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RESEARCH ARTICLE

The Impact of Rehabilitation Exercises and Infrared Device on Knee Osteoarthritis Rehabilitation in Women Over 40 Years

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Abstract
The study aimed to prepare exercises using infrared radiation and identify its effect on the rehabilitation of women with osteoarthritis at the age of (40) women. The researchers assumed that there were statistically significant differences between the results of the rehabilitation tests for women with osteoarthritis (muscular strength, degree of pain, range of motion) pre and post. For the research group, the experimental method was adopted by designing the experimental group on a sample that was intentionally chosen by (100%) of the women suffering from this injury who are attended by the Al-Warith Center for Physiotherapy / affiliated with the Abbasid Shrine, who number (6) injured. The researchers prepared the rehabilitation exercises according to systematic steps that took a period of time to prepare and implement for the period extending from (5/1/2023) until (5/19/2023), with an application rate of (3) consecutive qualifying weeks, each week of which (3) units represented Rehabilitation sessions, bringing the total number of sessions to (9) rehabilitation units. The conclusions are that applying rehabilitative exercises using infrared rays helps rehabilitate women suffering from knee osteoarthritis by developing the strength of the muscles surrounding the joint and thus getting rid of the injury. It was determined that there were significant differences at the $p<0.05$ level of Muscular strength, Motor range and Degree of pain. The researchers recommend the need for centers to pay attention to Physiotherapy and should develop the expertise of the therapists working in it on how to apply rehabilitative exercises using infrared radiation in light of the findings of this study.

Keywords
Rehabilitation Exercises, Infrared Rays, Knee Roughness

INTRODUCTION

Researchers have researched a lot of research and studies and reviewed many books and scientific references that focused on knee osteoarthritis (Faleh, 2017; Khurabit, 2022), which gained the attention of researchers and specialists because it is the most common due to the many causative factors, some of which are acquired because the individual is aware of their results, and others come about due to lack of adherence to health standards and neglect of precautionary aspects that avoid the owner from being exposed to excruciating pain (Mahmoud, 2020). It hinders human movement, which prompted us to search for the reasons and causes that lie behind the occurrence of knee pain, on the one hand. And knowing the natural methods and methods that can be employed and used in treating it, including (all types of movement therapy, physical therapy, and therapy using infrared radiation), the researchers have found at the core of their research factors that are almost neglected, but they have an effective effect and influence in causing pain and fueling its severe, excruciating attacks.

A feature of our research is the diagnosis of atypical causes. According to this description of the cause, we have drawn up a treatment methodology derived from the nature of the condition, where we have adopted methods that have a natural therapeutic property, which we will

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go on to explain in the course of our research, and which are preceded by diagnostic methods (Ghazali et al. 2021).

Through the exploratory experiment with its scientific dimensions and comparison with the results and pre-tests, the researchers will deal with a number of precise scientific postulates and draw the specific framework for the therapeutic exercises that are characterized by innovation on the one hand and ease of acceptance on the other hand by the injured person, which enables him to practice them with desire and ease because they intervene by changing the course of his structural condition, and there is a factor It is calculated for the sustainability of therapeutic exercises because they are inexpensive without the need to use unavailable methods and tools and achieve good results. The idea of carrying out the research came as an effort and the result of the spirit of the multidisciplinary team, which pours into the crucible of diagnosis and treatment of knee osteoarthritis.

Also, this study is only an attempt on how to rehabilitate knee osteoarthritis injuries and return to the normal position. Here lies a problem, and therefore the research problem focused on the lack of research that uses infrared rehabilitation exercises, and through informing the researchers of some experiences in the rest of the countries that dealt with infrared training. This is a new experiment that the researcher hopes will be successful. The research aimed to prepare rehabilitation exercises accompanied by infrared radiation to rehabilitate those suffering from osteoarthritis of the knee at the age of (40) women, and to identify the effect of exercises accompanied by infrared radiation in rehabilitating women with osteoarthritis (muscle strength (flexion and extension)) at the age of (40) women. The researchers assumed that there are differences Statistically significant between the results of rehabilitation tests for women with knee osteoarthritis (front and back thigh muscle strength) pre and post for the research group.

