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Effect of Rehabilitation Exercises Program on Functional Outcomes among Patients with Knee Fracture

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Abstract: *Knee fracture of the patella is a common injury among adults having higher prevalence among males population. The mechanism of injury either direct or indirect. The most common fracture pattern occurring is the transverse fracture followed by comminuted and vertical fractures. Treatment of patellar fractures depends on fracture type, integrity of extensor mechanism and size of fragment. Conservative management includes splinting and rest. Surgical techniques involve anterior tension band wiring and partial/total patellectomy. Physiotherapy management included early weight bearing followed by gradual mobilization and strengthening of extensor compartment of the knee joint. Fracture of patella is common among middle age group individuals. The treatment depends on type of fracture, extensor mechanism and articular congruence. Operative management mainly tension band wiring followed by early rehabilitation program expedites the functional outcome. Early weight bearing, ambulation, range of motion exercises followed by strengthening exercises of extensor mechanism helps to avoid unwanted complications and achieve good functional status. The study was designed to evaluate the Effect of rehabilitation exercises program on functional outcomes among patients with knee fracture. The research hypothesis showed that, there is positive effect of rehabilitative exercise program on the Functional outcomes among patients with knee fracture. Methods: A quasi-experimental design was utilized in this study. A random sample of 30 adult patients was selected randomly and divided an alternatively into two equal groups 15 each. Inclusions criteria were that patients should on surgical treatment with no local unclean or new injuries enjoyed in the study before applied prescribed management and they has diagnosed with curiae ligaments. Methods: there were Data were collected through three tools that were used to determine the effect of rehabilitative on functional outcomes joint and muscle. Tool I was consisted of two parts: socio deco graphic finical data and pain scathe. In addition, tool II Mobility index of knee was developed by researchers in English language to determine rouge of motional 90 degree to measure angle of the joint and list flexibility in performing the rouge of movement of the knee a flexion/ extension. Finally, tool III was muscle strength of the affected knee. Method: Official permission to carry out the study was taken, all tools were submitted to nine experts in the field of nursing and orthopedic to test its content validity and were tested for reliability for 10 patients using test – retest method within one week. Informed consent was taken from each participant after explanation of the purpose of study and confidentiality was assured. A pilot study was conducted on five patients to test the feasibility and applicability of the tools and the necessary modifications were done. Sixty adult patients with cruciat / igment injury randomly according to previously mentioned criteria and will be divided alternatively into two equally groups 30 patients. Biosociodemographic and clinical data were obtained from all patient participating in the study on the first day of admission. The results revealed that the majority of total patients were in the age (40 – <50 years) and female patients represented slightly higher percentage than male patients. There was a significant difference was found between experimental and control groups in the Level of education and occupation. Findings showed that equal distribution between the experimental and control groups regarding their medical diagnosis as all had Unilateral Knee fracture. Regarding body weight (kg) the Mean ± SD of experimental and control groups Regarding body height (cm) the Mean ± SD of experimental and control groups. In relation to body mass index it was observed that the Mean ± SD of experimental and control groups. Regarding the knee joint extension it was noticed that the majority of experimental group had incomplete extension. Furthermore, regarding gait equal distribution for both two groups had limping gait. In addition, the results illustrated that of experimental and control groups using of assistive devices for ambulation. There was a significant difference was found between experimental and control groups in the using of assistive devices for ambulation. Fortunately the results showed that there was improvement in the patients according to their assessment and physical examination of the affected joint before and after quadriceps muscle exercise programs among the experimental group. In conclusion, support the prescription of knee fracture strength training program for patients with knee fracture. The study revealed limited patients ROM, weak muscle strength, pain, and inability to perform activities of daily living prior to the strength training program. In addition, quadriceps muscle strength training is an important part in the management plan of patients with knee fracture, and has a positive effect on providing the patient with self-confidence to deal with disease related problems. Illustrated rehabilitation exercises program post knee fracture should be available as a reference for*

health care settings recommended [[1]Hend Abd El-Monem Eid Elshenawie, [2] Heba Abdel Mowla Ahmed. Effect of Rehabilitation Exercises on Functional Outcomes among Patients with Knee Fracture].
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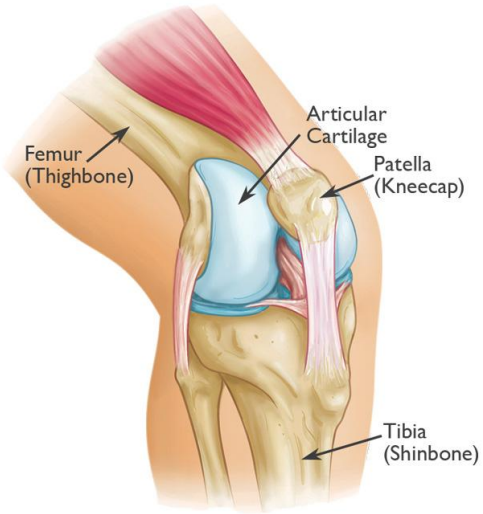
I. Introduction

Anatomy and Physiology of Knee Joint

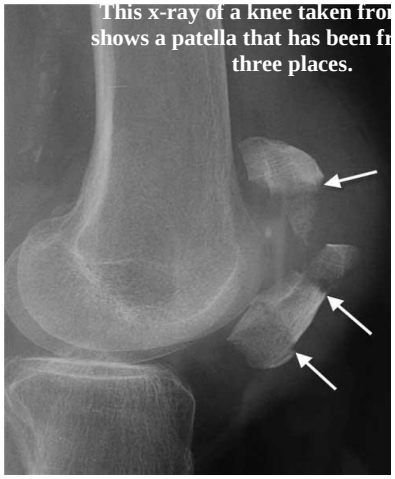
The primary function of the joints is to provide stability and mobility to the skeleton [(1)]. In addition, the joint is known as the sites at which any two or more bones come together. Some joints have no movement, slight movement and some are freely movable [(2)]. The most movable and complex joints in the body are the synovial joints [(3)]. The cartilage of synovial joints serves two very important functions. Not only it provides a remarkably smooth weight-bearing surface leading to joint move easily, but also it serves as a shock absorber, providing a soft, flexible foundation [(4, 5)]. Articular cartilage is a layer of hyaline cartilage that covers the end of each bone. Cartilage comprised mostly of water, collagen, and complex portions called proteoglycans, it may be thick or thin, not only depending on the size of the joint and the fit of the two bone ends, but also on the amount of weight and shearing forces that joint normally withstands [(6, 7)]. Besides articular cartilage has no blood vessels, lymph vessels, or nerves, therefore it regenerates slowly and insensitive to pain after injury. Regeneration occurs primarily at sites where the articular cartilage meets the synovial membrane, where blood vessels and nutrients are available [(8, 9)].



Healthy cartilage absorbs the force of the energy, transmits the load to the bone, and distributes the mechanical stress created by joint movement. Synovial joints function under continual mechanical stress. A joint's ability to withstand or resist this stress is a reflection of its health when the mechanical stress is too great or the joints' ability to resist this stress is compromised [(10, 11)]. One of the most complex and most frequently injured joints in the body is the knee or tibiofemoral joint. The condyles of the femur, the condyles of the tibia and the posterior surface of the patella form this hinge joint. The anterior part of the capsule consists of the tendon of the quadriceps femoris muscle, which also supports the patella [(12)].Anatomically the intra capsular structures include two cruciate ligaments which cross each other, extending from the intercondylar notch of the femur to the intracondylar eminence of the tibia helping in stabilizing the joint [(13)]. Knee is the third most common site of knee fracture after the spine and hip. During normal walking, a force of about three times body weight is transmitted through the knee. This force is unevenly distributed, with a large portion of the force being transmitted to the medial side of the knee. Going up and down stairs increases the force transmitted through the knee to approximately four to five times body weight [(14)].

