

**Effectiveness of specific muscular balance experiences on the level of change of Q Angle in junior athletics**

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**Abstract:** The study aimed to identify the effect of the proposed rehabilitation program on the change in QQ angle on the improvement of the degree of pain and muscular strength and the dynamic range of the infected foot and the degree of equilibrium. The researcher used the experimental method and the case study in the measurement method (tribal - (8) weeks of the program divided by three phases (3 units per week). Where the program was applied for each case alone, and the most important results of the rehabilitation program has had a positive impact on the rehabilitation of the infected foot and improve the walking and movement of the sample in question and the return of the injured to participate in the training modules positively.

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**Keywords:** Muscular balance, Q Angle, junior, athletics

**Problem and Importance of the research:**

We find that technology development has negative impacts that resulted from low movement and lack of effort in performance. Modern machinery now perform most works. Sports accidents and injuries increased. As a result, strong muscles turned to weak muscles and joints now suffer obstacles and osteoarthritis, in addition to the wrong positions during the period of daily life. Injury may be attributed to low physical fitness and individual is exposed to many general injuries, including knee joint, in particular. (30:6)

Knee joint is one of the big joints in the human body. Anderson & Hall (1995) concluded that the key distinctive anatomic and functional properties which are key reason for exposure to sports injury and dysfunction that may follow it is overlapping joint that can protrude (successive movement) and is located between the longest bones of the body; namely, femur and limb bon. At anterior, there are patella bones, which provides possible injury on any points of contact of each other with knee that depends in its stability on joints and muscles around it from all sides. It helps stability of joint during movement and imparts it with strength required for performance of its functions. (145:22) (27:296)

Scientific research contributes to progress of sports activities. If we looked into the international levels in Olympic championships and courses, we could identify the immense progress and rapid increase of performance standard of players. With the rapid development of all sports activities in terms of skill and tactic components, it has become difficult for researchers and stakeholders in the field of sports training and physical qualification to follow all developments. In addition, complication of sports

performance in many international sports competitions led to necessary to utilize many accurate educational media.

Knee joint suffers many diseases and injuries as a result of motor behavior that doesn't match the functional properties and those reasons for deterioration of joint efficiency that culminates by aspects of vibration in joint surfaces till they erode, become rough and movement between them becomes painful. This may end by bones being free of cartilages and suffer vibration to contact points and pressure. The foregoing may be accompanied by changes of joint casing which increases in thickness as a result of inflammations. All this is within the range of patellofemoral joint pains. (25)

In study by the Academic Orthopedic Surgeon Academy in 1997 AD, it was found that more than 4.1 million people are subject to medical supervision on annual basis because of knee problems. Some of those problems result from erosion of some parts of knee such as knee osteoarthritis. Other parts result in injury such as sudden movement that works on torsion of joint part more than the allowed motor range. (28)

Reasons for knee joint's exposure to infliction of early pains of patellofemoral joint syndrome is attributed to high physical loads that practitioners of sports activities in general suffer whether activities exercised by lower terminal or upper terminal because lower terminal is greater joint factor in almost all sports activities. In addition to nature of formation of the knee which consists of femur patella joint and patella bronchial joint and lack of mental means and weakness of its articular surfaces. (20:283)

Many scientific studies note that treatment of femur patella joint from early pains is necessary to avoid deterioration of knee condition by osteoarthritis

with formation change of it as well as deterioration of their main functions, which necessarily requires surgical intervention. (40:22)

**Essam Abdelkhalek (2005 AD)** adds that balance is the starting point for motor performance and it has role in the performance in which bodyweight changes for the center point. (7:139)

Mohamed Beriqaq and Ehab Al Bediwy (2007 AD) note that there is positive relation between motor balance and accuracy of performance, particularly in motor skills which are characterized by frequent turns and rolls whether on the longitudinal or cross axis which may cause player to lose his balance. This requires player to be more balanced before performance of any next movement. (12:88)

Mohamed (2009 AD) notes that balance is one of the basic physical characteristics. Experiences and objective observation that player can't perform any sports movement properly if it is not related during its performance with the status of balance. Accuracy of skill performance is related to the player's capacity of balance during performance of skill. (15:185)

In view of importance of physical rehabilitation from sports injuries in its various sides and the consequential possible performance of motor packages in high standard through national and international competitions in accordance with practice of the researcher of work in the field of physical rehabilitation, particularly amateurs. The researcher found deficit of performance of muscular balance of muscular balance experience performance, which leads to appearance of Q angle pains in juniors.