The areas of research were: a sample of women suffering from knee osteoarthritis, numbering (6) for the period from 2/25/2023 until 1/2023. And in the physical therapy hall in the Al-Warith Center of the Abbasid Shrine

MATERIALS AND METHODS

In the field of scientific research, choosing the correct approach to solve the problem depends mainly on the nature of the problem itself in order to reach the truth and reveal it. Therefore, the researcher adopted the experimental method with one group with two pre- and post-tests in order to suit the objectives of the research. A good sample selection will reduce sampling errors, which enhances the validity of the sample. The data and its accuracy represent the research community. The research community consists of people visiting the Al-Warith Center of the Abbasid Shrine in Karbala Governorate. The process of selecting the research sample is one of the problems that researchers face in their research, as the results of that research depend on it. Researchers must choose the research sample that. It represents the community of origin honestly with the aim of obtaining accurate results, and the researcher is the one who chooses the sample that suits his research and is the one who estimates his need for information that achieves his purpose.

In light of this concept, the research sample was chosen intentionally, as they were infected women in Karbala Governorate, aged (40 and above), who were diagnosed by doctors specialized in (Al-Warith Physiotherapy Center affiliated with the Abbasid Shrine), numbering (6) women.

Study Ethics

This study was conducted with the approval of the Ethics Committee of Al-Warith Center for Physiotherapy with reference number (ACP-2024-0338). All participants provided voluntary informed consent before participating in the study. The study protocol was conducted in compliance with the principles outlined in the Declaration of Helsinki and other relevant ethical guidelines. We ensured the privacy and confidentiality of the participants' data throughout the study. Any personal identifying information was kept confidential and was only accessible to the research team. Only aggregated and anonymized data were used for analysis and reporting purposes.

Participants were informed about the purpose and nature of the study, the potential benefits and risks involved, and their right to withdraw from the study at any time without penalty. They were assured that their decision to

participate or decline would not impact their future medical care or treatment.

The research team also provided detailed information about the rehabilitation exercises and infrared device being used in the study, including any potential side effects or discomfort that participants might experience. Participants were given the opportunity to ask questions and seek clarification before providing their consent.

Prior to the start of the study, the research team conducted a pilot study to ensure the safety and effectiveness of the rehabilitation exercises and infrared device. Based on the results of the pilot study, necessary adjustments were made to the study protocol to optimize the benefits and minimize potential risks for participants.

Data collection tools

Arab and foreign sources, the Internet, personal interviews, questionnaire forms, office tools, Kenova program for extracting range of motion, an infrared device, a visual analogue form for determining the degree of pain, a muscle force sensor device type (EK3-200) generation (3) (Italian).) Manufacture.

Research tests

A- Muscle strength test (Abdul Hamid, 2016): This is done through a muscular strength sensor device, generation (3). The purpose of the measurement: to measure the muscle strength (extension and flexion) of the research sample.

Unit of measurement: Newton.

Performance instructions

Performance description

Prone - bending the leg backwards.

Description of performance: From the prone position, the injured person extends the leg straight, then a force sensor device is placed on the end of the shin bone from behind, and the injured person is asked to bend the leg backward with maximum force, through which the device's reading is recorded and the best reading is taken.

2-Visual analogy form (Baker 2016).

It is a scale used in many foreign countries to determine the degree of pain at the site of injury. The purpose of the measurement: - To measure the degree of pain.

Unit of measurement: degree.

Performance instructions

The patient is presented with a sheet of paper with a 10 cm long line on it and divided into 10 degrees. The patient is asked to determine the degree of pain he feels while performing the movement of the affected part. Each square has a performance time of 5 seconds (meaning that after the end of the five seconds, the transition is made to The box after it) requires determining the degree of pain that the tester feels while moving the affected part to the maximum extent that can be reached.

Calculating grades: The degree of pain felt by the patient when moving the affected part to the maximum possible extent to reach it is recorded. A grade of zero expresses the absence of pain and a grade of 10 expresses the maximum pain that the injured person cannot bear.

Note: The degree of pain was measured using visual analogy, which was determined and applied by the specialist therapist, and in two modes

First situation

From the prone position bending

The laboratory lies on a bench at a height of (1) meter, with the back straight, the arms next to the body, and the leg in the natural flexed position. The injured person raises the injured leg while it is bent, then remains in this position until the pain is felt. After that, the score is recorded. .

The second position

From the prone position - extension: - the laboratory lies down on a platform at a height of (1) meter, with the back straight and the arms next to the body, and both legs are in the bent position, after which the injured person extends the injured leg and then remains in this position until the pain is felt, and it is recorded. grade in the form. Visual analogy, and the tests used by the researcher were determined after presenting them to a group of experts and specialists.