Knee Fractures

There are a number of things that can cause knee pain. Fractures can cause an incredible amount of pain, and unbelievably, sometimes just moving the wrong way can cause a fracture, especially among the elderly and others suffering from bone and joint degeneration. Luckily, in most cases, this condition can be taken care of easily and will heal quickly [(15)]. A knee fracture, probably the most common form of knee fracture, is a fracture of the kneecap, and it is very painful. The main cause of this type of injury is a fall, where the injured has landed directly on the kneecap. It can also happen during an eccentric contraction, or when the knee is straightening while the quadriceps muscle is contracting. The first thing a physician will do for a kneecap fracture is take x-rays, to find out to determine the type and severity of the fracture. Then a course of treatment will be chosen. There are actually many different types of patella fractures, with the most common ones being transverse, vertical, osteochondral and marginal [(16)]. When most people think of knee fractures, they



automatically think of the kneecap. However, in actuality, a knee fracture can be any fracture of the kneecap and the bones around the knee, including the tibia (shin bone) and the femur (thigh bone). There are a number of causes for these types of fractures, including sports-related injuries, automobile accidents and falls, particularly falls from heights. As with kneecap fractures, x-rays will confirm the diagnosis of these fractures. In most cases, these fractures can be treated with immobilization, but more severe fractures may require surgery [(17)].

Causes of a Knee Fracture: Knee fractures usually result from some sort of trauma and vary for each type of fracture [(18)].

Patella Fractures	Femoral Condyle Fractures	Tibial Eminence Fractures	Tibial Tubercle Fractures	Tibial Plateau Fractures
These fractures are usually caused by a direct hit to the kneecap. Patella fractures often occur when someone falls, or is in a car accident (if the knee hits the dashboard during a collision). This type of knee fracture can also be caused if the knee is in a semi-flexed position during a fall [(19)].	These fractures occur when the knee is stressed [(20)].	These fractures are also caused by accidents, such as a hit to the proximal tibia when the knee is flexed, and if the knee is hyper-extended during an accident. This type of fracture tends to mainly occur in patients who are between the ages of 8 and 14 years, but they are also reported in adult patients [(21)].	This type of knee fracture is more common in men than in women, and is often seen in athletes, especially those involved in jumping sports, such as basketball and hurdles. This is mainly seen in younger patients, and is rare with adults [(22)].	These fractures are caused by blows with extreme force, such as falling from a height or being hit by a vehicle. This is quite common with elderly patients, and people who have osteoporosis [(23)].

Knee Fracture Treatment

When someone has fractured their knee, there will be a number of things involved in the treatment of the injury. For one thing, the patient is going to be required to take it easy for a while, which should be no problem because, at first, it is going to be very difficult to put any weight on the knee. Physical therapy is usually required, and many patients will need to use a knee brace to keep the leg immobilized while it is healing. If the patient has a knee fracture, it is important to follow all nurse and physician's instructions in order for your knee to heal properly. Taking care of the problem right will reduce the risk of needing surgery later [(24)].

The overall goals of physical therapy are to prevent and minimize impairment, functional limitations, and disability resulting from knee fracture. Physical therapy goals are accomplished through the assessment, examination, and development of individual treatment plans by a physical therapist or a nurse to address each patient's functional limitations [(25)]. The nurse plays key role in helping the person with arthritis build self-efficacy for exercise, setting realistic goals, recalling previously successful experience, offering peer groups, and designing periodic assessment which includes medical history, knowledge of the individual's, physical activity level and physical limitations, current medication regimen, emotional and psychological status, and social needs [(26)]. To reinforce the efficacy of the exercise are only a few strategies that can be used to build self-efficacy for exercise. When assessing the musculoskeletal system, the nurse should examine the affected joints for tenderness, swelling, warmth, redness, subluxation, and crepitus. In addition, the nurse has a vital role in performing an exercise plan for the patient includes checking the pulse (at baseline, during the activity, and following the activity), careful observation of the patient is also important during activity including observing for dyspnea, flushed face, cyanotic nail beds, or lips [(27)].

Complaints of fatigue, tiredness, dizziness, and requests to sit down are additional signs of inability to tolerate the activity. Obviously, tightness and heaviness in the chest and tightness in the legs are indicative of diminished capacity for activity [(28)]. The benefits of activity on the health of patients support the need for incorporation of activity into the plan of care. The nurse's role has implication for knowledge about fitness and approval of exercise programs in which the patients may participate. Attention should be paid to the simplicity, effectiveness, and adaptability of a program for patients in whatever setting they may live. Acceptable exercise programs for patients should have realistic objectives and provide for improvement and maintenance of endurance, strength, flexibility, balance, and coordination while minimizing the risk of injury [(29)]. A careful exercise plane should be strongly encouraged. Working with a skilled physical therapist or rehabilitation nurse specialist may improve clinical outcomes. Regular exercise can improve flexibility and muscle strength, which in turn help to support the affected joints, reduce pain, improve function, and reduce falls [(30)].

Range of Motion Exercise

Range of motion (ROM) exercises are the first step when beginning an exercise program. In knee, knee fracture this type of exercise can be used to decrease stiffness, increase joint motion, and prevent soft tissues contractures. It can be also used during the warm-up period in performing an exercise program. During active ROM exercise, the patients move various muscle groups independently. On the other hand, Passive ROM exercise are done by the nurse to help in maintaining or restoring a patient's mobility by achieving several

outcomes as improving muscle strength and tone, increases circulation, decrease vascular complications of immobility, and facilitate patients comfort [31, 32].

Stretching Exercises

Stretching exercises are important for cardiovascular fitness and strength training for overall health. It also used to maintain or improve joint ROM and flexibility, reduce muscle soreness and prevent injury. By maximizing joint ROM, stretching makes it easier to perform activities of daily living. It can be also used during both warm-up and cool-down period of exercise program. Stretching exercises are the only exercises that will increase flexibility not strength or cardiovascular fitness. The stretching action should be performed slowly and carefully, maintaining tension on the muscle for 10 to 30 seconds and then slowly releasing the stretch. Patients may fell slight tension in muscles, but never stretch to the point of pain [33, 34, 35].

Strength Exercises

Strength exercises are an important element in comprehensive rehabilitation program and improving performance of daily living activities of patients with knee fracture [36, 37, 38]. Exercise should be in an appropriate progression; this progression should be suited to the patient and should be instituted when the patient can demonstrate it in good form and without pain. Therefore, the nurse is constantly assessing patient ability to carry out exercise and adapt exercise to fit the patient as needed through patient motivation. Motivation can be carried out in many ways ranging from assisting the patient to understand her or his medical condition and the objective of each exercise, to documenting objective of improvement and discussing it with the patient to stimulate further effort [39, 40].

Nursing Strategies

The nurse attitude and technique influence the patient response to exercise therefore the nurse should use clear simple instruction before, during, and after exercise. Beside; the nurse should give the patient full attention and demonstrate a willingness to listen to the patient. Moreover, when teaching patient the exercise, the nurse body alignment is an important mean of sitting a good example for the patient to protect the patient from musculoskeletal strain or injury [41, 42, 43]. The value of nursing education in the management of symptoms of knee fracture cannot be underestimated. Ultimately, it is the patient who must carry out measures to protect and strengthen joints, to reduce discomfort, and to make adaptations in daily living. Good patient education is a combination of providing knowledge, developing skills, and motivating the patient. Group knee fracture exercise program have been especially helpful in enabling patients to gain confidence in their ability to live full with this condition [44, 45]. Each patient should have an individualized exercise prescription that contains at a minimum the goal of the exercise, the type of movement in each exercise "number of repetitions of each movement", the frequency with which the exercise should be performed, the duration of the exercise, and any precautions the person should observe. Compliance with physical exercise programs may be problematic for the patient [46]. Failure to adhere to exercise programs may be a problem of motivation, and the traditional structure of supervised exercise programs may not address to highly individualized needs of the patient. Tailoring exercise regimens to meet the goals of the individual can foster motivation and commitment. Some strategies that have been useful in getting patient to initiate and continue exercise regimens are the use of group exercise [47, 48].