Hodge William (2006) notes that there are changes that may happen with age and that joint cartilages, after they were smooth and bright, can be exposed to osteoarthritis and atrophy due. Due to continuous friction, bone swelling and bulges appear at the ends of bones. This was confirmed by study that was conducted in England on the level of group of men and women which confirmed that 50% of men and 52% of women are inflicted with those changes in more than one joint, and that this percentage increases with age to 98% in the age group (70:65:18)

Measurement of frequent Q angle is a means that predicts knee joint injuries and Q angle is represented in the anterior level of femur muscles that results from pressure on patella and tibial tuberosity, which is known as being between the lines that results from strength created by quadriceps muscles and line of patella strings. (17) (272:24)

Q angle is measured by goniometer based on the fact that the person to be measured in standing position in distribution of bodyweight over foot and that knee is in the position of extension and the angle is represented in the central patella and ossisnavicularis. Goniometer is placed in the central

knee and interior superior iliac spine and the last arm on tibia tubercle. (19:3)

It is agreed between scientists of sports medicine that physical rehabilitation is restoration of the injured person to natural condition since rehabilitation is restoration of fitness and ability of performance. This means here that he make the individual fit with readiness of his capacities and abilities that preceded injury, which is the most difficult process. The means that bring us to achieve this purpose is synergy of the fields of medicine and physical education in the position of physical rehabilitation programs that contribute to improve individual's health and to maintain his safety since medical treatment and practices of motor activity are two sides of the new coin which contributes to treatment of many contemporary diseases and rehabilitation of the injured person and rationalization of his return to society peacefully. (3:99) (4:10)

Mohamed QadryBakry (2000) notes that treatment by codified movement is one of the natural means in the field of integrated treatment. Motor treatment and rehabilitation depends on physical exercises of all types. (13:78)

As a result, the researcher conducted such study that aims at identification of the effect of development of muscular balance exercises on the pains of Q angle for juniors and amateurs in the field of sports and try to visualize trainers and specialists in the field of training and rehabilitation on the scientific basis of planning of training for development of balance and motor consistency as two important characteristics for beginnings in exercise of sports activities for improvement of performance and upgrade of skill performance as well as avoiding juniors' exposure to injury.

Through the researcher's work in the field of health and physical rehabilitation clubs of sports injury, large number of juniors who suffer pains of patella joint syndrome pains which are represented in pains of knee joint, pains of knee cap and pains of drivers' knee and in view of the researcher's assumption of relation between Q angle and patella joint syndrome pains that urged the researcher to create rehabilitation program to be used in the exercises of muscular balance to correct the track of Q angle in the way that reduces pains of patella tumor joint syndrome and improves the motor range and muscular strength of knee joint and muscular strength of thigh joint in members of the research sample, which contributes to return to exercise of their normal life and sports activities as well as participation in competitions. Due to low number of research in that field, particularly in the field of Q Angle of knee joint, the researcher conducted this research to be starting point for discovery of other research in that field.

**Objectives of the research**

The research aims at identifying the effect of muscular balance exercise program on change of Q angle in juniors who are inflicted with patella tumor joint by:

- A- Reduction of severity of knee joint pain.
- B- Improvement of motor range of joint.
- C- Strengthening muscles that work around the joint.
- D- Strengthening the adduction and abduction muscles around knee joint.

**Hypotheses of the research:**

The researcher assumes that the proposed rehabilitation program positively affects change of Q angle by:

- A- Reduction of severity of knee pain of the injured person.
- B- Improvement of motor range of the injured person's joint of the injured persons.
- C- Improvement of muscular strength of muscles around the body of the injured.
- D- Improvement of muscular strength of abduction and adduction muscles of femur joint.

There are statistically significant differences between the pre measurement and post measurement in favor of the post measurement of the experimental group under research in the variables under research.

**Terms of the research:****1- Rehabilitation exercises:**

One of the means of physical sports treatment with the purpose of utilization of purposeful rated movement whether in the form of different exercises or physical, functional or skill works and to restore the basic functions of injured organ and physically rehabilitating it to exercise sports activity. (13: 78)

**2- Patellofemoral pain syndrome**

In case of kneecap arthritis, which is soft sport on the cartilage surface of it and it is named chondromalacia or dashboard knee, knee cap pain and runner's knee. (21:16)

**3- Q Angle**

The angle that creates the line that results from strength created by femoral quadriceps muscle and line of patella strings. (20:18)

**4- Chondromalacia Patella**

Case of erosion, fragility or breaking of articular cartilage of patella which results from extraordinary joint pressure or coercive strength. (21)

**5- Balance**

Man's ability to keep his part or various parts of the body in certain position as a result of the symmetric complicated activity of group of biological systems and devices for work against gravity effect. (15:47)

**Literatures:**

1- Myer et al., Gregory (2008 AD) conducted study titled, "Effect of blometric and dynamic balance exercises on development of muscular strength and balance and the falling strength of amateurs" which aims at comparison of blometric training and dynamic balance training on development of muscular strength, balance and fall strength of amateurs. The researcher used the experimental methodology. The first sample included (19 amateurs). The key results noted that blometric training and dynamic balance training are effective in increasing development of muscular strength and balance, and increase of muscular control on fall for amateur women players.

