted the pre-test on the sample on Sunday, 3/11/2025 at ten o'clock in the morning on the research sample of (5) players, in the Department of Sports Medicine, Ministry of Youth and Sports, and after the completion of the examination by the specialized doctor, he went to the hall to complete the physical tests.

Rehabilitation exercises with paraffin wax

Rehabilitation exercises were prepared with paraffin wax, and reviewing many Arab and foreign sources and references, and previous studies related to rehabilitation, and taking the opinion of a group of experts and specialists, as the researcher prepared physical exercises for the rehabilitation of the injury of the intermediate partial tear of the wrist ligaments after conducting the pre-test of the research variables of the research sample. This was during a period of (5) weeks throughout the rehabilitation period of the injured, as the rehabilitation training sessions were applied in the Department of Sports Medicine, Ministry of Youth and Sports, Baghdad, with the use of paraffin wax and under the supervision of the specialized therapist and according to the time period for each member of the research sample, by improving the range of motion, physical flexibility and the strength of the muscles working for him, as the wrist joint is one of the joints that move in all directions, as this was done to help in the Rehabilitation of a moderate partial tear of the wrist ligaments and the return of the injured to a normal state before the injury occurred in terms of range of motion and strength of the muscles working on the joint. The duration of the rehabilitation exercises was (5) weeks and (4) units, taking into account some important points that must be taken into account when performing these exercises (the injured person is warmed up to the wrist area using paraffin wax, the gradual giving of rehabilitation exercises from easy to difficult, the exercises are performed at the limits of pain, taking into account the extent and flexibility of the injured joint's joint when performing rehabilitation exercises and according to the degree of pain Commitment to apply the vocabulary of the rehabilitation sessions according to the specific time and place Stop applying the exercises when any side effects occur on the injured player)

The rehabilitative exercises were carried out each warm-up session using paraffin wax, as the first and second weeks included the use of static and motor exercises, flexibility exercises, and negative and positive range of motion, while the third week the researcher took into account the use of exercises that help the injured person to move to the second stage in order to achieve the adaptation of the athlete with the wrist joint, and the researcher took into account the principle of sequence and gradation in the repetition of the exercises and their subordinate groups in proportion to the level of The ability of the sufferer to realize the benefits of exercise. Using rubber bands of different resistance as described in Appendix (10) with light weights that help and the level of rehabilitation and rehabilitation, as it included fixed exercises without adding weights, fixed exercises with weights, mobile exercises without weights, moving exercises without weights Moving exercises by adding weights to activate and raise the

functional efficiency of the work of the working muscles and increase the range and motor flexibility, to prepare the injured part in a way True taking into account the principle of gradation from easy to difficult and increased exercise during the qualifying unit. Paraffin wax baths have been relied on to prepare the affected area, i.e. using wax as a substitute for warm-up, as the physiotherapist begins to prepare the injured part by washing it with soap and water to remove the fatty layer, dirt and dust stuck to the skin, which can lead to reducing the speed of heat conduction, as well as to prevent the transfer of dirt stuck to the skin to the wax, which affects its effectiveness, validity, and duration of use in rehabilitation, and after the melting of the paraffin wax mixture. It is ensured that its temperature is suitable for the rehabilitation of injured athletes by using a thermal sensor (thermometer) under the temperature of the mixture ranging between (52-58) degrees Celsius, and after the session, the hand is wrapped in a nylon bag, then with a piece of the bag and the wax layer are removed from the injured area, and then the rehabilitation exercises are applied directly.

Post-tests

The researcher conducted the post-test on the sample on Tuesday, 13/12/2025, at ten o'clock in the morning, on the research sample of (5) players, at the Department of Sports Medicine, Ministry of Youth and Sports, and after the completion of the examination by the specialized doctor, he went to the hall to complete the physical tests.

Statistical Methods:

The researcher used the Statistical Pouch (SPSS)

Presentation, analysis and discussion of the results :

Presentation and analysis of the results of the arithmetic medians and standard deviations of the pre- and post-measurements of the research group in the studied variables.