Motor range measurement test using the (Kenova) program application. The range of motion of the knee joint is measured to measure knee osteoarthritis injuries by measuring the joint angles using the application (Kenova program), which is a program designed to measure the angles to be measured in a way that is compatible with the nature of the sample individuals and the type of injury.

Objective of measurement

Measuring range of motion. Unit of measurement: degree

The laboratory bends the hip joint upward as much as possible by raising the entire leg upward with the greatest possible flexion.

Method of calculating the score

The score is calculated by analyzing the movement of the injured person after achieving the maximum range of motion by flexion that the injured lab can reach without feeling pain.

Exploratory experience. The researchers intended to conduct the exploratory experiment on 2/27/2023 on (2) of the research sample who were not enslaved from the main experiment. Its purpose was to know the conduct of the tests, control the components of the rehabilitation curriculum, and the safety of the devices and tools.

Pretests

The researchers conducted pre-tests on 2/28/2023 on the third auxiliary research sample in the afternoon in the physical therapy hall of the Al-Warith Physiotherapy Center in Karbala. The main experiment was that the researchers presented the rehabilitative exercises after preparing them to a group of experts to confirm their application to the research sample, as it included the rehabilitative exercises. The researchers, after reviewing many Arabic sources and references. Foreign and previous studies on rehabilitation developed rehabilitation exercises, and the purpose of these exercises was to strengthen the thigh muscles (improving muscle strength, reducing pain, range of motion, as well as the time and duration of performing the exercises.

The rehabilitation exercises prepared by researchers and presented in many sources and references include performing exercises accompanied by infrared radiation to rehabilitate women suffering from osteoarthritis of the knee joint, starting from (5/1/2023) until (5/19/2023). The purpose of these exercises is to improve muscle strength. Degree of pain, range of motion, as follows

Duration: (3) weeks.

The qualifying units consist of (9) units, three units per week (Sunday, Tuesday, Thursday).

The time of each rehabilitation unit is approximately (20) minutes, and the division is as follows: -

For (5-7) minutes, the infrared device is taken by the injured person at the beginning of the rehabilitation unit for the purpose of preparing the muscles and warming up in preparation for the start of the exercises. The intensity of the rays and their distance from the site of the injury is determined by the physical therapist. 13-minute qualifying exercises that include the following:

A- Start with static exercises, then dynamic exercises, accompanied by infrared radiation.

B- The sample tries to perform the exercises without assistance.

C- Researchers use a progression of exercises in terms of difficulty in each exercise.

D- The repetitions of rehabilitation exercises should be few and then begin to increase.

E- The researchers will use clarification methods so that the sample members can perform the exercises correctly.

The researchers also took into account, when developing the exercises, targeting the specificity of each muscle, as well as focusing on the fact that the exercises contain auxiliary tools and are graduated between stability and movement and between ease and difficulty, and are comprehensive in terms of the type of exercises and in a way that serves the sample to benefit from the rehabilitation exercises developed to accompany infrared rays.

Statistical method

A statistical program was used in the statistical analysis of the data obtained. Arithmetic mean, standard deviation, frequency, minimum and maximum values were used in statistical representations of the data. In the normality testing of the data, kurtosis and skewness values of ±1.5 were taken into consideration. Independent Samples T-test were used in the analysis of normally distributed data.

RESULTS

The researchers conducted pre- and post-tests for the research variables related to the rehabilitation of injured women among members of the research sample and treated the data statistically to achieve the objectives of the research and verify its hypothesis. The results are presented and analyzed below, as I discussed the statistical treatments obtained and adopted their interpretation and support them with scientific sources. Presentation of the results of the pre- and post-tests for the variables of degree of pain,

muscle strength, and range of motion among the research sample.

For the purpose of achieving the goal of the study, preparing rehabilitation exercises in rehabilitating women with knee osteoarthritis and identifying their effect between the pre-test and post-test and for the benefit of the post-test among the research sample. Therefore, the researchers processed the data obtained statistically using (mean, interquartile deviation) and to find out the significant differences between the pre- and post-tests for the group The research used the Wilcoxon test as shown in the tables below. Table (1) Arithmetic means, standard deviations, and T-test value between the pre- and post-tests for the research variables in tests of muscle strength, range of motion, and degree of pain.