**2- Study of Seham El Sayed Ghamry 2010 on:**

**Title: "Q angle and its effect on knee joints of sportsmen".** The purpose of the study was to prove that there is relation between knee angle and pains of sportsmen in the various sports activities. Sample of the research included one group of sports men in some sports academies (n=31) in the various sports activities in ages from 18-40 years. The researcher used suitable statistic treatments. Results of the following research showed that Q angle of Wadidegla players is 13.5°, walking players 19°, swimming players 13.6°, Zamalek players 13.8° and Academy players 16.5°. relation between Q angle and knee joint of academic players is statistically insignificant, and relation between Q angle and knee pain of WadiDegla players is statistically significant. Relation between Q angle and knee plain of Zamalek players is statistically significant. Relation between Q angle and knee pain of walking players is statistically insignificant, and relation between Q angle and knee pain of swimming players is statistically insignificant.

3- Mohamed Omar (2011 AD) conducted study titled "Effectiveness of program for muscular balance on the level of skill performance of some skills of fall on two legs for free wrestling players in military sports schools" identification of the effect of using muscular balance program for muscles working on the level of skill performance of skills of fall on legs for free wrestling players in military sports schools. The experimental methodology was used. Sample of the study included (20 players) as the key results noted that there are statistically significant differences between the experimental and control groups of the study in the average post measurements in favor of the post measurement of experimental group on the level of skill performance of skill of fall on legs for free wrestling players in sports military schools.

4- Al-Amir Abdulsattar (2013 AD) conducted study titled "effect of development of muscular balance for the muscles of lower limb on some physical variables and digital level for triple jump competitors with the purpose of designing training program for development of muscular balance of

lower limb muscles and identification of its effect on improvement of working muscle strength that correspond to the limb as well as improvement of some physical variables of jump competitors and digital level of triple jump competitors from (18-20) years. Experimental methodology was used. The sample included (15 players). The key results showed that the training program positively affected development of muscular balance and maximum strength of lower limb muscles as well as level of maximum speed and muscular strength of legs as well as symmetry, by increasing the growth rates between the average pre and post measurements for members of the research of sample.

5- Koitzh Nazir (2013 AD) conducted study titled, "Effect of motor balance on learning accuracy of shooting in basketball" that aims at identification of the effect of motor balance exercises on learning accuracy of shooting in basketball. Experimental methodology was used. The sample included (40 students). The key results showed that there are statistically significant difference between the pre and post measurements of the effect of motor balance experiences on learning the accuracy of ladder shooting in basketball and in favor of the post measurement, and there are statistically significant differences between the experimental and control groups.

6- Israa Gamal (2014 AD) conducted study titled, "Effect of motor balance exercises on the time of loss of balance and level of learning of crawling swimming on back for juniors". The study aims at identification of the effect of motor balance exercises on the time of loss of balance and level of learning of crawling swimming on back for juniors. Experimental methodology was used. The sample included (20 students). The key results noted that the experimental group made considerable improvement from the improvement of control group in each of the physical variables and time of loss of balance, side deviations and level of learning of back crawling tourism.

#### **7- Study of K. Mrityunjay, Deepak Chhabtra (2014)**

This study is titled, "Comparison between study of the effect of exercises of quadriceps muscles and strengthening of medial vastus muscle on Q angle and displacement of patella in ordinary persons". The purpose of the study is to find any previous strengthening exercises which are mentioned before that have better effect on the value of Q angle on displacement of patella. Sample of the research included 30 cases and ordinary Group A was divided into two groups. The first group is musculusvastus medialis extension and period of procedure was 4 weeks. The results showed that there is vast difference in the values of Group B of fixed strengthening

exercises of Q angle and displacement of patella after four weeks for the control group and strengthening muscles for the musculusvastus medialis which has greater effect on the value of Q angle and displacement of patella from the fixed strengthening exercises in reduction of the value of Q angle and side displacement of patella in ordinary persons.

