A PROPOSED REHABILITATION APPROACH FOR KNEE JOINT REPLACEMENT AND ITS EFFECT ON RANGE OF MOTION AND MUSCLE WEAKNESS

Dr. Qusaysaleh Mal Allah Al-Mousawi1, Dr. Khalil Ibrahim Almsafar2

College of Physical Education and Sports Sciences, Basra University, Iraq

Consultant Orthopedic Surgeon

Lecturers in Alzahra Medical College

1qusaialmosawi1973qq@gmail.com, 2dr_khalil1977@yahoo.com

ABSTRACT

In the research, we discussed the importance of the knee joint, as it is the most important joint in the human body and has a more complex structure as a result of the effort and burden that falls on it, which made it more vulnerable to injury, especially the severe prolapse of this joint, which causes severe pain. This explains the importance of the research in preparing the rehabilitation curriculum for it and the reason for choosing this research problem. Study procedures the curriculum was prepared in a scientific way and its impact on the extent of movement, joint muscle weakness, measurement before and after the curriculum, and then processing the data statistically and reaching the following conclusions, which are represented in the impact of the curriculum positively on patients in terms of functional and kinetic. As for the most important recommendations, it is necessary to apply the approach to patients who have joint replacement, and to prepare a special approach for the rest of the joints to be replaced.

I. INTRODUCTION AND IMPORTANCE OF RESEARCH

The largest and most important joint in the human body is the knee joint. It is the only joint that performs two opposite movements: stability by bearing body weight and movement by bending and stretching, walking and jumping. Making it more susceptible to injury, as the percentage of injury in this joint constitutes a large percentage through tears that challenge the ligaments and cartilage. Joint replacement based on the doctor's instructions that the joint has reached a very critical stage and needs a replacement operation, and this shows the importance of research in choosing the researcher. The nervous system of the new joint through the rehabilitation exercises prepared in the rehabilitation curriculum proposed by us to carry out all its vital work so that the patient can return to his activities freely even before the injury through the changes caused by this disease from acute. Pain and difficulty in movement and the ability of rehabilitation exercises to return the patient after the operation to a state closer to the normal level through the tests that are applied before and after the curriculum.

Research problem

By reviewing references and periodicals, they found that there is no specific rehabilitation curriculum for knee joint replacement that is based on scientific and functional foundations that enables the patient to perform his daily work properly after the joint replacement operation. Who has lost a large part of his job with an artificial joint that needs rehabilitation exercises that enable him to perform the stretching, tightening, lifting and lowering movements that the patient needs in his daily life to perform his daily work, and the ability to perform rehabilitation exercises to rehabilitate the joint gradually and sequentially, enabling him to reach an advanced state of performance Mobility through bending and tension and bearing body weight as a result of the adaptations that occur to the joint as a result of exercises performed inside the joint. Rehabilitation curriculum. From us to support sports medicine with new rehabilitative methods that enable the injured to reach a speedy recovery and this requires preparing a codified rehabilitation curriculum to replace the knee joint because of its importance in the human body. To replace this important joint.

Research Objectives
1 Preparing a rehabilitation curriculum for knee joint replacement
2 Recognizing the differences in the pre and post tests of the range of motion and the weakness of the joint muscles

Research Areas
1 The human domain: the coaches of the first-class football clubs in Basra Governorate.
2 Date range: 10/10/2020 to 1/6/2021.
3 Spatial domain Joint Replacement Center at Al-Jumhouri Hospital - Basma Amal Center for Medical Treatment

Research methodology and field procedures
The researchers used the experimental method for its suitability and the nature of the problem to be researched. Empirical research means “a deliberate or controlled change of the specific conditions of an event and the observation and interpretation of changes resulting in the event itself”. (Wajeeh Mahjoub: 1985: 398).