Table (3) shows the arithmetic means, standard deviations, calculated T, and sig value of the research sample.

| Significance | sigg | t | P | Post-testing | | Pre-test | | Testing | |
|--------------|-------|-------|-------|--------------|----------|----------|----------|-------------------|--|
| | | | | on | Going to | on | Going to | | |
| Moral | 0.002 | 6.78 | 4.60 | 0.79 | 17.80 | 0.83 | 13.20 | Approximate wrist | Measuring the range of motion of the wrist joint |
| Moral | 0.001 | 8.62 | 4.40 | 0.70 | 27.00 | 0.89 | 22.60 | Wrist removal | |
| Moral | 0.000 | 22.31 | 14.80 | 0.70 | 62.79 | 0.80 | 48.00 | Wrist flexion | |
| Moral | 0.000 | 21.00 | 12.60 | 0.69 | 45.60 | 0.72 | 33.00 | Wrist Extension | |

| | | | | | | | | | |
|-------|-------|-------|-------|------|--------|------|--------|---------------------------|---|
| Moral | 0.000 | 22.19 | 28.60 | 1.30 | 71.80 | 2.56 | 43.20 | Newton's Extensor Muscles | Measuring muscle strength to flex the wrist joint |
| Moral | 0.000 | 31.00 | 31.00 | 1.30 | 149.80 | 1.54 | 118.80 | Newton Holding Muscle | |
| Moral | 0.000 | 12.94 | 6.60 | 0.54 | 0.60 | 0.83 | 7.20 | Degree | Degree of pain |

Freedom score (n-1) = 4 significance level (0.05)

Through the presentation and analysis of the results of the pre- and post-measurements of the research sample, it was found that there is a significant difference between the pre- and post-measurements of the research group and in favor of the post-measurements, as the researcher attributes this difference to the use of rehabilitation exercises with paraffin wax, which had an effective role in the process of rehabilitating the injured, returning to the normal state, and getting rid of pain, and the rehabilitation exercises have the main and important role of returning athletes with wrist joint injuries throughout the rehabilitation period to the effectiveness of the exercises. The rehabilitation used was carefully selected and graded from easy to difficult and from simple to relatively complex, varied and comprehensive, with regular repetitions and times according to the type of exercise that suits and the level of type, degree and severity of the injury for all muscles, forearm ligaments, wrist and palm of the hand and in different directions, which helped in adapting to the working muscles and the injured ligaments, as it included fixed exercises as well as mobile exercises and negative and positive exercises throughout the rehabilitation period to be suitable with the type and degree. The severity of the injury contributes to the return of the range of motion of the wrist joint at (approximation, distance, flexion and extension) to its normal or close level, as well as a significant and obvious improvement in the strength of the muscles working on the wrist joint and a reduction in the degree of pain, which has been emphasized by (Farraj Abdel Hamid, 2005) that the practice of rehabilitation exercises leads to the improvement of flexibility in the joint, and the elasticity and strength of the muscles. Thus, increasing the range of motion (20:7), and here it must be stated that the rehabilitation exercises helped to relax the tense muscles and ligaments together in a slight way, thus improving their length slightly, which allowed the use of the joints at a greater angle, that is, the work of the working muscles improved in diastole and contraction better, and thus allowed the production of greater strength, as the rehabilitation exercises reduce muscle tension and lead to an increase in the muscle strength of the muscles working on the arm and their elongation. This leads to reducing the pressure on the ligaments, muscles and tendons, as well as increasing the stability of the joints and improving its functional efficiency (8:207), and rehabilitation exercises of various types, as well as the use of (body weight, therapist's hand, rubber ropes, assistive device, various weights) are one of the most important rehabilitation means that work to return to the normal state or as close as possible to the injured person, and in light of this, The use of different angles of muscular action helps the balanced and integrated growth of the muscle fibers of the entire muscle (25:10), and in this context,