Prevention of injury begins with pre exercise nursing assessment and evaluation for conditions that contraindicate exercise [49]. The nurse should explain to the patient the proper use of exercise to promote joint flexibility, muscle strength, and cardiopulmonary endurance. Individuals with unstable medical illness should not participate in vigorous exercise to prevent complication. If this patient included in exercise program the nurse should be good observer to any early signs and symptoms of fatigue and exercise should performing in a supervised environment, in which their response to exercise can be monitored and treatment implemented promptly if needed. Another strategy for reducing injury risk and maximizing benefit during exercise is careful monitoring of patients' performance to ensure that exercise was done correctly. Patient may require physical cues, as well as verbal instructions, particularly in the early phases of the exercise program. Be certain these patients use proper body mechanics and body alignment [50, 51].

Contraindications to exercise by the knee fracture patients.

Absolute contraindications	Relative contraindications
-Uncontrolled arrhythmias -Third degree heart block -Recent electrocardiographic changes -Unstable angina -Acute myocardial infarction -Acute congestive heart failure	-Cardiomyopathy -Valvular heart disease -Uncontrolled blood pressure -Uncontrolled metabolic disease

Adapted from Walker and Helwea (1998) [51].

The benefits of strength training are crucial to weight control, because individuals with more muscle mass have a higher metabolic rate. Muscle is active tissue that consumes calories while stored fat uses very little energy. Strength training can provide up to a 15% increase in metabolic rate, which is enormously helpful for weight loose and long-term weight control [52, 53]. Moreover, strength training provides similar improvements in depression as anti-depressant medications. Currently, it is not known because people feel well when they are stronger or if strength of them increases self-confidence and self-esteem, which has a strong impact on quality of life [54, 55, 56]. Finally, strength training is important for sleep improvement, because heart disease risk is lower when the body is leaner. Strength training help cardiac patient to gain not only strength and flexibility but also aerobic capacity when they did strength training three times a week as part of their rehabilitation program [57, 58, 59].

Three principles contribute to enhanced muscular strength. The first, the overload principle, states that a muscle grows in size and strength only when a workload beyond any previous demands is placed on it. As the muscle become stronger, the amount of stress required to produce overload rises. In the gradual progression principle, the amount of resistance provided during the exercise increases gradually, thereby keeping the exercise comfortable and safe for the patient. The third principle, specificity, requires that a specific muscle must be isolated so that the majority of the resistance falls on it to be strengthened [60, 61]. The size of a muscle is not the sole determinant of its strength. Differences for adipose tissue found in muscle causes variation in the strength of the muscle. Adipose tissue causes a decrease in muscle contraction efficiency. Adipose tissue not only lacks contractile power but also limits the speed and amount of contraction a muscle is capable of. Thus, a muscle with very little adipose tissue is stronger and more efficient than a muscle of the same size with greater percentage of adipose tissue [62, 63].

A number of factors are involved in strength training, among which the speed, duration, number of repetitions, and force with which exercises are performed. Inherent variations between individuals must also be taken into consideration when establishing realistic goals for patients following an exercise protocol [64, 65]. In order to plan an exercise program it should include three components. The first part includes the warm-up period while the second part is an aerobic exercise in addition the third part, which is known as a cool-down period. The nurse plays an important role in explaining the exercise program component to the patient in addition the benefit of exercise to improving or maintaining flexibility, range of motion, muscle strength and endurance, and cardiovascular fitness and health. In the achievement of this exercise program the nurse should have a specific therapeutic goals related to certain considerations involving disease activities, joint protection, progressive grading and self-management strategies are also taken into consideration [66, 67].

The first step in exercise program, which is a warm-up period, it provides neuromuscular and cardiovascular warm-up. During this time exercise are done to prepare patient for more vigorous activity. This warm-up is needed for exercise safety by all exercisers, is particularly important for the persons with arthritis, and may serve as an initial home exercise program. The period of warm-up can be progressed in number of exercise cessions and repetition. The exercise sessions include 12 to 15 sessions and in each session the repetition involve 5 to 10 repetitions. In performing warm-up, it is important to maintain pelvic stabilization and trunk rotation [68, 69, 70]. In performing this worm-up exercise, it is important to maintain pelvic stabilization and trunk rotation exercise to minimize the chances for low back pain with the increased activity. The goal of this period is to proceed to the second stage of an aerobic exercise component [71, 72].

The stage following the warm-up is the aerobic period; it provides the stimulus for adaptation and training of cardiovascular efficiency, muscular endurance, and activity tolerance. It can be described as dynamic, repetitive exercise requiring the use of large muscle groups. It improves the emotional status, weight management, self- concept, and fatigue [73, 74]. After the aerobic period, the third component of the exercise is the cool-down period, during this time exertion is reduced to a low intensity and gentle stretching of exercised muscles is performed. Therefore, the goal is to allow the cardiovascular response to safety adjust to less demand and to gently stretch muscle to minimize the possibility of delayed –onset muscle soreness [75].

It is becoming increasingly accepted that muscle strength play a major role in determining disability in knee fracture. This being the case, it is important to assess the muscle strength of individuals, over various joints, to plan a treatment program that will strength the appropriate muscle, leading to improved joint function and , therefore, reduced disability [76]. Quadriceps-strengthening exercises are particularly important for patients with knee fracture. Quadriceps weakness in such patients was once thought to be a clinical manifestation of disease atrophy resulting from knee pain. However, quadriceps weakness has recently been reported in patients with radiographic signs of knee fracture who have increased lower-extremity muscle mass and no knee pain [77].

Complications of knee Fractures: Even after successful treatment, some patients with patellar fractures may experience long-term complications.

Posttraumatic Arthritis	Muscle Weakness	Chronic Pain
Posttraumatic arthritis is a type of arthritis that develops after an injury. Even when your bones heal normally, the articular cartilage covering the bones can be damaged, leading to pain and stiffness over time. Severe arthritis occurs in a small percentage of patients with patellar fractures. Mild to moderate arthritis—a condition called *chondromalacia patella*—is much more common.	Some patients may have permanent weakness of the quadriceps muscle in the front of the thigh after a fracture. Some loss of motion in the knee, including both straightening (extension) and bending (flexion), is also common. This loss of motion is not usually disabling.	Long-term pain in the front of the knee is common with patellar fractures. While the cause of this pain is not completely understood, it is likely that it is related to posttraumatic arthritis, stiffness, and muscle weakness. Some patients find that they are more comfortable wearing a knee brace or support.

Significance of the study:

Patellar and tibial plateau fractures each account for 1% of all skeletal fractures. Distal femoral condyle fractures account for 4% of all femur fractures. Fractures of the knee can result in neurovascular compromise or compartment syndrome, with resultant risk of limb loss. [2] Soft-tissue infection or osteomyelitis can occur with open fractures. Other complications include nonunion, delayed union, knee fracture, avascular necrosis, fat embolism, and thrombophlebitis. the pieces of bone move out of place when the injury occurs. For these more complicated fractures, surgery is needed to restore and stabilize the kneecap and allow for the return of function.

Aim of the Study:

Determine the effect of rehabilitating exercises on the functional out comes among patients with fracture knee.

Research Hypothesis:

There is an effect of rehabilitative exercises on the functional out comes among patients with fracture knee.

Operational Definition:

Rehabilitation exercise:

Means Range of motion and mouse setting exercise for knee.

Fracture knee:

Means in the intrareticular knee fracture

Functional health status of the knee joint:

It includes the level of joint pain, stiffness, range of motion in affected joint, and quadriceps muscle strength in patients with knee fracture.

II. Materials and Method

Research design:

Quasi-experimental study without control group was used to carry out this study.

2) Setting:

The study was carried out in causality and in patient department of Hadara Orthopedic and traumatology university Hospital.

3) Subjects:

Random sample of 30 adult patients was selected randomly and divided an alternatively into two equal groups 15 each.