Population sample and research
The research community was represented by trainers suffering from acute knee joint replacement and in need of knee replacement from (50-55) to first-class clubs in Basra Governorate (10) who visit orthopedic and fracture doctors and joint replacement center in Basra General. The hospital was examined by orthopedic and traumatology Dr. Khalil Ibrahim, 4 of who were excluded for the presence of other injuries to the knee joint which the researchers chose to represent as “the part that represents the original community or the model. That the researcher as a whole and the focus of his work.” (Mahjoub meal 2002: 165) The researchers chose a sample of it in the intended way due to the availability of the ability to control its research variables more accurately than the rest of the samples, where the research sample consisted of (6) players. Partial rupture of the medial ligament of the knee joint, so the research sample consisted of 60%. In order to adjust the research variables accompanying the course of the research experiment and to identify the validity of the sample and to distribute the values of its variables moderately, the researcher found homogeneity of the research sample in terms of height, weight and age. And age of training using the skew modulus. The results showed that the individuals of the research sample were distributed normally in the search for variables, and therefore there are no outliers. The values of the deviation coefficient were limited to (±1), which indicates the normal distribution of the sample as shown in Table (1).

It shows the homogeneity among the members of the research sample in the morphological variables

<table>
<thead>
<tr>
<th>No</th>
<th>Variables</th>
<th>measuring unit</th>
<th>Arithmetic mean</th>
<th>standard deviation</th>
<th>Variation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>height</td>
<td>cm</td>
<td>173.000</td>
<td>4.939</td>
<td>2.855</td>
</tr>
<tr>
<td>2</td>
<td>the weight</td>
<td>kg</td>
<td>71.833</td>
<td>4.445</td>
<td>6.188</td>
</tr>
<tr>
<td>3</td>
<td>biological age</td>
<td>year</td>
<td>21.000</td>
<td>1.095</td>
<td>5.214</td>
</tr>
<tr>
<td>4</td>
<td>training age</td>
<td>year</td>
<td>7.500</td>
<td>1.048</td>
<td>13.973</td>
</tr>
</tbody>
</table>

Means of collecting information, devices and tools used in the research
1 Arab and foreign references and sources. and information network
2 Sample standardized tests of normal range of motion for knee joint and muscle weakness. A questionnaire form for the opinions of experts and specialists in the field of (sports medicine, rehabilitation, training physiology) about the proposed rehabilitation curriculum.
3 Japanese-made electronic stopwatch No. (4) and a device for measuring weight and height no. (1)
4 Goniometer to measure range of motion, medicine balls, camera, bed, rubber bands, rug, ice bags and tapes.
5 Crying Therapy Mat
6 Electrotherapy device - EMS (dozens)

7 Electrotherapy - EMS (Faradic)

Measurements and special tests in research

Body measurements (morphology)

1 Height measurement: The tester stands straight and barefoot in front of the wall-mounted centimeter ruler. Then we try to touch the highest point of the facing ruler from the highest area of the head and calculate the height to the nearest centimeter.

2 Measurement of body mass (weight): The weight is measured with a medical scale where (the detective) stands erect on the scale without wearing sports shoes, then the reading given by the indicator is taken to the nearest one kilogram.

Measuring the circumference of the thigh muscle

1 The purpose of the measurement: to know the size of the thigh muscles of the affected limb in its transverse circumference.

2 Measurement procedures: The casualty lies on the table with the legs extended. Using the measuring tape, the distance is calculated from the top of the patella bone and in the middle and (10) cm and in the direction to the femur, and a mark is made with a pen. The measurement is done by rolling the tape over the thigh muscle and the marked mark. Then in the same way the quadriceps muscle of the uninjured knee is measured and the difference in circumference between them indicates atrophy of the quadriceps muscle in the affected knee. If the difference is (1) cm, then the atrophy is minimal. And if it is (2) cm: the atrophy is medium, and if it is (3) cm, then it is high. (Vasile slot, Lăcrămioara slot)

3 Recording: Record the circumference of the injured player's thigh in centimeters.

Measure the circumference of the calf muscle

1 The purpose of the measurement: to know the size of the leg muscles of the affected limb in its transverse circumference.