#### **8- Study of Prachi Desbhratar (2014)**

Title of the study is, "Comparison of Q angle, twisting bronchium and muscular strengths in ordinary players and roughness for women". The study aims at comparing Q angle, twisting of bronchium and muscular strength between ordinary persons and patients of knee roughness and 40 who are not injured (normal). They were divided into two groups. Group one consisted of 40 patients with roughness of knee joint and group two are not injured. Average ages were over 45 and period of injury is one or more years and severity of injury (Kellgren and Lawrence, scale score) of the first grade or grade 2 to degree of Kellgren scale. Measurements such as Q angle measurement were taken from the standing position by goniometer system and bronchium twisting measurement from sitting position in 90° angle, and muscular measurement of quadriceps muscle and heads of femur, back muscle and stretching muscle of thigh joint and fixed strength using dynamometer. Results of the research showed that Q angle is low and muscular strength is low in the group of knee roughness injured persons as well as low muscular strength of each of quadriceps and thigh and back heads as well as stretching muscle of thigh joint in the same group and twisting of bronchium. There is no statistic significance. Conclusions of the research note that evaluation of Q angle, bronchium twisting and muscular strength shall be taken into account and shall be important as part in the form of evaluation before starting any rehabilitation program.

#### **9- Hugo, Elaine, Mario, Roberto (2014)**

The study is titled, "evaluation of track in various positions". The study aims at comparing the value of Q angle in the fixed position and rotation of patella terminal. Sample of the research included 56 volunteers- 30 women and 26 men. Q angle was calculated by photocopying. Results noted that there is difference between the standing position and biophotogrammetry position by squatting. Conclusions note that there are no differences between the various positions and stands in revision of Q angle. (56)

#### **10- Ashraf Al-Abbassy (2017) conducted a study titled "Knee injury of swimmers with disorder of Q angle and accompanying pains."**

The study aimed at identification of knee injury of swimmers with deficit in Q angle and identification of its reasons and the programs which are implemented by swimmers. The key results included

improvement of degree of Q angle of amateurs at 13° for boys and 18° for girls, as well as improvement of motor range and strength of muscle working on knee joint as well as disappearance of severity of their pain.

### Procedures of the research

#### Methodology of the research:

The researcher used the experimental methodology because it is suitable to nature and type of this research by the experimental design of single experimental group by application of post measurement.

#### Population and sample of the research:

Population of the research represents all participants in the games schools in Arish Sports

Stadium in the age group 15-17 years who are registered in the amateurs registers for the training year 2017/2018 AD. The researcher chose sample of the research in the purposeful method from the injured persons who visit motor rehabilitation center in Sinai. The main sample was (10) injured. The research was applied to single experimental sample.

#### Sample of the research:

The research sample was chosen in the purposive strata method in accordance with the specifications that were defined for safety of measures. The sample included 10 persons with patellofemoral joint syndrome of junior amateurs in ages between 15-18 years old.

**Table (1): Statistic description of the total sample in the variables under research N= 30 (Symmetry of the research sample in the variables under research)**

No	Variables	Unit of measurement	Arithmetic means	Median	Standard deviation	Skewed coefficient
1	Age	Year	16.65	16.5	46.	89.
2	Body height	Cm	166.17	165.6	3.61	1.4
3	Bodyweight	Kg	64.20	63.7	2.76	98.
4	Training life	Year	2.9	3.1	54.	88.
5	BMI	%	24.5	25	1.67	1.98

Table (1) indicates that all values of skewedness coefficients for the individuals the sample of the research in the variables of growth and muscular strength tests that ranged between (-0.86:1.07). These values were limited to ( $\pm 3$ ), which indicates symmetry of the members of the research sample in these variables before application of the proposed program.

#### Conditions for choice of research sample:

1- Members of the research sample are volunteers and they have desire to participate in application of the research to them.

2- It is preferred that body mass index doesn't exceed 26 so that there would be no factor of risk of weight increase as a key reason for patellofemoral pain syndrome.

3- Exercises shall be considered when tests are conducted on members of the same experimental group.

4- Persons who are not injured in any accidents or textural deformations shall be subject to medical examination by specialized physician before participation in the experiment of the research.

5- The injured case complains anterior knee pain that happens during walking or running, or during daily life tasks such as climbing stairs, falling or sitting for long periods of time at home or during driving for long periods of time or bicycling for completion of daily life duties, not any other knee

injury, provided injury is a first degree one and pain is related to daily activity on a side of knee.

6- Whoever has complaint of limb injury.

#### Administrative procedures

The researcher conducted the following administrative procedures to facilitate measures of the research as follows:

- Taking letter forwarded by the physician to the mentioned centers for execution of the research experiment.

- Taking approval of the mentioned center manager for execution of the research experiment.

- Explaining objectives of the research to the sample and assuring their desire to participate in the proposed program and assuring their compliance with the health and structural instructions by the research during daily life and during application of the research.

- Agreement with sample of the research and rehabilitation center on the time of required measurements and definition of appointments for execution of the program.

- Follow up with the specialized physician for each case separately, if any.