- The study group: with beguile the exercise program.
- The control group: will be exposes to the routine hospital care.
- Both groups: will be matched as much as possible Regards to sex, age, and type of knee ligament in jury

Inclusions criteria are as follow:

- On surgical treatment.
- No local unclean or new injuries.
- Before applied prescribed management.
- Patient has diagnosed with curiae ligaments.

Tools:

Two tools will be used to determine the effect of Rehabilitative on functional outcomes joint and muscle.

Tool 1:

Part 1: socio deco graphic finical data.

It will include age/sex/ level of education marital statues Occupation/ date of admission/ date of discharge / diagnosis and type of treatment.

Part 2:

Pain scathe: to assess level apian it is standardize linear score from 0-10 corresponding to degree of Pain in the affected knee doing rest and when walking or setup stairs where zero will indicate 1 up to 3 will indicate mild pain and 3up to 6 will indicate moderate pain 6 up to 9 will indicate seven pains. The tool with because for subjective estimation of patient's level of pain.

Tool 2: Mobility index of knee

This tool will be developed by researcher in English language woirg the heliometers to determine rouge of motional 90 degree to measure angle of the joint and list flexibility in performing the rouge of movement of the knee a flexion/ extension.

Tool 3:

Muscle strength of the affected knee this is identified by liker type scale develops by Lovett 1998 in English language to determine strength of patients muscle.

Method

1. Permission to carry out the study was taken from the responsible authorities after explaining of the study.
2. All tools will be submitted to nine experts in the field of nursing and orthopedic to test its content validity.
3. All tools were tested for reliability for 10 patients using test – retest method within one week.
4. Informed consent was taken from each participant after explanation of the purpose of study and confidentiality was assured.
5. A pilot study was conducted on five patients to test the feasibility and applicability of the tools and the necessary modifications were done.
6. Sixty adult patients with cruciat / igment injury randomly according to previously mentioned criteria and will be divided alternatively into two equally groups 30 patients.
7. Biosociodemographic and clinical data were obtained from all patient participating in the study on the first day of admission.
8. Patients in the control group were only exposed to routine hospital care by ward medical and nursing staff.
9. The investigator in the emergency or inpatient department to patient of the study group carried out the exercise program. It will consist of verbal instruction will using demonstration and remonstration .In addition, illustrated colored booklet will be distributed until the investigator will be assured that he gain the skills.
10. Patient of the study group was asked to bring one of the educated family members to attend the program.
11. Patients were followed weekly on the outpatient unit for 8 weeks to be sure that patients follow the instruction given to him correctly.
12. After the exercised completed evaluation was done for both group about functional ability and joint range of motion three times immediately on admission, after three week and at the end of program. Evaluation was done using the three tools to the affected knee by comparing it with unaffected one.
13. Comparison will be done between two groups to identify the effect rehabilitation program on the functional out comes among patients with crucial ligament injury.

Limitations of the study:

As a result of increased duration of muscle strength training period some patients withdrawing after several sessions which leading to exclude them from the selected subjects thus leading to increase period of data collection.

III. Results

This study was conducted in order to assess the effect of rehabilitating muscle strength training exercise on the functional out comes among patients with fracture knee.

Table 1: illustrates the characteristics of the control and the experimental groups according to their age, gender, educational level and their occupation.

It was observed that the majority of total patients (53.33%) were in the age (40 – <50 years), while about (3.33%) were in the age (20 – <30 years). As Regards patient's gender, it was noticed that female patients represented slightly higher percentage (76.67%) than male patients (23.33%). As regards the educational level (50.0%) of the patients can Read and write, while (10. 0%) have preparatory education. In relation to Occupation, it was seen that more than half of the patients (53.33%) were House wife. However, (3.33%) were Professional. There was a significant difference was found between experimental and control groups in the Level of education and occupation.

Table 1: Illustrates the Characteristics of the Control and the Experimental Groups according to their Age, Gender, Educational Level and their Occupation.

	Experimental (n=15)		Control (n=15)		Total n =30		Test of Sig.	
	No.	%	No.	%	No.	%		
Age (years)								
20 – <30	1	6.3	0	0.0	1	3.33	2.827	$^{MC}p=$ 0.539
30 – <40	0	0.0	2	13.3	2	7.00		
40 – <50	9	56.3	7	46.7	16	53.33		
50 – <60	5	33.00	6	40.0	11	36.67		
Gender								
Male	2	12.5	5	33.3	7	23.33	1.922	$^{FE}p=$ 0.220
Female	13	87.0	10	66.7	23	76.67		
Level of education								
Illiterate	6	40.0	1	6.7	7	23.33	9.734*	$^{MC}p=$ 0.012*
Read and write	8	50.0	7	46.7	15	50.0		
Primary education	0	0.0	5	33.3	5	16.67		
preparatory education	1	6.3	2	13.3	3	10.0		
Secondary education	0	0.0	0	0.0	0	0.0		
University	0	0.0	0	0.0	0	0.0		
Occupation								
Professional	0	0.0	1	6.7	1	3.33	7.790*	$^{MC}p=$ 0.022*
Manual	2	12.5	7	46.7	9	30.0		
House wife	9	60.0	7	46.7	16	53.33		
Not Work	4	25.0	0	0.0	4	13.33		

n: Number of patients

χ^2, p: χ^2 and p values for Chi square test for comparing between the two groups

MC: Monte Carlo for Chi square test

FE: Fisher Exact for Chi square test

*: Statistically significant at $p \leq 0.05$

Table 2: Frequency distribution of the patients according to their assessment and physical examination of the affected Joint among the two groups. Findings showed that equal distribution between the experimental and control groups regarding their medical diagnosis as all had Unilateral Knee fracture. Regarding body weight (kg) the Mean ± SD of experimental and control groups were (89.63 ± 18.33) and (85.20 ± 10.19) respectively. Regarding body height (cm) the Mean ± SD of experimental and control groups were (159.31 ± 5.40) and (153.20 ± 40.62) respectively. In relation to body mass index it was observed that the Mean ± SD of experimental and control groups were (35.29 ± 6.84) and (35.56 ± 13.36) respectively. Regarding the knee joint extension it was noticed that the majority of experimental group (93.33%) had incomplete extension, while (26.7%) of control group were had complete knee joint extension. Furthermore, regarding gait equal distribution for both two groups (80.0%) had limping gait. In addition, the results illustrated that of experimental and control groups using of assistive devices for ambulation (50.0%) and (100.0%) respectively. There was a significant difference was found between experimental and control groups in the using of assistive devices for ambulation.

Table 2: Frequency Distribution of the Patients according to their assessment and Physical Examination of the Affected Joint among the Two Groups

Assessment and Physical Examination of the Affected Joint	Experimental (n=15)		Control (n=15)		Test of Sig.	p
	No.	%	No.	%		
Medical diagnosis						
Unilateral Knee fracture	15	100.0	15	100.0	-	-
Bilateral Knee fracture	0	0.0	0	0.0		
Weight (KG)						
Min. – Max.	60.0 – 130.0		70.0 – 105.0		t=0.823	0.417
Mean ± SD.	89.63 ± 18.33		85.20 ± 10.19			
Height (cm)						
Min. – Max.	150.0 – 170.0		10.0 – 179.0		t=0.597	0.555
Mean ± SD.	159.31 ± 5.40		153.20 ± 40.62			
Body Mass Index (BMI)						
Min. – Max.	23.44 – 50.78		25.61 – 78.0		t=0.072	0.943
Mean ± SD.	35.29 ± 6.84		35.56 ± 13.36			
Extension						
Complete	1	6.3	4	26.7	$\chi^2_=$	$^{FE}p=$

Incomplete	14	93.33	11	73.3	2.386	0.172
Gait						
Stable	3	18.8	3	20.0	$\chi^2_{=}$ 0.008	$^{FE}p=$ 1.000
Limping	12	80.0	12	80.0		
Dragging	0	0.0	0	0.0		
Using of assistive devices for ambulation						
Cane	8	50.0	15	100.0	$\chi^2_{=}$ 9.749*	$^{MC}p=$ 0.003*
Crutches	5	33.33	0	0.0		
Walker	0	0.0	0	0.0		
Not used	2	12.5	0	0.0		

