# The Effect of the Thermal Frequency Device for Shock Waves on the Efficiency of the Knee Joint and the Skill of Rotating The Cord Backward by Bounce for Female Students with Simple Rupture of the Lateral Collateral Ligament

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## Abstract

The research problem lies in the injury of the collateral ligament of the knee joint and what causes this injury of pain. This pain increases in cases of bending and extending the knee joint for any movement and by informing researchers about the physical therapy units, they found that rehabilitation of the injury is usually through traditional rehabilitative exercises, such as weights, for example, which are often unwanted by the injured who prefer the faster and easier method of performance and by using modern devices, including the thermal frequency device and the shock waves because it generates the desire and the rehabilitation and psychological effect on the injured, therefore, the researchers decided to go into this experiment by using rehabilitative exercises in a scientifically studied manner accompanied by a thermal frequency device and vibrational waves to rehabilitate the collateral ligament injury for students by strengthening the muscles surrounding the joint, in addition, the development of some rope skills in rhythmic gymnastics for students, and the research aims to prepare rehabilitative exercises accompanied by a thermal frequency device for vibrational waves in the efficiency of the knee joint and the skill of rotating the rope backward with rebound for students with a simple tear of the lateral ligament, the researchers used the experimental approach in the method of (one group) with the two pre and post-tests due to its suitability to the nature of the problem, the sample was chosen by the intentional method of (7) students with partial tearing of the lateral ligament of the knee joint based on a medical report from the specialist doctor, and after a medical examination and an (MRI) scan. In light of the results reached by the researchers, the following conclusions came out: The rehabilitative exercises have a positive effect in rehabilitating the partial tear of the lateral ligament for students with rhythmic gymnastics.

***Key Words:*** *Thermal frequency and shock waves device, knee joint efficiency, the skill of turning the rope backwards by bouncing the rope, simple rupture of the lateral collateral ligament.*

## Introduction

The use of devices and tools in the sports field has a great role in preparing the athlete, and it has a great role in the educational and training process, and it is one of the most important ingredients that contribute effectively to teaching players to motor skills and developing their sense of confidence and safety during motor performance (1), and the thermal frequency and shock waves device is one of the medical devices developed in the field of prevention, rehabilitation and physical therapy, and thus it has become one of the most important treatment requirements, in addition to adopting rehabilitative and therapeutic exercises that help in healing or avoiding injury. The researchers used rehabilitative exercise therapy, accompanied by a thermal frequency and shock wave device, which the main goal is to provide appropriate treatment for sports injuries and to rehabilitate the lateral ligament of the knee joint and strengthen the muscles in order to maintain joint flexibility and not atrophy of those muscles, most of the students suffer from various kinds of injuries, and

these injuries stand in the way of the development of their levels. Therefore, we find that sports injuries are constantly increasing, and this may be the reason for the lack of interest in warming up, excessive training (very high repetitions, high intensity, poor planning of training programs) so that it is not commensurate with the ability of students, falls and fatigue during performance, the performance of movement in excess of the ability of the student, all these factors directly affect the effectiveness of your rhythmic gymnastics, because this event requires a high level of skillful performance because most of the skills need to move quickly, jump and change direction and may lead to a sports injury, here comes the role of sports medicine in treating the injury, but the student's return to performance again after the injury, in order to undergo a sports medical rehabilitation, as her return without undergoing rehabilitative exercises exposes her to a greater injury. Therefore, rehabilitation and therapeutic exercises are generally considered the most effective means in returning injured students to the normal state they were in before the injury. As there are indications that these exercises affect the student's body with many effects, including (restoring muscles and joints to their functional capabilities, returning them to work well ... etc.). The urgent need to use modern means and techniques in physiotherapy, including rehabilitative exercises, accompanied by a thermal frequency device and shock waves appeared. These, in turn, increase muscle capacity and increase its flexibility much faster. The knee joint is one of the important joints in the body and that knee injury has become a phenomenon that attracts attention and causes concern, and especially in the effectiveness of your rhythmic gymnastics, this is the delicate part that it is used in its tactical significance and is very clear during the performance, which leads to the student being injured in the knee joint about 99% of injuries in the knee joint are minor, and they may become physical injuries if appropriate treatment is used at the right time. Hence the importance of research in the use of rehabilitative exercises accompanied by a thermal frequency device for shock waves in the efficiency of the knee joint and the skill of rotating the rope backward by rebounding for students with simple tearing of the lateral ligament.