- Consulting experts in the field of natural medicine and sports medicine and specialists to identify the applicable methods of treatment and the

means used of treatment which are used for knee injuries, and to use them in everything related to the practical basis for designing the experimental program by designing expert survey form.

- Assuring safety of systems and tools before execution of experimental program.

**Data collection tools:**

1. Medical reports of each case.
2. Test of identification of pain.
3. Goniometer for measurement of motor range of knee joint to the nearest 5 degrees and to measure Q angle.
4. Leg extension- leg curl system to measure muscular strength of knee joint from twisting position and extension using variable weights and multi hip system to measure muscular strength around thigh joint using variable weights.

**Medical diagnosis:**

**Through the treating physician, which includes:**

**A- Interview:**

Raising questions to identify the pathological level of the injured in connection with the program of patellofemoral pain, and to assure injury that happens for the first time. Chronic cases were excluded and asked about the symptoms that the injured feels and when they have happened in the daily life conditions and level of pain that he feels.

**B- Clinical examination test**

This test reference to whether swelling is internal or external by the injured being in relaxation position, then patella shall be pushed down to the point of meeting of patella with femur. If swelling is internal, fluid under patella will return it and will define the net patella limits. If swelling is external, slight knock will be felt or knock will be felt in specific stop point when patella collides with the gap between patella and femur bones and patella border will be covered with excess external swelling.

**1- Patella apprehension test**

In this test, filler around knee is put and twisted at 20 degree then patella is pressed in direction of the gap of patella and femur bones. Test would be positive if there is positive feeling of pain or sound of friction.

**2- Patella apprehension test**

While knee is in relaxation position, patella is laterally pushed so the injured person showed it in voluntary response or by force, so this test is positive.

**3- Waldron Test**

Patella is examined by hand when individual twists knee slowly for several times, even if the injured felt pain, constriction or abnormal movement of patella. In case of appearance of any of those signs or symptoms continuously, this doesn't mean that test is positive. This is evidenced by existed cartilage leniency. (chondromalacia)

**4- Clark's sign:**

Using hand palm, hand is put close to the upper pole of patella. The injured shall stretch quadriceps while physician shall pull down slowly. If the injured managed to do this without pain, the test shall be positive and this test can show pain if pressure is enormous. Therefore, it is necessary to repeat the procedure several times with increase of pressure in case of stretching of the entire knee and at 30, 60,90 degrees on flexion of joint.

**Measurements:**

**1. Visual analog scale of pain**

Severity of pain is measured by defining muscle pain directly by using analogous visual scales or Clarkson Muscle soreness rating.

The direct method of assessment of muscular pain included use of Clarkson rated scale which is measurement the degrees of which range between 0:10, as 0 means that no person of the sample feels pain (0= no pain soreness) while 10 refers to inability of the person to bear pain (10= unbearable soreness complete pain relief). The figures between 0:10 present the various degrees by which tested person can express his feeling of pain as well.

**2. Evaluation of Q angle**

This is measured by drawing upper front line from the front upper iliac spine to the middle knee as intersection of these lines represents Q angle of quadriceps muscles and thigh heads. Q angle is measured in the position of stretching on back provided knee is stretched and quadriceps muscle is not stretched. This is one of the conventional methods of measurement of Q angle.

**3. Evaluation of muscular strength**

Muscular strength is defined as the strength that can be created by muscle or group of muscles. Test of muscular strength can be utilized in explanation of progress in the standard of training or rehabilitation from sports injuries or identification of the effect of improvement of rehabilitation programs. It can be defined using one of the following four methods:

- 1- Immovable dynamometer (Isometric testing)
- 2- Movable dynamometer (isotonic testing)
- 3- Isokinetic testing
- 4- Variable resistance testing

The fourth method was used for muscular strength of thigh joint and muscular strength of knee joint because of difficulty of moving the injured, travelling with them, and measurement by isokinetic system in Cairo and availability of fourth method.

**4- Measuring range of motion at the knee**

Goniometer system for measurement of kinetic range of knee joint.

**- Contraction (twisting):**

From prostration position, leg angle is right with thigh 90°. Fixed goniometer arm is put in parallel to thigh muscle at the outside and movable arm is

parallel to leg muscle from the outside as well. It takes right angle of joint so that joint axis takes extension of system extensions at knee joint, then the injured flexes the knee joint "limb on thigh" to the maximum degree that the injured can do and reading between immovable and movable arm is taken, and this measurement shall be repeated three times and shall take the best reading of each patient separately.

### **Stretching**

The injured person sits for long time and examiner stretches goniometer bar on knee joint at the outside. Knee joint is the center and first goniometer bar is on the outer limb and other arm on the outer thigh. He repeats for three times and takes the best reading.

