



THE EFFECT OF TENS, US AND BALANCE EXERCISE AGAINST PATELAL FRACTURE IN THE ELDERLY : A CASE REPORT

Ummi Syarfina Janani¹, Farid Rahman², Akhmad Zaenal Arifin³

¹*Faculty of health science, Universitas Muhammadiyah Surakarta*

²*Faculty of health science, Universitas Muhammadiyah Surakarta*

³*Bayangkara's Hospital*

*Corresponding author : Ummi Syarfina Janani, Email: ummisyarfina.j@gmail.com

Abstract

Introduction:

Patellar fractures most often occur due to trauma, this condition often results in several problems such as pain, decreased muscle strength and decreased range of motion of the joint. The goal to be obtained is to know the effect of TENS, US and balance fatigue on reducing pain, increasing muscle strength and joint range of motion as well as increasing stability and balance in order to reduce risk factors for falls in patients with patellar fracture conditions .

case presentation:

A male patient aged 65 years in July 2019 had an accident, the accident occurred while driving a motor vehicle and was hit from behind. The patient fell and his right knee hit the barrier. The patient was immediately referred to the hospital for emergency treatment.

Management and outcomes:

Giving TENS and US modalities as well as balance and stability exercises its effectives for reduce pain, increase muscle strength, increase joint range of motion and improve stability and balance in patellar fractures.

Discussion

After fourth physiotherapy and exercise interventions were given, the results obtained were a decrease in motion pain and pressure from T1 to , an increase in muscle strength in the flexor knee from T1 with a muscle strength value of 4/5, an increase in muscle strength to 5/5 at T4, an increase in the range of motion of the joint on flexor knee at T1 the result is 95⁰ and becomes 115⁰ at T4, and there is a decrease in risk factors for falling. Giving TENS and US modalities as well as balance and stability exercises can reduce pain, increase muscle strength, increase joint range of motion and improve stability and balance in patellar fractures.

Conclusion:after given by physiotherapy modalities and exercise in patellar fracture it shows a good progression. The fourth physicaltherapy's treatment showed that there was an decrease in pain, improve the range of motion,increase muscle strength and reducing risk factors of fall.

Keywords: patellar fracture, risk factors for falls, elderly, TENS (Transcutaneous electrical nerve stimulation), US (Ultrasound).



Introduction

The patella is located in the quadriceps tendon complex and articulates with the trochlear groove of the femur, which serves to increase the length of the fulcrum on the quadriceps unit to reduce the pressure between the tendon and femur (Kakazu *et al.*, 2016). Based on data every year, 1 in 100 cases of fracture is a fracture of the patella, and most often occurs due to trauma. The most common cause is traffic accidents, which is 78.3%, followed by work accidents 13.7% and household accidents 11.4% (Schuett *et al.*, 2015). Patellar fractures can be classified according to the mechanism of the trauma.

The most common occurrence is a direct impact of anterior part of the patella. This collision can be caused by a small amount of energy such as a fall and an impact with a strong pressure such as an accident while driving a motorcycle. A direct impact on the anterior patella most often results in a comminuted fracture due to impact of the patella on the femoral condyle. There are also rarer cases of indirect eccentric contraction caused by flexion of the knee joint against contraction of the quadriceps (Steinmetz *et al.*, 2020).

According to Fractures in the Elderly A Guide to Practical (Solheim *et al.*, 2019). Management showed several problems that often occur in patellar fractures are pain, disturbances in the extensor mechanism (difficulty in moving the knee joint towards extension) and knee stiffness. However, recently the risk factors for falling in cases of patellar fractures in the elderly have been found. Patellar fractures in the elderly are more likely to lead to fragility fractures which are very at risk for secondary fracture complications (Byun *et al.*, 2019). The most common physiotherapy problems are decreased joint range of motion, decreased muscle strength, increased risk of falls and functional impairment. The role of physiotherapists is needed from the first day after surgery until the recovery period. The first day after surgery physiotherapy plays an important role to reduce inflammation and prevent stiffness of motion with early mobilization that is pain free and according to patient tolerance (Matthews *et al.*, 2017). The next few days to 12 weeks physiotherapy plays a role in the rehabilitation phase which aims to increase muscle strength, increase joint range of motion, increase stability and improve quality of life in functional activities.