**Research problem:** The research problem lies in the presence of large numbers of female students with knee joint, especially in the effectiveness of rhythmic gymnastics because this event requires a high level of skillful performance because most of the skills need to move quickly, jump and change direction.

**Research Objective:**

The research objective is prepare rehabilitative exercises (with the shock wave thermal frequency device, the knee joint's efficiency and the skill of spinning the rope backward with rebound) and the effect on the efficiency of the knee joint for female students with a simple tear of the lateral ligament.

**Research fields:**

**The human field:** Third stage students of the College of Physical Education and Sports Sciences - University of Kufa.

**Time field:** from 6/12/2020 to 2/3/2021.

**Spatial field:** Gymnastics classroom at the College of Physical Education and Sports Sciences / University of Kufa.

Research methodology and field procedures:

**Research Methodology:**

The researchers used the experimental approach in the (one group) method with two pre and post- tests, due to its suitability to the nature of the problem

**Community and sample research:**

The research community consisted of (7) female students with partial rupture of the lateral ligament in the College of Physical Education and Sports Sciences / University of Kufa, the sample was deliberately chosen, and their number was (5) students out of (7) and the reason for that was their lack of commitment to the rehabilitative units and they were excluded and their number was (2), so the sample percentage became 71% of the original for those with a partial tear of the lateral ligament of the knee joint based on a medical report from the specialist(*), and after a medical examination and taking an (MRI) scan. And those who did not pass from their injury (1-2 months). The researchers homogenized the sample with variables (height, weight, age and degree of injury) and table (1) shows that.

**Table (1) shows the homogeneity of the sample.**

| Measurements | Mean | Std. Deviation | Median | Skew ness |
|---|---|---|---|---|
| Length (cm) | 173 | 5,449 | 170,800 | 0,514 |
| Weight (kg) | 60 | 3,162 | 61 | 1,186 |
| Age (years) | 19 | 0,547 | 18,600 | 0,609 |

The value of the skew ness is confined to ± 3, and this indicates the homogeneity of the research sample.

**Tests used:**

**Pain scale test:**

**The purpose of the test:** To measure the degree of pain.

**Tools used**: Digital scale.

**Method used**: The injured lies face down, the researchers ask her to bend the injured leg from the knee to the injured woman to point to the face that when she feels pain, the facial expressions become the same expressions that the patient referred to, and from here the degree of pain is determined by the degrees under each expression.