### **Records:**

#### **\* Data collection form of every injured:**

Form is designed for every injured person to register his data and to register the pre and post measurements in the variables of the research which are (Q angle of knee joint, kinetic range of knee joint and muscular strength of knee and thigh joint).

#### **\* Medical record of each patient:**

File was designed for each patient to identify the date of injury and whether there are other problems or injuries that the patient suffers and that may lead to failure of the research experience or affect the research results.

#### **\* Declaration of patient:**

The researcher was keen on having declaration from each patient who participates within the sample of the research to reflect his desire to participate in the research with no liability on the part of the researcher after review of the steps and method of application of the research by the researcher.

#### **\* Difference of age and sex:**

Sample of the research was chosen. All of them are men. Symmetry of sample in terms of height, weight and age were considered and body mass index was considered to be no more than 26.

#### **Steps of the research:**

- After the researcher defined the problem, hypotheses, sample and variables of the research and the tools used in collection of data and after consulting supervisors and experts, the research was carried out as follows:

- **Pilot experiment**
- **Basic experiment**
- **Pilot experiment:**

The researcher conducted pilot experiment on sample of three injured who meet specifications of the experimental sample in the period from 01/12/2018 to 10/12/2018 and suffer pains of patellofemoral joint syndrome. The experiment was conducted after obtaining administrative approvals. The purpose of pilot experiment was:

1- To accurately determine the applicable measurements.

2- Application of the proposed rehabilitation program to the sample and avoiding the obstacles and assurance of feasibility of the program for pain relief and improvement of other variables of the research for sample of the research.

#### **Basic study:**

The proposed rehabilitation program was executed by muscular balance in the period from 15-12 to 05/02/2019 to the experimental group which is inflicted with patellofemoral joint syndromes of 10 injured of juniors aged 15-18 years on the injured and health limb, through three phases each of which is two weeks and three units of weekly program. Unit time ranges between 30-60 minutes according to progress in the program after inspection of medical reports for each case. Chronic cases or cases that complain any other injury of knee joint. The proposed program was implemented on case by case basis in accordance with receipt of them. Measurement starts by definition of pain in every session for identification of severity of pain for the injured because of its importance in clarification of severity of pain in the beginning of implementation of the program. At the end of execution of the program, it is followed by measurement of Q angle and measurement of muscular strength of knee joint and muscular strength of thigh joint by graded weights which patient can lift once for maximum possible number. The best attempt takes (1 RM). The same method was used in study of Seham Al Ghamry (2001) and study of Gregory (2008) (11) (57).

Measurement of kinetic range for identification of the main functions of knee joint which is twisting and stretching (flexibility) which is the best attempt.

This is followed by performance of rehabilitation programs which are indicated on attachments, provided some exercises are defined as homework that the injured performs at home.

#### **Phases of building rehabilitation program and its objectives:**

3/4/3/1- First Phase: Isometric exercises with maximum 5-10 seconds or up to the limits of pain and exercises of stable muscular and kinetic work with twisting of knee joint.

#### **A- Objectives of first phase:**

1. To improve and active blood circulation and lymphatic system of knee joint muscles.
2. Removal of infiltrations.
3. Relief of pain of the injured area.
4. Full protection of joint.
5. Maintenance of muscle strength.
6. Early positivity of muscular work of lower terminal, particularly the quadriceps femur muscle.

7. Preparation of muscles to perform the second phase exercises.

C- Observations of first phase.

- Experiences in the first phase depend on time (isometric exercises).

- Exercises up to the limits of pain in the injured.

- Warm up and warm down exercise time is (10) minutes to the limits of pain.

- Number of exercises of first phase (1-11) exercises in rehabilitation unit.

- Rehabilitation unit time in first phase. (30 minutes)

- Exercise time per group is attributed to the patient condition according to type of injury.

- Period of rehabilitation in first phase is three weeks.

- Number of weekly rehabilitation sessions is four.

- Muscle stretch exercises shall be performed up to the limits of pain for anterior muscles, ulterior muscles, femur joint muscles, Gemellus muscles and iliotibial band muscles before and after every phase through help of rehabilitation specialist or available systems.

- All exercises are performed and patient's back is supported in accordance with the patient's condition and exercise form and type.

#### **B- Second Phase:**

B- Objectives of second phase:

- Completion of first phase objectives.

- Improvement of Q Angle.

- Restoration of kinetic range of injured terminal.

C- Observations of second phase:

- Exercises in the second phase depend on repetitions. (isometric contractions up to the limits of pain with maximum 5-7 sec)

- Exercises up to limits of pain in the injured.

- Time of warm up and warm down exercises is (15) minutes.

- Number of exercises in second phase is (1-15) exercises per rehabilitation unit.