χ^2, p: χ^2 and p values for Chi square test for comparing between the two groups
MC: Monte Carlo for Chi square test
FE: Fisher Exact for Chi square test
t, p: t and p values for Student t-test for comparing between the two groups
*: Statistically significant at $p \leq 0.05$

Table 3: Frequency Distribution of the patients according to their assessment and physical examination of the affected joint before and after quadriceps muscle exercise programs among the experimental group patients. Fortunately the results showed that there was improvement in the patients according to their assessment and physical examination of the affected joint before and after quadriceps muscle exercise programs among the experimental group. Regarding Tenderness to pressure around knee joint it was decreased from (93.8%) to (43.8) and there was a significant difference was found. Regarding knee joint effusion it was noticed that the majority of experimental group patients (81.3%) and (46.2%) respectively were suffering from either right and left knees second degree joint effusion before conducting the training exercises, while this percentage decreased to (43.8%) and (31.3%) respectively after practicing the planned training exercises and there was a significant difference was found. On the other hand, it was observed that regarding knee joint crepitation it was noticed that the more than half of experimental group patients (68.8%) were suffering from either right and left knees second and third degrees knee joint crepitation before following the training exercises, while this percentage decreased to (31.3%) after practicing the planned training exercises and there was a significant difference was found. In addition, there was improvement in the temperature of the skin around the knee joint after conducting the training program as it noticed that most of the experimental group patients either right and left knees (93.8%) and (100%) respectively were warm in temperature and there was a significant difference was found.

Table 3: Frequency Distribution of the Patients According to their Assessment and Physical Examination of the Affected Joint before and after Quadriceps Muscle Exercise Programs among the Experimental Group Patients

Postoperative Knee Fracture Assessment Checklist	Exercise Training (n=15)				p
	Before		After		
	No.	%	No.	%	
Tenderness to pressure around knee joint					
Right knee					
Yes	15	93.8	7	43.8	0.006*
No	1	6.3	9	56.3	
Left knee					
Yes	9	56.3	5	31.3	0.125
No	7	43.8	11	68.8	
Knee joint effusion					
Right knee					
Yes	13	81.3	7	43.8	0.031*
No	3	18.8	9	56.3	
If yes					
1st degree	6	46.2	3	42.9	0.500
2nd degree	7	53.8	4	57.1	
3rd degree	0	0.0	0	0.0	
Left knee					
Yes	10	62.5	5	31.3	0.063
No	6	37.5	11	68.8	
If yes					
1st degree	2	20.0	2	40.0	$^{MH}p=$ 0.317
2nd degree	3	30.0	3	60.0	
3rd degree	5	50.0	0	0.0	
Crepitation					
Right knee					
Yes	11	68.8	5	31.3	0.031*

Postoperative Knee Fracture Assessment Checklist	Exercise Training (n=15)				p
	Before		After		
	No.	%	No.	%	
No	5	31.3	11	68.8	
Left knee					
Yes	8	50.0	4	25.0	0.125
No	8	50.0	12	75.0	
Temperature of the skin around the knee joint					
Right knee					
Warm	8	50.0	15	93.8	1.000
Cold	2	12.5	1	6.3	
Hot	6	37.5	0	0.0	
Left knee					
Warm	7	43.8	16	100.0	$^{MH}p=0.005^{*}$
Cold	7	43.8	0	0.0	
Hot	2	12.5	0	0.0	

p value for McNemar test for compare between before and after
MH: Marginal Homogeneity Test
*: Statistically significant at $p \leq 0.05$

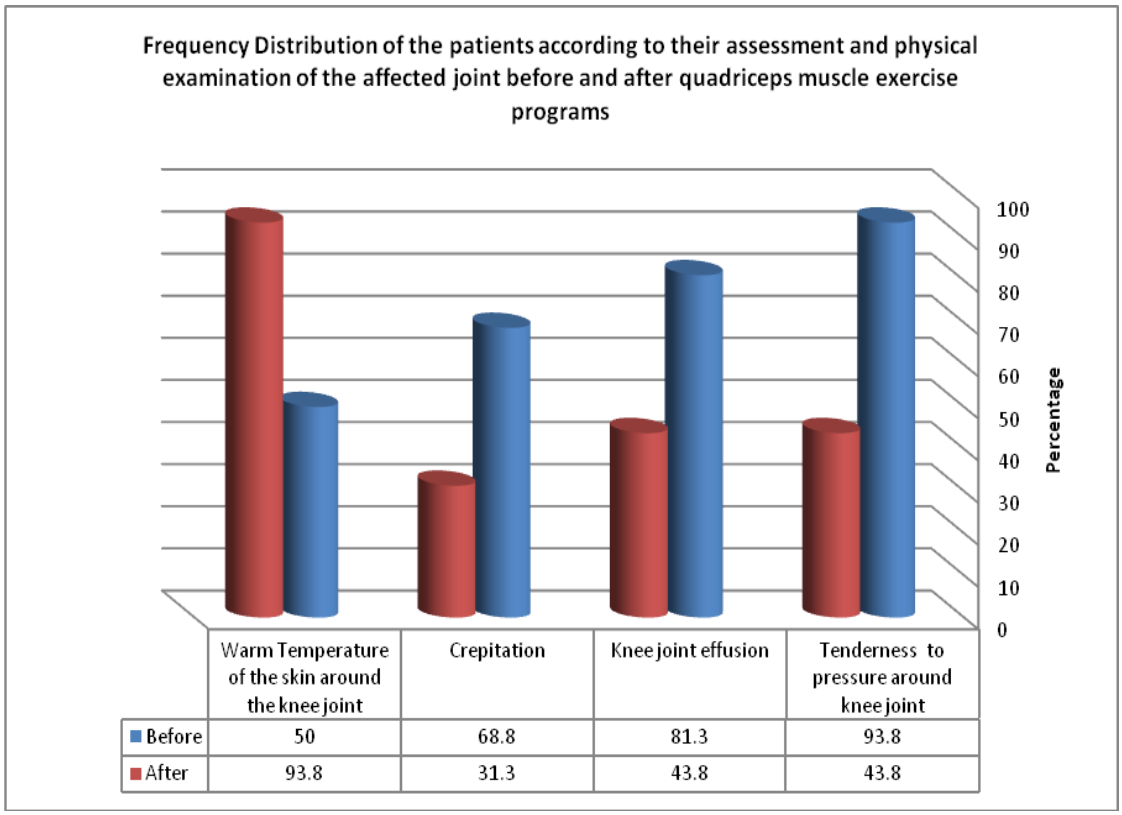


Table 4: Frequency Distribution of the patients according to their Assessment of range of motion (ROM) of the affected knee joint before and after quadriceps muscle exercise programs among the experimental group. The knee range of motion and muscle strength was significantly improved in the left and right knee joint after the strength exercise. In relation to ROM, there is a wide range of fluctuations complete right knee flexion was (6.3%) and increased to be (56.3%) post exercises. As regard complete right knee flexion ROM was (25.0%), following the exercise it became (68.8%) and there was a significant difference was found. Before the exercise the Knee Joint second degree effusion in the knees was (68.8%). Following the exercise, it was changed to (0.0%) and there was a significant difference was found.