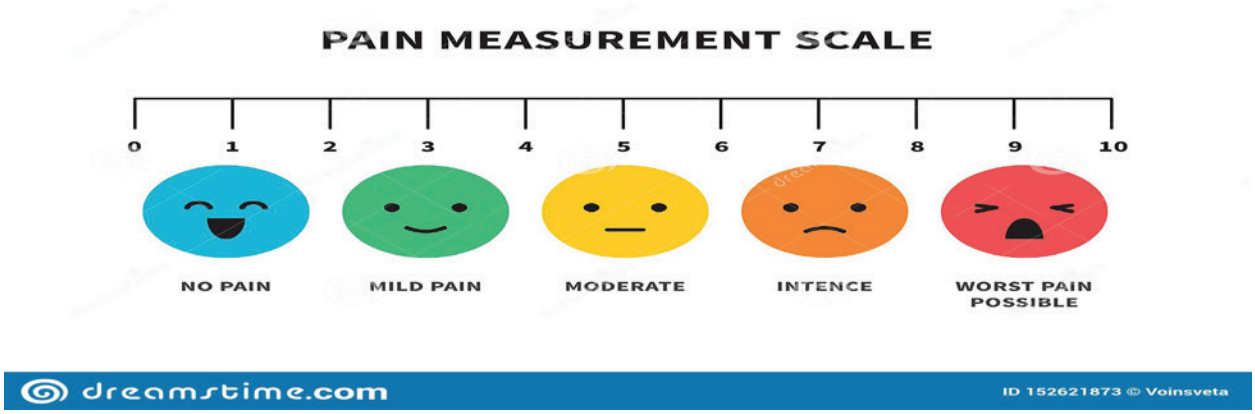


**Figure (1) shows the digital pain scale.**

**Register:** Researchers ask the patient to refer to each face using the words to describe the severity of the pain.

**Notice**: The pain score scale that the researchers used to measure the degree of pain is a digital ruler that contains five pictures of faces that express the intensity of pain, and each of these five expressions contains varying degrees of pain degrees, i.e. for each expression a specific degree of pain of these degrees is from (0-10), zero indicates no pain and ten indicates very severe pain.

Test the skill of turning the rope backwards with a bounce:

As the researchers evaluated the technical performance of the rope skill based on the apparent shape of the skill, using the Canon camera, recording it manually via CD, and presenting it to the evaluators for analysis and recording the results of their evaluation through the evaluation form prepared for this in advance of 10 marks, noting that two attempts will be given to each student and choose the best.

**Physical Measurements:** The researchers conducted pre-tests on the members of the research sample consisting of (5) students with partial tearing of the lateral ligament of the knee joint, on Sunday, 6-12-2020.

Measurement of muscle strength of the muscles operating on the knee joint [1]:

**Measuring the strength of the knee extensor muscles:**

**The purpose of the test**: Measuring the strength of the muscles working on the knee joint from the front (quadriceps muscle).

**Tools and devices used**: Chair, dynamometer.

**Test procedures**: The student sits on the table in a comfortable position, and the dynamometer device is attached to the student's leg and is installed under the table behind the student, and she pulls the device with maximum force to the limits of pain.

**Register**: The student pulls out the device with maximum force, records the reading of the device, and the register is done in kg. The student is given three attempts and the best attempt is recorded.

Measuring the strength of the knee flexors: [2]

**The purpose of the test**: Measurement of muscle strength working on the knee joint from the back (posterior muscles).

**Tools and devices used:** Chair, dynamometer.

**Test procedures:** The student sits on the table in a comfortable position, and the dynamometer is attached to the student's leg and is fixed under the table in front of the student and she pulls the device with maximum force forward to the injured leg.

**Register:** The student pulls out the device with maximum force and records the reading of the device in kg. The student is given three attempts and the best attempt is recorded.

Motor range measurement: [3]

**Positive motor range measurement:**

**The purpose of the test:** Measuring the range of motion of the affected knee joint without assistance.

**Tools used:** Goniometer device.

**Test procedures:** The injured stands in a normal position, so that the leg opening is according to shoulder width (resting on the healthy leg), the injured bends the affected knee to the maximum extent possible so that when the maximum degree of bending is reached, one of the researchers takes a goniometer to take the measurement by placing the fixed arm on the thigh and the center of the goniometer on the end of the knee joint and moving the other arm according to the bending of the leg.

**Register:** When applying the measurement, the researchers took a measurement of the maximum flexion angle (the range of motion) of the injured knee without assistance, and it was three attempts, the researchers took the best attempt, and there was a rest period between one attempt and another full minute.

Passive motor range measurement:

**The purpose of the test:** Measuring the range of motion of the affected knee joint with assistance.

**Tools used:** Goniometer device.

**Test procedures:** The injured woman lies and extends her legs on the surface of the ground, the injured bends the injured leg so that one of the researchers puts his hand on the injured leg to help her bend her knee to the maximum, provided that there is no pain.

**Register:** When applying the measurement, one of the researchers takes a measurement of the maximum flexion angle (the range of motion) of the affected knee with the help and it was three attempts and the researchers took the best attempt and there was a rest period between one attempt and another full minute.