- Time of rehabilitation in second phase (45 minutes)

- Time of exercise per group is attributed to the patient's condition according to injury.

- Period of rehabilitation in the second phase is three weeks.

- Number of sessions is four sessions per week.

- Muscle strength exercises are performed within the limits of pain for each of the anterior and ulterior femur muscles and for thigh joint muscles, Gemellus muscles and iliotibial band muscles before and after every phase by help of rehabilitation specialist or by available systems.

- All exercises are performed and the patient's back is supported according to the patient condition and form and type of exercise.

#### **D- Third phase:**

A- Objectives of third phase:

1. Restoration of functional condition of knee joint muscles to the nearest natural condition.

2. Identification of progress of recovery through exercises of knee twisting from movement.

3. Activation of blood circulation and lymphatic system.

4. Development of muscle power of lower terminal, particularly femur muscles, femur quadriceps muscle, ulterior muscles, medial oblique muscle and lateral opaque muscle, and adduction and abduction thigh joint.

5. Restoration of flexibility of knee joint without pain to the closest normal condition.

6. Restoration of balance.

B- Notes of third phase

- Exercises in the third phase depend on the kinetic range and exercises with variable weight resistance on strength of knee joint muscle and balance exercises.

- Exercises up to the limits of pain in the injured.

- Time of warm up and warm down exercises (10) minutes.

- Number of exercises in the phase of (1-16) exercises per rehabilitation unit.

- Time of rehabilitation unit in third phase. (60 minutes)

- Time of exercise in every group is attributed to the patient's condition in accordance with injury.

- Period of rehabilitation in the third phase is three weeks.

- Number of sessions per week is four sessions.

- Muscle stretch exercises are performed up to the limits of pain for anterior and ulterior femur muscles and for thigh joint muscles, Gemellus muscles and iliotibial band muscles before and after every phase by help of rehabilitation specialist or by available systems.

- All exercises are performed while the patient's back is supported according to the patient's condition and exercise form and type.

#### **3-5 Data collection:**

After application of the measurements under research and recording of results, the researcher downloaded those data and put them in the form of tables that make statistic treatment easy.

3-6 Statistic treatment:

The researcher used in analysis of the research results some statistic treatments which are suitable to nature of the research. The following was used:

- Arithmetic means



- Standard deviations
- Median
- Body mass index= weight/ height length
- Skewedness coefficient

- For significance of differences between post measurement and pre measurement of injured leg. (Z) Wilcoxon test

### Presentation, interpretation and discussion of the results

#### Research results:

Table (2) indicates the arithmetic means and significance of differences between the pre and post measurements as well as percentage of improvement in the variables of the research in the sample under research for the injured joint. N= 10

No	Variable	Unit of measurement	Premeasurement average	Post measurement average	Difference between averages	Positive ranks	Negative ranks	Value (z)	Significance	Percentage of improvement
1	Pain severity	Score out of 10	6.5	1	5.5	-	10	3.01*	004	84.61%
2	Q angle	Degree ( )	14.2	13.3	9.	-	10	2.00*	004.	6.33%
3	Kinetic range of knee joint (twisting)	Degree	27.9	34.5	6.6	10	-	2.00*	0.003	24%
4	Kinetic range of knee joint (stretching )	Degree	25,5	20,4	5.1	-	10	2.78*	004	20%
5	Muscle strength of knee joint (twisting)	Degree	3.5	7	3.5	10	-	2.02*	004	100%
6	Muscle strength of knee joint (stretching)	Degree	4	7.5	3.5	10	-	2.02*	004	87.5%
7	Muscle strength of knee joint adduction	Degree	5	7	2	10	-	2.81*	003	40%
8	Muscle strength of knee joint Abduction	Degree	4	6.5	2.5	10	-	3.01*	002	62.2%
9	General balance	Second	22.6	25	2.4	10	-	2.02*	004	10.61%
11	Movable balance	Number	14	15.5	1.5	10	-	2.02*	004	10.71%
10	Immovable balance	Second	20.2	22.8	2,6	10	-	3.01*	002	12.87%

(Z) table value at statistic significance of 0.05 = 1.96

**First: Discussion of the results and hypotheses of the research which state that:** “There are statistically significant differences between the average pre measurement and post measurement of the experimental group in (pain relief, restoration of muscular power, restoration of kinetic range and improvement of Q angle in the injured)”.