with regard to the use of positive and negative mobile exercises in the advanced stages of rehabilitation, these exercises have worked to increase the range of motion, as well as improve neuromuscular compatibility and improve muscle contractions, thus restoring the motor abilities and basic functions of the wrist joint as close as possible to normal. This is consistent with the results of a study (Ahmed Ali Al-Attar and Abdel Halim Mustafa, 2006), as this study proved that the application of rehabilitation exercises has a wide effect on the return of motor range and functional efficiency closer to normal after a period of time, which varies according to the nature of the injury, its degree, the nature of the injured, and the degree of their acceptance of treatment. (83:1), the most important thing that the researcher wants is to rehabilitate the wrist joint for the research sample of athletes with partial (intermediate degree) tear of the wrist ligaments. The results of the two tables showed that the use of a rehabilitation program with paraffin wax as an alternative to warm-up to prepare the affected area because of its properties and a clear effect on improving the functional efficiency of the wrist joint ligaments, this helped to warm and prepare the affected area due to the heat generated by the wax. The ability of the wax to retain heat for a relatively long time, which helps to increase blood perfusion in the area of injury and prepare it for the application of rehabilitation exercises, thus helping to reduce pain, thus acting as an alternative to warm-ups and contributing to faster healing of the injury, and this is what I emphasized (Hayat Ayad Rafael, 1986). Skin from all warnings except the warmth of paraffin and hard layers of paraffin, as it prevents heat leakage (3:211), as well as the researcher believes that the use of paraffin wax rehabilitation as an alternative to warming up in the affected part, especially the limbs such as the two feet, feet, elbow and knees, and then the rehabilitation exercises are used immediately after the removal of waxing from the affected area, as it has an important role in the development of muscle extension and the injured ligaments in the injured people, especially when using this thermal method with rehabilitation exercises. The use of paraffin wax aims to heat the affected area and increase blood flow to the working muscles and ligaments that have been torn and uninjured (and it works to relieve pain and increase the nutrition of the cells in the area of injury, and works to absorb fluids, infiltration and blood pools in the area of injury, and helps to relax muscle contractions, break up adhesions between tissues, increase the elasticity of these tissues, reduce muscle stiffness and joint ligaments, and this helps to increase the range of motion). and muscle strength and pain reduction (6:46).

Conclusions:

- 1- The use of a rehabilitation program with paraffin wax has a positive effect on improving the athletes with wrist joint and returning to normal.
- 2- The use of paraffin wax, which was used as an alternative to warm-up, helped to prepare the injured area, thus preparing the injured to perform rehabilitative

exercises, which helped the course to increase the range of motion and reduce or reduce the degree of pain.

Recommendations:

Through the conclusions of the researcher, he recommends the following:

- 1- The researcher recommends emphasizing the application of a rehabilitation program accompanied by paraffin wax in a way that is consistent with the level of injury to improve the muscular strength and range of motion of the wrist joint.
- 2- Use paraffin wax, which has been used as a warm-up substitute to prepare the upper and lower extremities before applying rehabilitative exercises.
- 3- The necessity of conducting similar future studies related to the injuries to which the athlete is exposed and conducting research and studies of other injuries individually and in their different stages in order to delve into the specificity of each injury and prepare its psychological and rehabilitation sessions.

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Table (2) shows the form of the pain score test

| Dimensional | | | | | | | Tribal | | | | | | | Name of the athlete with wrist joint |
|---------------------|---|----------------|-------------------|------------------------|---|--------------|---------------------|--|----------------|-------------------|------------------------|---|--------------|--------------------------------------|
| Pain Grade (1 – 10) | | | | | | | Pain Grade (1 – 10) | | | | | | | |
| Total | Pain in motion at the angle of natural ranges | | | | Pain when applying pressure to the area | Pain at rest | Total | Pain in motion at the angle of the ranges Natural | | | | Pain when applying pressure to the area | Pain at rest | |
| | 80° To bend | 75° Ext end | 40° Dis tan ce | 25° Ap pro xi ma te | | | | 80° To bend | 75° Ext end | 40° Dis tan ce | 25° Ap pro xi ma te | | | |
| 10 | 2 | 2 | 2 | 2 | 1 | 1 | 10 | 2 | 2 | 2 | 2 | 1 | 1 | |
| | | | | | | | | | | | | | | |