The main experience:

After the sample was selected from the women with a partial tear of the lateral ligament of the knee joint from the College of Physical Education and Sports Sciences / University of Kufa and after the necessary medical examinations (clinical examination, magnetic resonance examination (MRI)), the main experiment was started on Tuesday, 8/12/2020, and the approach was applied

curriculum rehabilitation.

**Preparation and implementation of rehabilitating exercises accompanied by a thermal frequency device and vibrating waves:**

Researchers have presented the exercises and qualification curriculum to experts and specialists, and it has been revised and modified to bring it out in its final form.

- The treatment was done using rehabilitative exercises and accompanied by a heat frequency and shock wave machine.

- Most of the rehabilitative exercises accompanied by a thermal frequency device and vibrating waves work to develop the muscles and tendons working on the knee joint to achieve the goal of the curriculum.

- The period of time for the rehabilitative unit is (12) weeks.

- The number of rehabilitation units is three units per week (Sunday, Tuesday and Thursday), so the total units are 36 rehabilitative units.

- The researchers took care that the rehabilitative exercises be modern and accompanied by the thermal frequency device and the vibrating waves and of a different character from the usual traditional exercises inside the treatment centers. For single mode as well as increasing iterations.

- The time of the rehabilitation unit, accompanied by the thermal frequency device and the vibrating waves, ranges between (20-30) minutes.

- The rehabilitation unit included a 10-minute warm-up for all parts of the body for the purpose of preparing the muscles.

- The intensity of the exercise depends on the injured person not to feel pain during the performance.

- The researchers took care that the exercises were modern, so he would explain the exercise thoroughly and pay attention to applying the exercise correctly to ensure the safety of the injured person.

- Not continuing when performing exercises when the affected person feels pain or stress.

- The rehabilitation units ended on Monday 1/3/2021.

The post- tests were conducted on the research sample on Tuesday 2/3/2021 at 10 O'clock a.m. that is, after (12 )weeks had passed since the start of the experiment, in the order of the same pre-tests, and in the same circumstances, and for each patient separately.

## Presentation of Results

**Table (2) Shows the mean and standard deviations of the pre and post- tests of the pain score variable.**

| Variables | Measuring unit | Pre -test | | Post- test | | Average ranks | | Total ranks | | Wilcoxon value | Sig level | Sig type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Std. Deviation | Mean | Std. Deviation | Negative | Positive | Negative | Positive | | | |
| Flexing strength for the infected leg | Kg | 14.600 | 3.113 | 25.800 | 4.449 | 0.00 | 3.00 | 0.00 | 15.00 | 2.022 | 0.041 | Sig |

***Cont...*** **Table (2) Shows the mean and standard deviations of the pre and post- tests of the pain score variable.**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Extensor strength of the infected leg | Kg | 13.000 | 2.545 | 28.600 | 4.722 | 0.00 | 3.00 | 0.00 | 15.00 | 2.023 | 0.043 | Sig |
| Positive motor range for the infected leg | degree | 100.000 | 13.039 | 61.000 | 13.942 | 3.00 | 0.00 | 14.0 | 0.00 | 2.022 | 0.042 | Sig |
| Passive motor range for the infected leg | degree | 116.000 | 14.431 | 61.000 | 12.942 | 3.00 | 0.00 | 15.00 | 0.00 | 2.022 | 0.043 | Sig |
| Pain degree | degree | 8.700 | 1.095 | 2.400 | 1.673 | 3.00 | 0.00 | 15.00 | 0.00 | 2.042 | 0.041 | Sig |
| Turn the rope back with a bounce | degree | 4.800 | 1.095 | 2.400 | 1.534 | 3.00 | 0.00 | 15.00 | 0.00 | 3.041 | 0.041 | Sig |

Below the significance level (0.05) and the degree of freedom (4).