Table (1) indicates the arithmetic means and percentages of improvement for the variables under research as the highest percentage of improvement was in the variable of muscular strength of knee joint of twisting since percentage of improvement was 100%, and the slightest percentage of improvement was in the variable of Q angle as percentage of improvement was 6.3%. Table (1) indicates that all variables of the research made considerable improvement due to efficiency of the proposed program under research. This agrees with the results of the study of Seham El Sayed El Ghamry (2001); study of Janis (2004); study of Paul Van (2006); study of Michelle (2006); and study of Christina (2008); results of the study of Karina (2008); study of Hinges (2009); study of Soka (2010); study of Rezgy (2010); study of Lawrence (2011); study of Daniel (2011); study of

Harvey (2012); study of Osteris (2012); study of Velson (2012); study of Sheo (2012); study of Revlez (2013); and study of Peters (2013).

This agrees with notes of the American pain foundation (2006) that rehabilitation exercises are common in the program of rehabilitation for pain treatment. It doesn't only maintain health but helps to relieve balance over time as well. (142)

This agrees with Mohamed Qadry Bakry, Ali Galaleddin (2011) that rehabilitation exercises are necessary in the rehabilitation program and contribute to reduce pain. (20)

**Therefore, hypotheses of the research which state statistically significant differences between the pre measurements and post measurements as a result of application of the proposed program in favor of the post measurement in sample of members of the research in reduction of injured knee joint pain.**

This is consistent with the study of Al-Amir Abdelsattar (2013 AD) (10); Koitzh Nazir (2013 AD) (30); and Israa Gamal (2014 AD) (8). The results of those studies showed that programs of kinetic performance which are scientifically planned largely contribute to improvement of physical variables and

performance standard of main skills of each sport separately, particularly with juniors.

The researcher attributes those significant differences between the average pre and post measurements in the variables of muscular balance and standard of kinetic performance of the sample under research for the experimental group. However, the proposed rehabilitation program was characterized by continuity in the rehabilitation program without interruption. Therefore, they achieved positive results that led to differences between pre and post measurements in the experimental group in the variables of muscular balance under research.

These results agree with the notes of Elsayed Abdelmaksoud (1997 AD) (11) that the rated training programs that consider on design of them the scientific bases and principles that regulate them and that their exercises were chosen based on the kinetic tracks of the various skills which work on the working muscles on performance of skills directly that would be more concentrated on development of physical and skill performance together.

These results agree with the results of study of Sameh Al Shabrawy (1998AD) (13), Mohamed Saeed Abulnour (2007 AD) (22), and Basamat Mohamed Ali (2009 AD) (12) in that contents of the part of physical preparation which applies to members of control group created positive effect on the level of kata performance under research as a result of repetition of package of physical duties on members of this group, which had prominent effect in progress of kata performance level under research in the control group.

The researcher attributes these significant differences between averages between the post measurements of the experimental group in the variables of muscular balance and variables under research to the positive effect of package of specific exercises which were dedicated to develop muscular balance under research since the researcher considered on his choice of those exercises that they shall be variable and related to nature of skill performances in accordance with the nature of exercised sport under research, in addition to rating of rehabilitation loads of those exercises and definition of suitable times for performance of them in accordance with the nature and objective of those selected exercises.

In this context, Ahmed Mohamed and Ali Fahmy (1996 AD) (6) notes that the available level in growth of kinetic balance allows individual to rapidly master the complicated technicalities of types of sports skills and easy and smooth performance of them on the highest standard. In addition, no success can be achieved in sports without growth of this functional side of balance in individuals, particularly in rehabilitation programs.

This agrees with the results of study of Mohamed Omar (2008 AD) (23); Koitzh Nazir (2013 AD) (30) and Israa Gamal (2014 AD) (8) as they showed statistically significant differences between the average post measurements of experimental and control groups in the physical variables and standard of performance of basic skills in favor of the experimental group.

The researcher attributes those differences between (pre and post) measurements and increase of change to the rehabilitation program which was characterized by strength exercises from stability and movement by body weight and graded weights for femur quadriceps, anterior muscles, medial and lateral muscles, knee joint, abduction and adduction muscles of thigh joint, progress in time and severity of those exercises from a phase to another.

### Conclusions:

Use of the proposed exercises showed positive effect on the level of muscular balance and Q angle level, and the variables under research in group of individuals of the experimental group under research.

### Recommendations:

1- Necessity to use similar exercises to the kinetic tracks of skills that are created during the phase of sports rehabilitation after injuries.

2- To conduct similar study to identify the effect of muscular balance exercises on the variables and various age groups, subject to individual differences that bring juniors to the highest levels of exercise and championship.

3- To pay attention to rehabilitation programs for the problems of knees of sportsmen and non-sportsmen after appearance of pain in early phases and after diagnosis by specialists.

4- Application of other research on Q angle is necessary for sportsmen and non-sportsmen and its relation to knee pains.

5- Necessity to apply research that indicates comparison between physiotherapy and treatment by rehabilitation exercises of knee problems of sportsmen and non-sportsmen.

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