2 Measurement procedures: The casualty lies on the table with the legs extended. Using a tape measure, the distance from the top of the patella bone and in the middle is calculated, 5 cm is calculated and in the direction under the tibia, a mark is made with a ballpoint pen. The measurement is done by rolling the tape over the calf muscle and the marked mark. Then in the same way the uninjured calf muscle of the knee is measured and the difference in circumference between them indicates atrophy of the calf muscle in the affected knee. If the difference is (1) cm, then the atrophy is minimal. If it is (2) cm: the atrophy is medium, and if it is (3) cm, it is high.

3 Recording: The injured player records the circumference of the calf muscle in centimeters.

Testing the range of motion of the knee joint in case of tension

1 Purpose of the test: The test aims to measure the range of motion of the affected knee joint in case of stress.

2 Instruments used: goniometer, laboratory lying mat.

3 Description of the examination: The person who took the measurement stands next to the laboratory (the injured) while he is lying on the rug. The goniometer is placed on one side of the affected knee area (medial or lateral), then the patient is asked to extend the affected leg forward and the moving arm of the device moves with the mediastinal axial line of the affected leg, the other remains fixed in its first position, and the angle between the two arms of the device is read. The measurement, which represents the extension angle of the affected knee joint. Recording: Goniometer refers to the measurement of the range of motion of the affected knee joint in degrees to the laboratory (Inaam Magdy Al-Najjar 1996: 67)
Testing the range of motion of the knee joint in case of flexion

1. Purpose of the test: The test aims to measure the range of motion of the affected knee joint in case of flexion.

2. For the instruments used: goniometer, lying mat in the laboratory.

3. Description of the examination: The cyst is standing next to the laboratory (the injured) while he is lying on the rug, then the patient is asked to bend the leg (the affected joint) inward, and the movable arm moves with the movement from the joint to the inside and parallel to the longitudinal mediastinal line of the affected leg while the other arm remains stationary in its first position and reads the angle between the two arms of the device, which represents the angle of flexion of the affected knee joint. Recording: Goniometer refers to the measurement of the range of motion of the affected knee joint in degrees to the laboratory (Inaam Majeed Al-Najjar 67)

Tribal tests

After identifying the members of the research sample of trainers who need joint replacement after a series of clinical examination procedures by Orthopedic and Traumatology Consultant Dr. Khalil Ibrahim and examination by (MRI), the researchers conducted preliminary tests on the research. Sample (6) the researchers provided a brief explanation of how the measurements were carried out and their sequence. The researchers also demonstrated that all measurement conditions (time, place, and climate) are able to create similar or similar conditions when subsequent tests are performed.

Eligible Curricula Used

The researchers prepared a rehabilitation curriculum for knee joint replacement after reviewing Arab and foreign sources and a personal interview with experts and specialists. And the information network to obtain sufficient information, and through the modest experience of researchers in the field of work, the curriculum was prepared in the form of Annex (1), where they dealt with a group of physical therapy devices represented in pain relief. Devices, electrotherapy devices and cpm devices. Sequential rehabilitation exercises from easy to difficult, from simple to complex, and contains (30) qualifying units at a rate of three units per week, with a time rate for each unit ranging from 40 to 60 minutes, and the curriculum lasts for two and a half months, and the curriculum was implemented on 05/12 until (February 20, 2021)

Postal tests

The post tests were conducted after the completion of the application of the curriculum by the research sample on (9/2/2021) at nine o’clock in the morning at Basmat Amal Center for Physiotherapy and Medical Rehabilitation.