Case presentations:

A male patient aged 65 years in July 2019 had an accident, and it occurred while driving a motor vehicle while someone was hit from behind. The patient fell and his right knee hit the barrier and immediately referred to the hospital for emergency treatment because the patient's condition required surgery and the next day the patient underwent surgery. This patient's condition requires to use a wire










on the patella in the right leg. After surgery the patient is recommended to do physiotherapy treatment, but because the patient has a high blood sugar, so it makes the wound after surgery inhibit the patient to get the physiotherapeutic treatment. The patient received physiotherapy treatment at the hospital after the wound closed, it start when October 2019. Patient still using crutches to walk when he first come, he also was unable to support one leg and unable to lift the right leg, was unable to straighten the knee, and was unable to bend the knee backwards. After 8 months of undergoing physiotherapy at the hospital, the patient is now able to walk without assistive devices, is able to lift the right leg, the range of motion of the knee joint is quite improved, and supports one leg which is still not very good. The purpose of the physiotherapy treatment given is to reduce pain, increase muscle strength, increase joint range of motion, reduce risk factors for falls and increase functional activity. Some of the important examinations carried out by physiotherapists in dealing with patellar fracture conditions like this, some of which are vital signs, examination of pain with NRS (Numerical Rating Scale), examination of muscle strength with MMT (Manual Muscle Testing), examination of joint range of motion with ROM (Range of Motion), fall risk factors with four step stage test and functional activity with KOOS (Knee Injury and Osteoarthritis Outcome Score). Examination of vital signs was carried out before physiotherapy intervention was given, from examination of vital signs in the form of blood pressure, pulse, respiration and body temperature of the patient, the results obtained were within normal limits.

Management and Outcome

Some of the interventions given are interventions that need to be given based on the problems the patient is experiencing such as pain when wanting to walk from a sitting position, tenderness in the medial and lateral knee areas, difficulty when trying to bend the right knee, imbalance when supporting on one leg and difficulty doing some activities. functional. The intervention that can be given is TENS (Transcutaneous Electrical Nerve Stimulation) which is aimed at reducing the pain felt by the patient, the second is US with the aim of accelerating and assisting the healing process in the tissue, the third is strengthening the quadriceps muscle to increase muscle strength, hold relax stretching on the quadriceps muscle which is used to increase the range of motion of the joint.



Table 12. Physiotherapy Intervention Dosage

Intervention	Dose	Picture	Information
TENS	F : 100 Hz I : 29 Ma Q: 15 minutes T : TENS		The pads are placed on the medial and lateral sides of the patient's right knee.
US	F : 1 Mhz I : 1.5 w/cm Q: 5 minutes Q :-		US is given on the medial and lateral sides of the knee.
<i>Hold relax stretching</i>	F: 2x a week I : 5-10 reps 2 sets Q: 5-10 minutes T : muscle stretching with hold relax technique		<i>Stretching</i> performed with a hold relax stretching technique on the quadriceps muscle
<i>Strengthening exercise</i>	F: 2 x a week I : 10-15x reps 1 set Q: 5-10 minutes T : quadriceps strengthening exercise		Strengthening the quadriceps muscle with the patient sitting and the legs hanging then alternately straightening the leg for 2 seconds and returning to the starting position.
<i>Balance exercise</i>	F: 2x a week I: 8-10 reps 2 sets Q: 5-10 minutes T: plantar flexion exercise		The patient is directed to perform plantar flexion movements on both feet simultaneously and hold hands on the chair in front of the patient
	F: 2x a week I : 8-10x reps 2 sets Q: 5-10 minutes T : Knee flexion balance		The patient is directed to stand with one leg bending the knee back with the hands holding both chairs for stabilization and alternately on both legs
	F: 2x a week I : 8-10 reps 2 sets Q: 5-10 minutes T : Hip flexion balance		The patient is directed to stand with hip flexion and holding onto both chairs and then alternately on the other side of the leg



After doing physiotherapy interventions for four therapy sessions, it was found that there were some improvements in the evaluation in the 4th physiotherapy process, and the results were described in the tables below.

Table 1. Results of pain evaluation with NRS (Numerical Rating Scale)

Painful	T1	T4
Silent pain	0/10	0/10
Tenderness	5/10	3/10
Motion pain	6/10	4/10

Pain measurement results with NRS (Numerical Rating Scale), pain examination was carried out using NRS (Numerical Rating Scale) on 3 indicators, namely silent pain, tenderness and motion pain. The results of the examination of the patient did not feel pain when standing still or resting and the pain was more felt when he wanted to walk from a stationary position and when pressed in the lateral and medial knee areas. With the value of validity and reliability on the NRS is 0.95 (Alghadir *et al.*, 2018). After four times of therapy showed a change in tenderness and motion pain. Tenderness on the medial and lateral sides of the knee was at T1: 5/10 while at the last evaluation it was T4: 3/10, on motion pain during flexion of the right knee, T1: 6/10 at the last evaluation became T4: 4/10.