Table 1. Comparison of the differences in results of the rehabilitative exercises using infrared rays and knee osteoarthritis

Variables	Pre-Test		Post-Test		T Value	Sig Level	Sig Type
	Mean	Standard Deviation	Mean	Standard Deviation			
Muscular strength	38.665	6.562	51.833	5.845	6.403	0.001	Sig
Motor range	22.333	6.713	7.834	1.166	5.008	0.004	Sig
Degree of pain	51.832	5.846	25.001	3.283	19.848	0.000	Sig

*p<0.05: Abbreviations: MS: Muscular strenth, MT: Aspartate Motor range

DISCUSSION

It is evident from Table (1) and the values for the pain degree test, which showed the values of the arithmetic mean, the standard deviation, and the T-test value, as the mean value for the pre-test was (51.832) and for the post-test (25.000), and the standard deviation value reached (5.846) and the T-test value (19.848) and below a significance level smaller than the significance level (0.05).

Which indicates the presence of significant differences in favor of the post-test. The researcher attributes this to the use of the rehabilitation curriculum prepared by the researcher, which included reducing the degree of pain, improving strength, and range of motion, as it had a positive effect in reducing pain and eliminating it during the rehabilitation stages, and the patients were able to achieve these. Moral values: Due to the correct performance of the exercises, through the direct supervision of the researchers, these significant results were achieved, which were in favor of the effect of using rehabilitative exercises using infrared rays. make the player feel comfortable and relieve pain. Flexibility exercises complement any rehabilitation program and greatly relieve the affected person. Strength exercises also have an effective importance in alleviating and eliminating pain. Therefore, when developing rehabilitation exercises, the researchers focused on using exercises represented by strength exercises, stretching, and the goal is to reduce pain. Pain and to remove it, preceded by infrared rays, which played a role in relieving pain.

Table (1) shows the values of the pre-test for the muscular strength variable if the arithmetic mean value was (38.667) and the standard deviation value was (6.562). After applying the rehabilitation exercises using infrared rays for the muscular strength variable, the results of the post-test were in the arithmetic mean values (51.833) and the deviation value. The standard value is (5.845) and the value of the T-test is less than (0.05). This indicates that there is a significant positive effect between the pre-test and the post-test on the muscle strength variable and for the benefit of the post-test. The researchers attribute the emergence of these results to the rehabilitation exercises that included strength exercises, stretching, and the use of infrared radiation, as they were of great importance in improving muscle strength during the rehabilitation of women suffering from osteoarthritis of the knee. The researchers point out that performing strength exercises had a positive effect in rehabilitating the injured women and trying to return it soon. His

health condition before the injury, and that the muscle maintains its ability to protect itself. It became clear from the results that the curriculum, which contained the exercises that the researchers used, had a moral impact on the time of returning to competitions. recurrence of injury and improving muscle strength (Al-Naja, 2018) emphasizes that rehabilitation exercises must include strengthening exercises.

These exercises aim to increase muscle strength and endurance (Farhan, 2017) also confirms that the importance of muscle strength for health, especially health. The musculoskeletal system and the scientific basis for developing muscular strength is done through the two rules of gradualness and increasing the load, and any type of resistance can be used to achieve this purpose. Whether in the form of free weights, weight training devices, rubber ropes, or exercises in which body weight is used, and to work on engaging the muscles that have the largest space and to regulate special exercises for these muscles in a way that serves the success of the rehabilitation process, and this is what the researchers worked on, as they used tools There are multiple ways to improve muscular strength according to the rules of gradualness and increasing burden. Researchers believe that the improvement in the muscular strength component came as a result of harmonic adaptations in the neuromuscular system, i.e. (regulation of nerve impulses), more than the strength resulting from muscular hypertrophy. This is due to the duration of the rehabilitation exercises, which lasted for (10) weeks Muscular strength exercises help to strengthen the connective tissues in the muscle and protect them from injuries. The stretching exercises used in the rehabilitation curriculum also had an effective effect in increasing muscle strength using several methods in the rehabilitation process for women with knee osteoarthritis (Othman 653, 2018) indicates the positive effect of the flexibility component in improving Muscle strength and its development.