Statistical means

1. Percentage
2. Arithmetic mean
3. Standard deviation
4. Standard error
5. One independent sample T test

Presentation and analysis of results

Presentation and analysis of the results of previous and post tests of the range of motion of the knee joint

Table (2) shows the arithmetic mean, standard deviation, standard error, significance level and (t) value calculated in the flexion and extension variable of the affected knee joint before and after the sample curriculum.
It is clear from the above table that there are statistically significant differences between the pre and remote tests of the flexion test for the affected knee joint for the research sample group and in favor of the test after the curriculum. The arithmetic mean of the pretest for knee flexion was (104.666) with a standard deviation (13.261) and the arithmetic mean of the pretest for knee joint extension was (141000). With a standard deviation of (14.791) and the arithmetic mean of the post-test of the knee flexion test (44.000) and a deviation of (2.529), the arithmetic mean of the post-test of the knee flexion test (168.166) and a standard deviation of (4.708) and the calculated T value of the knee flexion test was (10.229) with a standard error of (5.931) and at the level of significance (0.000), which is less than the level of statistical significance (0.05), meaning that there is a significant difference between the pre-test and the post-test. and the calculated test. The T-value of the tidal test for the knee joint was (4.154), with a standard error of (6.539), and at the significance level (0.009) which is less than the level of statistical significance (0.05), that is, there is a significant difference between the pre- and post-test and the evolution rate of the flexion test (57.96%), and the evolution rate of the tidal test (16.15%)

Presentation and analysis of the results of the differences in the tests to measure the thickness of the calf and thigh muscle of the affected leg before and after the research sample method

Table (3)It shows the arithmetic mean, standard deviation, standard error, level of significance and (t) value calculated in the calf and thigh muscle thickness variable of the affected leg before and after the sample chart.

<table>
<thead>
<tr>
<th>Variable</th>
<th>measuring unit</th>
<th>pretest</th>
<th>post test</th>
<th>standard error</th>
<th>Calculate (t) value</th>
<th>probability value</th>
<th>indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf muscle thickness</td>
<td>cm</td>
<td>2.500</td>
<td>0.547</td>
<td>0.500</td>
<td>0.089</td>
<td>0.254</td>
<td>7.865</td>
</tr>
<tr>
<td>Thigh muscle thickness</td>
<td>cm</td>
<td>2.666</td>
<td>0.516</td>
<td>0.583</td>
<td>0.194</td>
<td>0.181</td>
<td>11.478</td>
</tr>
</tbody>
</table>

It is clear from the above table that there are statistically significant differences between the pre and post test to test the thickness of the leg and thigh muscles for the research sample group and in favor of the test after the curriculum. (2.666) with the standard deviation (0.516) and the arithmetic mean of the post-test of calf muscle thickness (0.500), with a deviation of (0.089), the arithmetic mean of the test of thigh muscle thickness (0.583) and the standard deviation (0.194), and the calculated T value for muscle thickness test was (7.865) with standard error (0.254) and at a significance level (0.001) which is less than the level of statistical significance. (0.05), that is, there is a significant difference between the pre and post test, and the calculated T value for the thigh muscle thickness test was (11.478) with a standard error of (0.181) and at the level of significance (0.000), which is less than the level of statistical significance (0.05), which means that there is a significant difference between the pre- and post-test and with the percentage of development of the calf muscle thickness test (80%) and the rate of development. For quadriceps ecstasy (78%)

Discussing the results of measuring the flexion and extension of the knee joint of the affected leg for the research sample before and after the method.
The range of motion obtained by the knee joint in the tests (before the syllabus) gave preference to the tests after the syllabus, and this is a natural result of the flexibility of the joint. On (30) rehabilitation units, at a rate of (3) rehabilitation units per week, the researcher has been keen since the beginning of the curriculum on the use of therapeutic devices such as cryotherapy, and then thermal and electrical stimulation, and because they have a major role in improving the range of movement, as the use of devices in The beginning of the curriculum is considered an alternative to the warm-up exercises, through which you work to raise the temperature of the muscles and thus reduce the viscosity of the muscles. The fluid surrounding the joint. The more viscous it is, the less or limited the movement of the joint and vice versa. This is agreed upon by Talha Hosam, Wafaa Salah, Mustafa Kamel and Saeed Abdul Rashid. Ease of muscle movement, which leads to increased flexibility.” (Talha Hossam El-Din: Wafaa Salah El-Din, Mustafa Kamel Hamad, Saeed Abdel-Rasheed: 1997: 280) as well as the gradation of units to give the joint flexibility in proportion to the nature of the changes that occurred. The rehabilitation approach to developing muscle strength increases significantly in the event of an increase in the motor performance capacity of the knee joint, and thus helps to use the properties of the rubber components in the muscle at the beginning of the movement (“Abu El-Ala” Abdel-Fattah: 1997: 98) and this is consistent with the importance of flexibility, because the more you lean On the knee joint its width hinders its strength and speed, and this is reflected in the level of neuromuscular compatibility between muscle fibers as well as between muscles which are very important in restoring the healing of the knee joint to perform its normal functions Flexion, extension, lifting, lowering, adduction, abduction, carrying and fixation of the body. The researchers also believe that one of the important indicators of the return of the joint to its normal position is through flexion, extension, and removal of the limitation that occurred as a result of the injury in the range of motion. Throughout the rehabilitation period.