Table 2. Active motion check

Active motion	Dextra	Sinistra	Complaints dextra	sinistra complaint
Flexion	Not full ROM	Full ROM	No pain	No pain
Extension	Full ROM	Full ROM	No pain	No pain

Table 3. Passive motion check

Passive motion	Dextra	Sinistra	Complaints dextra	sinistra complaint	End feel dextra	End feel Sinistra
Flexion	Not full ROM	Full ROM	Painful	No pain	Firm	Elastic
Extension	Full ROM	Full ROM	No pain	No pain	Firm	Firm



On examination of active motion for passive movements in knee flexion still feels pain and has not been able to full ROM because this movement is also still limited by the wire attached to the patient's patella.

Table 4. The results of the evaluation of the joint range of motion with a goniometry.

Region	T1	T4
Knee (D)	S: 0-0-95o	S : 0-0-110o
Knee (S)	S: 0-0-135o	S: 0-0-135o

The next examination is the range of motion in the knee joint which is measured using a goniometer during knee extension and flexion movements. Based on the measurements, the results showed that the patient was able to perform maximal knee flexion and extension movements on the left leg and the patient could perform maximal knee extension movements but had not been able to maximally perform knee flexion movements. With the value of the validity and reliability of the goniometer of 0.98 (Hancock *et al.*, 2018). The results of the evaluation of the range of motion of the joint as measured by a goniometer showed that there was an increase in the range of motion of the knee joint in the right leg. At T1 knee flexion the patient is only able to do up to 95° and at T4 the patient is able to do up to 110°.

Table 5. The results of the evaluation of muscle strength with MMT (Manual Muscle Testing)

muscle groups	T1	T4
Knee flexors (D)	4/5	5/5
Knee extensors (D)	5/5	5/5
Knee flexors (S)	5/5	5/5
Knee extensors (S)	5/5	5/5

The results of the evaluation of muscle strength measured using MMT showed a change that was between T1 to T4. At T1 the knee flexor muscle group was measured muscle strength and the result was 4/5 which means the patient is able to move and is able to resist minimal resistance, after T4 the test results show the patient gets a 5/5 result which means that the patient is able to move and fight maximum resistance.



Table 6. The results of the evaluation of the fall risk factor checklist (CDC, 2017).

Fall history	Yes	No	Information
Experiencing a fall within a year?	√		
Feeling about to fall/unbalanced when standing or walking		√	
Medical conditions			
Heart problems / arrhythmia		√	
Cognitive problems		√	
Incontinence		√	
Depression		√	
Eating disorders		√	
Other medical problems		√	
Medication / Supplements			
Psychoactive drugs		√	
Opioids		√	
Drugs that cause confusion or sedation		√	
Drugs that cause hypotension		√	
Gait . strength and balance			
Time up and go (TUG) Test(> 12 seconds)	√		14 second result
Thirty second chair stand test (below average score by age and gender)	√		Result 12x repetition
Four stage balance test (full tandem stance < 10 seconds)	√		Results 10 seconds full tandem
Vision			
Actuality <20/40 or not having an eye check for more than a year		√	
Postural hypotension			
Decreased systolic BP > 20 mmHg or diastolic BP > 10 mmHg, experiencing lightheadedness and dizziness when trying to get up from a sleeping position.		√	



Examination of fall risk factors is also very important to do, in addition to the patient's condition, the age factor also greatly affects the risk of falling. The risk factor for falling is tested through several indicators of balance tests, namely, Time Up and Go Test, Thirty Chair Stand Test, and Four Stage Step Test. The results obtained after the patient was given physiotherapy intervention and exercise therapy after the 4th therapy on the fall risk factor checklist were that the patient felt more stable when walking and standing upright and there were some improvements in the balance and stability tests carried out with time up and down, go test, four stage step test, and thirty chair stand test.

Table 7. Balance test and risk factors for falls with the Time Up and Go Test (CDC, 2017)

Standard	T1	T4
12 seconds	17 seconds	14 seconds

There is a change with the results of T1: 17 seconds and T4: 14 seconds with the normal standard being 12 seconds. Changes in scores that improve to near normal on balance tests and risk factors for falls with the Time Up and Go Test.

Table 8. Balance and fall risk test with the Four Stage Step Test (CDC, 2017)

Position	T1	T4	Interpretation
Stand with both feet parallel	10 seconds	10 seconds	Able to do
Stand with the other half of the foot forward	10 seconds	10 seconds	Able to do
Stand with one foot in front	10 seconds	10 seconds	Able to do
Standing on one leg	8 seconds	10 seconds	Able to do

The balance test with the four stage step test illustrates a change in T1 and T4, when T1 the patient has not been able to perform a full tandem stance with a time of 10 seconds. At T4 the patient is able to perform a full tandem stance with a time of 10 seconds.

Table 9. Balance and fall risk tests with the Thirty Chair Stand Test (CDC, 2017).