Table (4): Frequency Distribution of the patients according to their Assessment of range of motion of the affected knee joint before and after quadriceps muscle exercise programs among the experimental group

Range of motion of knee joint	Exercise Training (n =15)				p
	Before		After		
	No.	%	No.	%	
Right knee Flexion					0.008*
Complete	1	6.3	9	56.3	
Incomplete	14	93.8	7	43.8	
Left knee Flexion					
Complete	4	25.0	11	68.8	0.039*
Incomplete	11	75.0	5	31.3	
Knee Joint Effusion Degree					
1st degree	2	12.5	0	0.0	-
2nd degree	10	68.8	0	0.0	
3rd degree	3	18.8	0	0.0	

p value for Z: Z for Wilcoxon signed ranks test
McNemartest and for compare between before and after
*: Statistically significant at $p \leq 0.05$

Table (5): Assessment of Muscle Strength of the Affected Knee Joint Before and after Quadriceps Muscle Exercise Programs. The knee range of motion and muscle strength was significantly improved in the left and right knee joint after the strength exercise. In relation to ROM, there is a wide range of fluctuations in its mean value it was 1.88 ± 0.62 and increased to be 3.0 ± 1.21 post exercises in right knee. As regard left knee, the mean value of ROM was 1.56 ± 0.81, following the exercise it became 2.81 ± 1.33 and there was a significant difference was found. Regarding the mean value of quadriceps muscle strength scoring scale in both knees it was noticed that mean was 3.81 ± 1.11.

Table (5): Assessment of Muscle Strength of the Affected Knee Joint Before and after Quadriceps Muscle Exercise Programs

Quadriceps muscle strength	Exercise Training (n =15)				p
	Before		After		
	No.	%	No.	%	
Right knee					
0	0	0.0	0	0.0	0.005*
1	4	25.0	2	12.5	
2	9	62.5	4	25.0	
3	2	12.5	3	18.8	
4	0	0.0	6	37.5	
5	0	0.0	1	6.3	
Min. – Max.	1.0 – 3.0		1.0 – 5.0		
Mean ± SD	1.88 ± 0.62		3.0 ± 1.21		
Left knee					
0	1	6.3	1	6.3	0.002*
1	7	43.8	2	12.5	
2	5	37.5	2	12.5	
3	6	37.5	6	37.5	
4	2	12.5	4	25.0	
5	0	0.0	1	6.3	
Min. – Max.	0.0 – 3.0		0.0 – 5.0		
Mean ± SD	1.56 ± 0.81		2.81 ± 1.33		
Quadriceps muscle strength scoring scale					
0=No muscle contraction	0	0.0	-	-	-
1=Muscle contraction but no movement	1	6.3	-	-	
2=Poor, full ROM without gravity	1	6.3	-	-	
3=Fair, full ROM with gravity	2	12.5	-	-	
4=Good, Full ROM against gravity with moderate resistance	7	50.0	-	-	
5=Normal ,full ROM against gravity with full resistance	4	25.0	-	-	
Min. – Max.	1.0 – 5.0		-		-

Mean ± SD	3.81 ± 1.11	-	

p value for Z: Z for Wilcoxon signed ranks test
*: Statistically significant at $p \leq 0.05$

Table (6): Assessment of Pain or Discomfort of the Affected Knee Joint before and after Quadriceps Muscle Exercise Programs. Pain or discomfort **during bed rest** were significantly decreased and mobility significantly increased in all patients. Concerning pain, it was found that (25.0%) of the patients were experience none or insignificant pain before exercise, while (6.3%) of the patients were experience none or insignificant pain while ambulating after the exercise and there was a significant difference was found. It was observed that there is a wide range of fluctuations in its mean value it was 1.0 ± 0.73 and increased to be 1.44 ± 0.63 post exercises.

Table (6): Assessment of Pain or Discomfort of the Affected Knee Joint before and after Quadriceps Muscle Exercise Programs

Pain or Discomfort	**Exercise Training (n =15)**				**p**
	Before		**After**		
	No.	**%**	**No.**	**%**	
During bed rest					
None or insignificant.	4	25.0	1	6.3	0.035*
Only on movement or in certain positions.	8	50.0	7	43.8	
With no movement.	3	25.0	7	43.8	
Min. – Max.	0.0 – 2.0		0.0 – 2.0		
Mean ± SD	1.0 ± 0.73		1.44 ± 0.63		

p value for Z: Z for Wilcoxon signed ranks test
*: Statistically significant at $p \leq 0.05$

Table (7): Assessment of Morning stiffness of the affected knee joint before and after quadriceps muscle exercise programs. Morning stiffness or regressive pain after arising were significantly improved compared between before (18.8%) and after exercise to (56.3%) increased in all patients. In the same table morning stiffness was significantly improved compared between before 50% and after exercise to 90% and there was a significant difference was found. It was observed that there is a wide range of fluctuations in its mean value it was 1.13 ± 0.72 and decreased to be 0.44 ± 0.51post exercises.

Table (7): Assessment of Morning Stiffness of The Affected Knee Joint Before and After Quadriceps Muscle Exercise Programs

Morning stiffness	**Exercise Training (n =15)**				**p**
	Before		**After**		
	No.	**%**	**No.**	**%**	
Morning stiffness or regressive pain after arising					
1min or less	3	18.8	9	56.3	0.005*
more than 1 but less than 15 min	7	50.0	6	43.8	
15 min or more	5	31.3	0	0.0	
Min. – Max.	0.0 – 2.0		0.0 – 1.0		
Mean ± SD	1.13 ± 0.72		0.44 ± 0.51		

p value for Z: Z for Wilcoxon signed ranks test
*: Statistically significant at $p \leq 0.05$

Table (8): Assessment of Morning stiffness of the affected knee joint before and after quadriceps muscle exercise program. The mean value of morning stiffness While ambulating before the exercise was 1.81 ± 1.17, then it decreased to be 1.0 ± 0.97 after that and there was a significant difference was found. Furthermore, it was observed that, the mean value of morning stiffness while getting up from sitting in patients was 0.19 ± 0.40, and then it decreased 0.69 ± 0.48 following the exercise and there was a significant difference was found.

Table (8): Assessment of Morning Stiffness of the Affected Knee Joint Before and After Quadriceps Muscle Exercise Program

Morning stiffness	**Exercise Training (n =15)**				**p**
	Before		**After**		
	No.	**%**	**No.**	**%**	
While ambulating					
None	6	37.5	3	18.8	0.026*

Only after walking for short distance	5	31.3	3	18.8	
After initial walking and increasing with continued ambulation	4	25.0	4	25.0	
After initial walking and not increasing with continued ambulation	1	6.3	6	37.5	
Min. – Max.	0.0 – 3.0		0.0 – 3.0		
Mean ± SD	1.81 ± 1.17		1.0 ± 0.97		
While getting up from sitting					
With difficulty	13	81.3	5	31.3	0.005*
Without difficulty	3	18.8	11	68.8	
Min. – Max.	0.0 – 1 .0		0.0 – 1.0		
Mean ± SD	0.69 ± 0.48		0.19 ± 0.40		

p value for Z: Z for Wilcoxon signed ranks test
*: Statistically significant at $p \leq 0.05$

Table (9): Assessment of Maximum distance walked of the affected knee joint before and after quadriceps muscle exercise programs. During the present study, it was noticed that the maximum distance walked from 300-500 m was increased from (12.5 %) to (18.8) of patients was significantly improved p = 0.046*

Table (9): Assessment of Maximum Distance Walked of the Affected Knee Joint Before and After Quadriceps Muscle Exercise Programs

Maximum Distance Walked	**Exercise Training (n =15)**				**p**
	Before		**After**		
	No.	**%**	**No.**	**%**	
Maximum Distance Walked (May Walk with Pain)					
Unlimited	5	31.3	3	18.8	0.046*
More than 1km, but limited	7	43.8	3	18.8	
About a km (in about 15 mit)	2	12.5	3	18.8	
From 500-900m (in about 8-15 min)	0	0.0	1	6.3	
From 300-500 m	2	12.5	3	18.8	
From 100-300 m	0	0.0	1	6.3	
Less than 100 m	0	0.0	2	12.5	
With one walking stick or crutch	0	0.0	0	0.0	
With two walking sticks or crutches	0	0.0	0	0.0	
Min. – Max.	0.0 – 4.0		0.0 – 6.0		
Mean ± SD	1.19 ± 1.28		2.56 ± 2.06		

P value for Z: Z for Wilcoxon signed ranks test for compare between before and after
*: Statistically significant at $p \leq 0.05$