This is consistent with the study (Adeeb, 2015), which recommended that stretching exercises should be accompanied by muscular strength. Therefore, the researchers took into account when preparing the exercises and after they contribute to alleviating pain, which is accompanied by an improvement in the muscular strength that was lost due to the injury, which leads to lack of strength. The ability to move, and this leads to a weakness in the level of working strength in the affected part. The researchers also used a progression in the exercises in terms of performance time and the gradual difficulty and ease of each exercise. This helped in the effectiveness of these exercises and thus improved the strength of the sample members to achieve the goals of the exercises set.

From Table (1), the pre-test values for the range of motion variable appear, as the arithmetic mean value was (22.333) and the standard deviation value was (6.713). The post-test values after applying the rehabilitation exercises using infrared radiation were the arithmetic mean value (7.834) and the standard deviation (1.169). The value of the T-test was (5.008) with a significance level below (0.05), which showed the presence of significant differences, indicating an improvement in the range of motion of the research sample, and that the rehabilitation exercises using infrared radiation that the researchers usedThe researchers were characterized by diversity and progression with the aim of helping the muscle to return to its natural state and through it improving and restoring the range of motion of the hip joint. The intensity of the exercises used was appropriate and within the limits of the affected sample's capacity as well as within the limits of the injury, as obtaining a sufficient amount of range of motion for the muscles of a particular joint, its tendons and ligaments or The group of joints in a particular movement or activity depends on the amount and intensity of exercises performed in a wide range of motion degree of range of motion previously acquired by the individual, and as (Razouqi, 2020) indicates, rehabilitative exercises achieve several goals, including improving the detailed range of motion, and (Muhammad, 2021) shows that rehabilitative exercises work to strengthen the working muscles of the affected part and reach the range of motion. Full joint, after using rehabilitation exercises accompanied by infrared rays, which have proven their effectiveness The researchers reached the following conclusions and recommendations.

The exercises prepared by the researchers and preceded by the use of infrared radiation have a positive effect in improving the muscle strength of women suffering from knee osteoarthritis. The exercises prepared by the researchers and

preceded by the use of infrared radiation contributed to alleviating and improving the level of pain for women suffering from osteoarthritis of Exercise preceded by the use of infrared rays have a positive effect in restoring and improving the range of motion of women suffering from knee osteoarthritis.

As for the recommendations

Guided by the rehabilitative exercises prepared by the researcher in rehabilitating women with osteoarthritis. Use the measuring and testing devices that researchers used when evaluating knee osteoarthritis injuries. Taking into account the psychological aspect during the rehabilitation of injured players in general. Continue to perform some exercises regularly even after completing the rehabilitation curriculum in order to prevent the injury from occurring again. Conduct similar studies in games, samples, and other levels. Conduct similar studies on other muscles, and before that, study the characteristics of these muscles before starting to develop rehabilitation exercises. That is, other variables related to knee osteoarthritis injuries using other methods and methods in addition to exercises.

Appendices

From a standing position, arms in front, the injured person swings the affected leg forward and then backward, with the leg tight. Standing with the arms aside, the injured person swings the affected leg to the sides (right - left), with emphasis on tightening the muscles of the affected leg. From a standing position and using a rubber band, the injured person places the rubber band on the affected leg and pulls the band to the four sides alternately, so that each side has 10 repetitions. From a standing position, leaning against the wall of the pool, with the arms next to the body, the injured person bends the legs so that they are at a 90-degree angle between the thigh and the leg, then remains in this position. From the standing position, resting the arms on the wall of the rehabilitation center, the injured person raises the legs by pushing the ground with the combs and returning them back down. Standing, arms bent, the injured person places the comb of the injured leg on the edge of the chair (it is inside the water), and attempts to go down by bending the leg at the knee joint. The exercise is performed for both legs alternately. Standing in front of a ladder, arms holding the ladder. The injured person climbs only one ladder and ascends with the healthy leg. The the knee. The exercises used with infrared rays have a positive effect in improving the muscular strength of the research sample.

injured leg is then pulled and bent at the knee joint while pulling it and then descending.

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Conflict of Interest

Authors declare no conflict of interest.

Ethics Statement

The interventional study was accepted by Ethics Committee of Al-Warith Center for Physiotherapy (Protocol number- ACP-2024-0338).

Author Contributions

Planned by the authors: Study Design, NHFAH and SAH ; Data Collection, NHFAH and SAH ; Statistical Analysis, NHFAH and SAH; Data Interpretation, NHFAH and SAH; Manuscript Preparation, NHFAH and SAH ; Literature Search. All authors have read and agreed to the published version of the manuscript.

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