Standard	T1	T4	Interpretation
< 12	8	12	Does not have balance disorders and risk factors for falling.



The results of the balance test and fall risk factors showed that there was a change in T1 and T4, at T1 the patient was able to do 8 repetitions and on the evaluation after T4 the patient was able to do 12 repetitions. These results indicate that the patient does not have balance disorders and risk factors for falling.

Table 10. Functional activity ability with KOOS (Knee Injury and Osteoarthritis Outcome Score)

Category	T1	T4
Painful	88.3	88.9
Signs and symptoms	65	71.43
Daily activities	82.4	85.3
Sports activities	65	75
Quality of life	68.75	75
Total	$364.5 : 5 = 72.9$	$438.2 : 5 = 87.64$

Furthermore, the functional activity ability test was carried out with KOOS (Knee Injury and Osteoarthritis Outcome Score). This test is carried out to determine the ability of the patient's functional activity to be disturbed, so that the physiotherapy process is more focused and able to improve the patient's functional activity ability. KOOS is categorized into several categories, namely pain, signs and symptoms, daily activities, sports activities, and quality of life. The bigger the score, the better the indicator. KOOS has validity and reliability values of 0.73-0.85(Multanen *et al.*, 2018). Based on the results in the table above, there is a change in the results of KOOS (Knee Injury and Osteoarthritis Outcome Score) on T1 with a total value of 72.9 and on T4 with a total score of 87.64.

Discussions

TENS (Transcutaneous Electrical Nerve Stimulation)

Conventional TENS produces an analgesia effect mainly through a segmental mechanism, namely by activating A beta fibers which in turn inhibits nociceptive neurons in the dorsal horn of the spinal cord. to reduce the amount of pain experienced either by aiding in the healing process or influencing the transmission and perception of pain. This refers to the gate control theory which states that the gate consists of inhibitory interstitial cells known as the substantia gelatinosa and located in the posterior horn and T cells. Intake of impulses from large and small diameter fibers will close the gate and will block the transmission of impulses from the fibers. nociceptor afferents so that pain is reduced or disappeared (Starkey *et al.*, 2015).



Ultrasound

Ultrasound has several therapeutic effects, one of which is deep heating which can be used to treat several musculoskeletal conditions. The effects of ultrasound include increasing the rate of tissue repair, wound healing, increasing blood flow, increasing tissue extensibility, reducing calcium deposits, reducing pain and muscle spasm. The way ultrasound works to be able to produce these effects is by changing the speed of nerve conduction which results in changes in cell membrane permeability, this change will stimulate the process of tissue repair and can increase the healing process in the tissue. Pain reduction will not occur directly but pain reduction will be caused by the effect of ultrasound application which will result in increased capillary permeability and will increase oxygen delivery to oxygen-deficient areas (Starkey *et al.*, 2015).

Hold relax stretching on the quadriceps muscle

Is a technique by contracting the antagonist muscle group that shortens isometrically to provide maximum stretching effect against the maximum resistance given by the physiotherapist. Then followed by relaxation of the agonist muscle which is contracted isotonic to stretch the antagonist muscle that is spasming or shortening the goal is to relax the stretching of the muscle and increase the range of motion of the joint and reduce pain (Mumtazah and Abdullah, 2020). *Hold relax* refers to the activity of the golgi tendon and muscle spindles. Muscle spindles are responsible for receiving and providing information on changes in the length and speed of changes that occur in the muscles or what are commonly referred to as stretch receptors. Golgi tendon plays a role in the protection mechanism through autogenic inhibition, this Golgi tendon will relax the muscle after 6 seconds. Isometric contractions performed on muscles that experience excess tension will facilitate the occurrence of autogenic inhibition, a reflex for relaxation that occurs in muscles when the Golgi tendon of the muscle is stimulated (Oscar *et al.*, 2012).

Strengthening quadriceps and balance stability exercises

Balance and stability exercises have long been considered important in the primary prevention of risk factors for falls. Balance training along with leg muscle strengthening exercises have been shown to reduce the risk of falls and subsequent fractures. Varied exercise over a longer period of time (most positive trials longer than 12 weeks) is recommended to prevent falls in some communities. With the strength of the leg muscles will increase the patient's stability when standing, walking and other activities. As leg stability improves balance exercises are easier to do. Improving stability and balance in cases of fractures in the elderly can reduce the risk of falling and the potential for a second fracture (Solheim *et al.*, 2019).



Conclusion

After physiotherapy intervention and exercise therapy in patellar fracture cases were given for 4 therapy sessions, the results showed that there was a decrease in pain, an increase in the range of motion of the joint, an increase in muscle strength, reducing risk factors for falls and improving the patient's quality of life in carrying out daily activities. .

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