Table (10): Assessment of Activity of Daily Living of the Affected Knee Joint Before and after Quadriceps Muscle Exercise Programs

Activity of Daily Living	Exercise Training				p
	Before		After		
	No.	%	No.	%	
Ability to Climb Up a Standard Flight of Stairs					
Without difficulty (0)	0	0.0	1	6.3	<0.001*
With some difficulty (0.5)	1	6.3	8	50.0	
Moderate difficulty (1)	4	25.0	6	37.5	
Sever difficulty (1.5)	9	56.3	1	6.3	
Unable (2)	2	12.5	0	0.0	
Min. – Max.	0.50 – 2.0		0.0 – 1.50		
Mean ± SD	1.38 ± 0.39		0.72 ± 0.36		
Ability to Climb Down a Standard Flight of Stairs					
Without difficulty (0)	0	0.0	1	6.3	0.001*
With some difficulty (0.5)	2	12.5	8	50.0	
Moderate difficulty (1)	2	12.5	5	31.3	
Sever difficulty (1.5)	7	43.8	2	12.5	
Unable (2)	5	31.3	0	0.0	
Min. – Max.	0.50 – 2.0		0.0 – 1.50		
Mean ± SD	1.47 ± 0.50		0.75 ± 0.41		
Ability to Bend the Knee					
Without difficulty (0)	0	0.0	2	12.5	<0.001*
With some difficulty (0.5)	1	6.3	8	50.0	
Moderate difficulty (1)	6	37.5	5	31.3	
Sever difficulty (1.5)	6	37.5	1	6.3	

Unable (2)	3	18.8	0	0.0	
Min. – Max.	0.50 – 2.0		0.0 – 1.50		
Mean ± SD	1.34 ± 0.44		0.66 ± 0.40		
Ability to Walk on Uneven Ground					0.004*
Without difficulty (0)	0	0.0	2	12.5	
With some difficulty (0.5)	4	25.0	8	50.0	
Moderate difficulty (1)	5	31.3	5	31.3	
Sever difficulty (1.5)	6	37.5	1	6.3	
Unable (2)	1	6.3	0	0.0	
Min. – Max.	0.5 – 2.0		0.0 – 1.50		
Mean ± SD	1.13 ± 0.47		0.66 ± 0.40		

P value for Z: Z for Wilcoxon signed ranks test for compare between before and after
*: Statistically significant at $p \leq 0.05$

IV. Discussion

Knee fracture of the patella is a common injury among adults having higher prevalence among males population. The mechanism of injury either direct or indirect. The most common fracture pattern occurring is the transverse fracture followed by comminuted and vertical fractures. Physical therapy plays an important part in the complete management of patients with knee fracture, because it provides patients with important knowledge for management and control of disease process through behavioral modifications, weight loss, and muscle strength [(73)].

Nursing care of patients is directed toward prevention the development of the disease on one hand through accurate assessment and identifying the patients at risk, and management of the patients complains as joint pain and limited mobility on the other hand. Therefore, care of patients with knee fracture is extremely complex and presents many challenges even for an experienced nurse [(11, 12)]. Patients need careful monitoring of their physical and psychological condition. However, by utilizing key assessment skills leading to a problem list and identifying the treatment plan, a nurse can deliver safe and effective management to these patients [(37,133,134)].

In the present study, there were statistically significant improvement in rang of motion (ROM) flexion and extension angle in both knee joints after strength training, and statistically significant improvement in quadriceps muscle strength ranged from full ROM against gravity with moderate resistance to full ROM against gravity with full resistance. Also the findings of the present study revealed that, strengthening of the quadriceps muscle improve level of pain, joint stiffness and crepitation. In addition, improvement in maximum distance walked by the patients with knee fracture during the present study.

O'Reilly *et al*. (1998) [(163)] Reported that Quadriceps weakness is common among patients with knee fracture. It is a manifestation of atrophy for disuse developed as a result of the painful limb not from bearing weight. They also found positive correlation between quadriceps muscle strength and reporting pain as well as disability in patients with knee fracture. Furthermore, Moguel et *al*. (2004) [(164)], and Page *et al*. (2003) [(165)] observed that recent attention has focused on the quadriceps strength mechanism in the management of patients with knee fracture. They also concluded that quadriceps strength training using exercise programs decreasing pain, muscle atrophy, stiffness, and improve mobility in patients suffering from arthritis of the knee joints.

The majority of the patients included in the present study were in the age category of 40 to less than 60 years. This finding was in constant with many studies that indicate increased in prevalence of knee fracture with age [(42, 45, 46)]. Davis *et al.* (2001) [(153)] have reported that the increased incidence of knee fracture occur most among women older than 45 years. But after the age of 50 years, the problem of knee fracture in most joints is higher in men than in women and affection most of joints as hand, knee, and hip joint. This result is accordance with Felson *et al*. (1997) [(166)] who reported that 27% of people aged 63 to 70 years had knee fracture diagnosed radiographically. The result of the present study is in opposition with Carty *et al*. (1993) [(38)] study, which found increased incidence of degenerative joint changes in the second decade among men and women.

Concerning occupation, more than half of the patients in the present study were housewives. These patients have reporting difficulty in performing activities of daily living due to joint pain. This results in congruent with McAlindon *et al.* (1999) [(76)] Further examined the relation between level of physical activities and reporting pain in patients with knee fracture, they concluded that heavy physical activities increase the loud on the affected knee. Other studies added that, job requiring squatting the knee and lifting heavy objects were associated with increased level of pain and disability in patients with knee fracture[(80-83).] Moreover, Maetzel *et al.* (1997) [(80)], and Cooper *et al.* (1994) [(81)] proved that forces across the knee increase in the crouching or squatting position. Other occupational activities, including climbing stairs, walking on uneven ground, standing, and sitting for a long period have been inconsistently linked to knee fracture.

Among the patients of the present study, the majority of the sample were obese and morbid obese. Those patients with increased body mass index were reporting more pain and discomfort associated with limited ability to perform activities of daily living. This result was supported by that of Abed El-Gafar *et al* (2003) [(131)]

who found that statistically significant association between obesity and knee fracture. Felson *et al.* (1992) [170] observed that obesity is a risk factor for knee fracture, especially fracture of the knee joint. They also reported that women who lost only an average of 11 pounds were able to decrease their risk of development of knee fracture by up to 50%. A joint can be overloaded simply by the increase in weight. For every step that a person takes, a force of approximately three times one's body weight is transmitted across the knee joint. Therefore, it is easy to see why an increased risk of knee fracture occurs in overweight persons.

Similar findings were reported by Gelber *et al.* (1999) [9] who found that a strong association between obesity and knee fracture, suggesting that the lesser effect of obesity in men compared with a woman in the incidence of knee fracture. Also Gelber proved that, overweight during 20s age had a larger effect on his subsequent risk of developing knee fracture than being overweight during his 40s years of age. Perhaps this reflects a combined effect of certain physical activities and increased weight at younger ages. Moreover, overweight in childhood and adolescence correlated with incidence of knee fracture at age 20 years, due to joint damage from overweight may occur even earlier during skeletal growth and development.

Brandt *et al*. (1998) [73] reported that mobility is one of the most important goals for patients with knee fracture. They also founded that walking aids can unload affected joints, resulting in less pain and improved balance. A walking aide should be used as walking stick, cane, and crutches in patients with knee fracture. The present study found that 90% of the patients in the present study use nothing during mobility. As regards to knee joint assessment, joint effusion, and crepitation in both knee joint of present sample before and after strength training there were statistically significant improvement in two variables. This goes hand on hand with Gladys *et al.* (2004)[164] who reported that rehabilitating patients with knee fracture through exercise program reducing the inflammatory process, decreasing pain, preventing further joint damage, maintaining and restoring decreased muscle dysfunction.