Discussing the results of measuring the thickness of the calf and thigh muscle of the affected leg for the members of the research sample before and after the curriculum.
Measure the circumference of the calf and thigh muscle of the affected leg before and after the curriculum.

Through the results presented in Table No. (2) and the significant differences in the tests whose results were in favor of the post-test, the researchers attributed the reason for the ethical differences of this variable to the treatment and rehabilitation program, which is: Based on scientific foundations on how to choose the appropriate rehabilitative therapeutic exercises for the knee with rupture Partial in the knee medial ligament which helped to increase the size of the muscle in the circumference of the affected thigh and calf, that is, the increase in the anatomical section of the muscle groups. The process of adaptation with the muscles surrounding the knee joint and the gradual gradation in the therapeutic exercises and the gradual increase in weight with weights led to an increase in the circumference of the calf muscles and thigh muscles and the elimination of atrophy, and this is consistent with what was indicated by Abu Al-Ala Abdel-Fattah (Abu Al-Ela Ahmed Abdel-Fattah: 247: 1997). Indicated that muscle amplification is one of the main factors associated with muscle strength, as the injured sample of athletes has a precedent. And the cumulative preparation for functional adaptation and psychological rehabilitation which makes the level of response better than the injured non-athletes. Developing muscle strength means increasing its frequency and force of contraction, as this continually correlates the muscle with the resulting force, especially when performing maximum strength exercises, which require the mobilization of many fibers by type and the intensity of the resistance that correlates with an increase in nerve signals to give the maximum contraction, and this state can only be reached through “training and performing therapeutic (resistance) exercises for muscle strength, which in turn activate the reflex actions of the nervous system to innervate the largest number of muscle fibers and to show maximum muscle contraction (Haider Naim Rouhi: 2002) Researchers believe that when any muscle of the body is subjected to external loads frequently, regularly and on a strict scientific basis by rationing the load at the level of the sample, the body as a whole, especially the working muscle area, must face. This load provides immediate and cumulative responses so that we can continue to face these external changes. The change in the internal environment is one of those reactions in terms of physical and chemical, whether through number or quantity, and this is what appeared through the change in the size of the muscle, that is, the increase in the size of the muscle. Cross-section, which is one of the important physiological changes on the cumulative effects of the approach, which has a significant effect in showing muscle strength, and this, is in agreement with the results of the research.

II. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. The rehabilitative method designed to replace the knee joint has made a change and a positive effect in restoring the range of motion of the knee joint and getting rid of atrophy of the thigh and leg muscles.

2. There are differences in the pre and post tests of the range of motion (flexion - extension) of the artificial knee joint in favor of the curriculum.
There are differences in the pre and post examinations in the circumference of the muscle (thigh - calf) in favor of the method of eliminating muscle atrophy.

**Recommendations**

1. Emphasis on the use of the method prepared by the researchers, which has a role in returning the research sample members to a level closer to healthy individuals.

2. The use of specialized rehabilitative therapeutic exercises for the type of injury and according to the level of the injured.

3. The use of therapeutic devices, especially cooling devices between units, for the purpose of recovery and rest after the rehabilitation unit.

**REFERENCES**

1. Inaam Majdi Al-Najjar: A proposed approach for the rehabilitation of acute spinal injuries, College of Physical Education, University of Baghdad, 1996.