Table No. (2) shows the value of Wilcoxon (2,022) with a probability of error (0,041), which is less than the significance level of (0.05), and this means that there are statistically significant differences between the pre and post-test for the variable of the strength of the thigh muscles flexion and in favor of the post test, as for the Wilcoxon value (2,023) with error probability (0,043), which is less than the significance level of (0.05), this means that there are statistically significant differences between the pre and post-test for the variable of extensor thigh muscle strength in favor of the post test. And the Wilcoxon value is (2,022) with a probability of error (0,042), which is smaller than the level of significance of (05,0), and this means that there are statistically significant differences between the pre and post-test of the positive motor range variable in favor of the post test, as for the Wilcoxon value (2,022) with error probability (0,043), which is less than the significance level of (0.05), this means that there are statistically significant differences between the pre and post-test of the motor range variable in favor of the post test.

And table (2) shows us that the value of Wilcoxon is (2,042) with probability of error (041,0), which is less than the significance level of (0.05), and this means that there are statistically significant differences between the pre and post measurements of the variable degree of pain in favor of post-test. Also table (2) shows us that the value of Wilcoxon is (3,041) with error probability (0,041), which is less than the significance level of (0.05), and this means that there are statistically significant differences between the pre and post-test of the skill of spinning the rope in favor of the post-test.

## Discuss the Results

Through the presentation and analysis of the results of the pre and post-tests of the variable (strength) of the research sample, it emerged that there are significant differences between the pre and post tests and in favor

of the post-test, the researchers attribute the reason for these differences to the increase in strength for the tests through rehabilitative exercises that take place in the individual taking a certain position through slow movement in this position and gradually the ease and difficulty of the rehabilitative unit, it starts with seconds and reaches (60) seconds of steadiness and then returns to the initial position that has a great effect on resistance and with repeated (3-6) times, it will lead to the work of certain muscle groups and for a long period that leads to an increase in muscle strength in general, both (Mcanada & lyndo huey) state that "rehabilitating exercises contribute to the rehabilitation of many sports injuries, the elimination of the outcome of the injury, and the return of the injured person to his health before the injury until the injured gradually regains his athletic level, thus achieving the goal of the rehabilitation program" [(4)], through the presentation and analysis of the results of the pre and post tests for the variable (range of motion), it emerged that there are significant differences between the pre and post tests and in favor of the post-test, meaning that qualification gives an opportunity for good graduated work, it contributes to the growth of weak muscle groups, helps the patient to recover the muscle tone lost due to injury, and helps to relax, and the patient is more receptive to performing rehabilitative exercises [(5)] .

Performing and adhering to rehabilitative exercises regularly and within certain repetitions and specific times makes the body more flexible and gives the muscles and joints a series of freedom of movement[(6)]. Also, "the best way to develop flexibility is to perform exercises with little force in order to sustain performance for an extended period of time to cause tissue adaptation events [(7)].

By presenting and analyzing the results of the pre and post tests for the variable (pain scale) of the sample of the research, it emerged that there are significant differences between the pre and post tests and in favor of the post-test, "We can increase the benefits gained by doing rehabilitative exercises that try to correct the local imbalance when it is addressed by the movements that are implemented in many positions, the focus seeks to restore balance to the muscles concerned, as part of the process of softening all muscles of the body, and the thigh muscles should be strengthened, thus eliminating pain [(8)].

By presenting and analyzing the results of the pre and post-tests of the skill (turning the rope back by bounce) of the research sample, it emerged that there are significant differences between the pre and post tests and in favor of the post-test, the researchers attribute that the rehabilitative exercises helped in improving the technical performance in line with the capabilities and capabilities available to each student in order to reach a good level of performance of the required skill.

## Conclusions

In light of the results reached by the researchers, they came out with the following conclusions: -

- The rehabilitative exercises accompanied by the thermal frequency device and the vibrating waves have a positive effect on the rehabilitation of muscle strength and range of motion and the disappearance of the degree of pain for the partial rupture of the lateral ligament of the students injured in rhythmic gymnastics.

- Significant differences appeared for the post-tests in the muscular strength of the muscles (extensor and flexor), the range of motion and the degree of pain of the knee affected by a partial tear of the lateral collateral ligament of the research sample.

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**Conflict of Interest:** None to declare.

**Ethical Clearance:** All experimental protocols were approved under the Faculty of Physical Education and Sports Sciences and all experiments were carried out in accordance with approved guidelines.

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