Moreover, excessive joint effusion as a one of symptoms associated with acute injury and chronic degenerative joint conditions. The occurrence of quadriceps muscle inhibition as a result of joint pathology has been associated with factors such as pain, inflammatory process, and the presence of fluid within the joint space. McNair *et al*. (1996)[171] investigated the effects of excessive fluid in the knee joint on the performance of the quadriceps muscle and determined whether quadriceps muscle performance can be altered by exercising the swollen joint. They concluded that exercising of swollen knee joints improved the muscle strength. From the results derived from the present study it was found that no significant differences was seen between the temperature of the skin around the knee joint in both knee before and after implementation of quadriceps strength training in studied patients.

In relation to change in angle of ROM in knee joint, the finding of the present study revealed that there was a prominent and statistically significant improvement in flexion and extension angle in both knee joint after strength training. In this regards, Topp *et al* (2002)[63] Abed El-Gafar *et al.* (2003)[131] reported that exercise programs to strengthen the quadriceps muscles that help to improve knee ROM, as well as muscle after program implication for patients with knee fracture. This is in agreement with Jan *et al.* (1996) [87] who reported that, 10 minute stretch exercise resulted in a significant increase in passive muscle movement, ROM.

Moreover, Baar *et al.* (2001)[172] funded that exercise of the patients with fracture of knee, nine months' follow up, improve ROM, joints stability, and aerobic fitness. These functions are often impaired in patients with knee fracture. Furthermore, Slemenda *et al.* (1998) [173], and Fransen *et al*. (2002) [174] concluded that, in healthy joints, muscles control four functions; movement, stabilization, shock absorption and proprioception or ability to sense the body's position, location, movement and orientation. They also reported that strong association between quadriceps muscle strength and progression or advancement of knee fracture. Furthermore, they found that quadriceps muscle weakness not only results from painful knee fracture but also is itself a risk factor for structural damage to the joint. The effect of quadriceps strength in knee fracture disease progression is particularly important, given the frequency with which quadriceps strengthening exercise are prescribed for persons with knee fracture[165] .

Concerning the assessment of quadriceps muscle strength done to the studied patients in the present study, it was found that statistically significant improvement in quadriceps muscle strength ranged from full ROM against gravity with moderate resistance to full ROM against gravity with full resistance in right and left leg. Similar finding was also reported by Slemenda *et al.* (1998)[173], and Felson *et al.* (1998)[173], they emphasized that strengthening exercise was effective in improving aerobic capacity, joint mobility in addition, increase muscle strength. Pain and discomfort, including pain during activities of daily living and morning stiffness which are considered as a main clinical finding of knee fracture. The finding of the present study revealed that strengthening of the quadriceps muscle in patients with knee fracture improving level of pain, joint stiffness, and mobility. The finding were in line with Sisto *et al.* (2006) [176], Riemsma *et al*. (2002) [177], and Sherman *et al.* (2003) [178], who found statistically significant difference in the scores of patients global assessment of pain, discomfort, and psychological status, and depression in response to their program. The finding congruent with Pennin *et al.* (2001) [179] they reported that aerobic and resistance exercise programs

reduce the symptoms in patients with knee fracture including pain, joint stiffness, and mobility impairment. In the present study, there were positive correlations between joint pain on one hand and limitation in physical activity, and activities of daily living such as ability to wake, climbing up and down stairs on the other hand. This finding in constant with Creamer *et al.* (1996) [(94)] study which found positive correlation between self-reporting disability and pain in patients attending primary care with knee fracture. In addition, they found strong positive correlation between pain severity and disability in patients with knee fracture.

As for the other impairment in activities of daily living as climbing up and down stairs, the results of the present study revealed that significant improvement in climbing up and down stairs without difficulty. In addition, increase ability of the patient to bend on the knee without and with some difficulty. Page *et al.* (2003)[(165)], Topp *et al.* (2002)[(63)] have reported that exercise programs to strengthen the quadriceps muscle that help to strength knee joint during climbing up and down stair, resulting in decreased pain and improving gait in patients with knee fracture. They also founded that 20% reduction in pain and a 10% to 15% decrease in time to complete various functional tasks including stairs climbing. Other studies found that, aerobic and resistance exercise programs may reduce the incidence of activity of daily living disability in persons with symptomatic knee fracture [(172,179)].

The present study showed that muscle strength improves the maximum distance walked by the patients with knee fracture in approximately half of the sample. This finding in congruent with Baar *et al.* (2001) [(172)], and Dakker *et al.* (1993)[(180)] they examined the effectiveness of exercises in patients with knee fracture of the hip and knee: nine months follow up. They funded that improvement in muscle strength, stability of the joint, and improving walking pattern in those patients. This study succeeded in improving pain and discomfort scores, Activities of daily living scores, and maximum distance walked scores using Algofunctional for knee fracture Index for knee fracture. In addition, improvement in angle of ROM in knee joint, and quadriceps muscle strength. This reflects the desirable effect of exercise training on one hand and the patient's interest in knowing about their disease on the other hand. The patients were interested to learn more about simple ways to do activities of daily living. These patients' interests were used as a key to increase patient's compliance and cooperation during training period. Simple explanation to the patient about aim of the training, duration and frequency of each session, and good patient preparation before, during, and after the training resulting in increased patients motivation, cooperation, and compliance. In addition, statistically significant changes between before and after exercise training.

Exercise is important for providing a healthy structure for joint to perform its normal function in protecting joint during activities of daily living. Moreover, cartilage requires regular motion to maintain equilibrium between cartilage breakdown and cartilage repair. Strong muscles around the knee joints are also important for helping the knee absorb and dealing with sudden stresses. In addition to, increase ability to perform activities of daily living. Finally, the obtained results have put in evidence that a well-planned muscle strength exercise carried out by the nurse could be successful. However, the nurse plays an important role in planning and applying exercise program in order to modifying patient's risk factors of knee fracture which improve activities of daily living. On the other hand, nurses should incorporate exercise program into their routine general practice activity.

V. Conclusions And Recommendations

Conclusions

Based on the results of the present study, it can be concluded that the findings support the prescription of knee fracture strength training program for patients with knee fracture. The study revealed limited patients ROM, weak muscle strength, pain, and inability to perform activities of daily living prior to the strength training program. However, statistically significant improvements of ROM, muscle strengths, pain, and ability to perform activities of daily living were demonstrated after program implementation. Quadriceps muscle strength training is an important part in the management plan of patients with knee fracture, and has a positive effect on providing the patient with self-confidence to deal with disease related problems.

The present study had also proved that greater body mass index is associated with an increased risk of subsequent knee fracture. Excess weight increases the biomechanical load on knee joint during weight –bearing activity as walk, climb up and down flight of stairs, and squat the knee. In addition, those patients were associated with increased severity of pain, joint stiffness, effusion, and crepitus. Moreover, those patients were reported limited knee joint ROM, and weak quadriceps muscle. Moreover, the clinical outcomes (activities of daily living) demonstrate that muscle strength training is a simple, efficient, and cost-effective line of treatment for knee fracture which doesn't respond to pharmacological and surgical intervention.

Recommendations: As a result of this study, the following recommendations are suggested:

For the nurses:	For the patients:	Suggestion for further studies:
1-Nurses working in rehabilitation unites should update their knowledge through attending in-service training programs and workshops. 2-Periodic scientific meetings among physicians, nurses, and physiotherapists must be conducted to discuss patient's problems and establish a comprehensive plan to meet the patient's needs. 3-The curriculum of all nursing schools should include the nurse's role in planning, implementation, and evaluation of an exercise program.	1- Patients should be included in exercise and physical rehabilitation programs for prevention and early treatment of knee fracture. 2- Follow exercise training program according to plan of treatment get better effects. 3- Early diagnosis and management of knee fracture minimize functional disability and improve quality of life.	1- Study to identify patient's characteristics that affect the outcome of exercise training program. 2- Study to determine criteria for safe exercise training program. 3- Study to determine effect of pelvic muscle strength in patients with hip knee fracture. 4- Study relation between using assistive devices during mobility for knee fracture patients on pain intensity and improving balance.

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