Experts and specialists whose opinion was taken on the qualification program prepared by the researcher:

1. Prof. Dr. Kamel Shanin Manahi, Rehabilitation of Injured, University of Basra / College of Physical Education and Sports Sciences.

2. Professor Ammar Jassim Muslim, Football Training Physiologist, University of Basra / College of Physical Education and Sports Sciences.

3. Professor / Majid Jaseb Hussein, football training physiologist, University of Maysan / Faculty of Physical Education and Sports Sciences.


5. Professor Sakina Kamel Hamza, Rehabilitation of Injured, University of Babylon / College of Physical Education and Sports Sciences.

6. Professor Walaa Fadel Ibrahim, Rehabilitation of Injured, University of Karbala / College of Physical Education and Sports Sciences.

Supplement (1)

<table>
<thead>
<tr>
<th>total time</th>
<th>Rest between groups</th>
<th>rest between repetitions %</th>
<th>Repetition</th>
<th>Time</th>
<th>The exercises used</th>
<th>Qualifying unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 sec</td>
<td>2 sec</td>
<td>-</td>
<td>-</td>
<td>2 sec</td>
<td>1. Cryotherapy: The affected leg is exposed to a low temperature ranging from minus 90° to minus 148° as a maximum.</td>
<td>First</td>
</tr>
<tr>
<td></td>
<td>2 sec</td>
<td>-</td>
<td>-</td>
<td>15 sec</td>
<td>2. Electrotherapy - EMS (Tens)</td>
<td>Second</td>
</tr>
<tr>
<td></td>
<td>2 sec</td>
<td>-</td>
<td>-</td>
<td>10 sec</td>
<td>3. Electrotherapy - EMS (faradic)</td>
<td></td>
</tr>
<tr>
<td>27 sec</td>
<td>2 sec</td>
<td>-</td>
<td>-</td>
<td>15 sec</td>
<td>1. Electrotherapy - EMS (Tens)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10 sec</td>
<td>2. Electrotherapy - EMS (faradic)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 sec</td>
<td>-</td>
<td>-</td>
<td>2 sec</td>
<td>1. Cryotherapy: The affected leg is exposed to a low temperature ranging from minus 90° to minus 148° as a maximum.</td>
<td></td>
</tr>
<tr>
<td>31 sec</td>
<td>2 sec</td>
<td>-</td>
<td>-</td>
<td>15 sec</td>
<td>2. Electrotherapy - EMS (Tens)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10 sec</td>
<td>3. Electrotherapy - EMS (faradic)</td>
<td></td>
</tr>
</tbody>
</table>
After completing the physical therapy device, the patient is subjected to a set of rehabilitation exercises, and this is a model of some of the exercises used in the curriculum.

After the operation, we put the negative flexion and tension device (cpm), which works slowly and gradually to increase the flexibility of the joint. The device will be turned off in case the patient needs to rest and use the device frequently.

We put ice around the knee, where the ice gives coolness and pressure to relieve pain and swelling and rehabilitate exercises.

Move the foot up and down, and this exercise is repeated ten times in three sets.

Foot exercises are important exercises by moving the foot up and down to improve blood circulation. It is also recommended to place a pillow under the foot for intermittent periods to prevent fluid from draining and settling in the joint of the foot.

**Tighten the leg while pressing the knee down:**

Tighten your thigh muscles, trying to push your knee down while pulling your ankle up. A small pillow or rolled-up towel can be placed at the end of the foot.

Hold for 10 seconds and then slowly relax. Do this exercise 5 times and repeat at least 10 times a day.
This exercise, as previously described, helps prevent loss of quadriceps strength and reduces swelling by squeezing fluid outside the knee.

Raising the leg from a lying position, where we tighten the thigh muscle with the knee straight. We raise the leg until it reaches a straight position, while pulling the foot towards the body, while the support remains in the first days. Stay in this position for 5-10 seconds. Do this exercise 5 times and repeat at least 5 times a day as much as possible.