

Physiotherapy Management for Osteoarthritis Knee: A Case Study

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Abstract

Introduction: Osteoarthritis (OA) is the most common form of arthritis affecting approximately 302 million people worldwide. OA is characterized by pathology involving the entire joint including cartilage degradation, bone remodeling, synovial inflammatory osteophyte formation, leading to pain, stiffness, swelling, and loss of normal joint function. The most commonly affected appendicular joints include: knees, hips and hands. Conservative therapy consists of pharmacological and non-pharmacological therapy given to patients with mild to moderate knee OA. Non-pharmacological therapy can be in the form of exercise therapy and physical modalities. The purpose of this study was to determine the effectiveness of a physiotherapy program using Ultrasound, TENS, Quadriceps Setting and Passive Hamstring Exercise.

Case Presentation: Patients with the initials Mr. M is 60 years old with the main job as a sand porter. Nine months ago, the patient fell under a sandbag while working and hit his head and back. As a result, the back fractured and had to be operated on. One week after surgery the patient had a urinary tract disorder, so he needed to be operated on again. As a result of the operation the patient was required to use a catheter. The patient began to complain of stiffness due to the use of the catheter and bed rest in the long term (8 months).

Management and Outcome: The patient attended therapy three times in two weeks with a physiotherapy programs Ultrasound, TENS, Quadriceps Setting and Passive Hamstring Exercise. Patient were evaluated using Numerical Rating Scale (NRS), Meter line, Goniometer, and Manual Muscle Testing (MMT),

Conclusion: Physiotherapy with the intensity of patient visits three times in two weeks with the intervention of Ultrasound, TENS, Quadriceps Setting and Passive Hamstring Exercise can reduce pain, decrease edema, improve leg muscle strength, and increase range of motion of knee joint.

Keyword: Osteoarthritis, Ultrasound, Tens, Quadriceps Setting Exercise, Passive hamstring Exercise, Physiotherapy

Introduction

Osteoarthritis (OA) is the most common form of arthritis affecting approximately 302 million people worldwide. OA is characterized by pathology involving the entire joint including cartilage degradation, bone remodeling, synovial inflammatory osteophyte formation, leading to pain, stiffness, swelling, and loss of normal joint function. The most commonly affected appendicular joints include; knees, hips and hands (Arthritis & Rheumatology, (2020).

Conservative therapy that can be given to patients with mild to moderate knee OA is pharmacological and non-pharmacological therapy. Non-pharmacological therapy can be in the form of exercise therapy and physical modalities. Ultrasound (US) is one of the most widely used non-pharmacological treatment methods for OA with its analgesic and antispasmodic effects on muscles (Yildiz et al., 2015). Transcutaneous Electrical Nerve Stimulation (TENS) is a modality used by physiotherapists in Indonesia, namely by using electrical energy that will stimulate the nervous system through the surface of the skin which has been proven to be effective in stimulating various types of pain (Jiemesha & Angliadi, 2014).

Case Presentation

Subjective examination

Patients with the initials Mr. M is 60 years old with the main job as a sand porter. Nine months ago, the patient fell under a sandbag that hit his head and back while working. As a result, the back fractured and had to be operated on. One week after surgery the patient had a urinary tract disorder, so he needed to be operated on again. As a result of the operation the patient was required to use a catheter. The patient began to complain of stiffness due to the use of the catheter and bed rest in the long term (8 months).

Physical examination

When a static inspection was carried out, the patient's right leg appeared to be slightly floating not attached to the bed in a lying position. Dynamically the patient looks difficult when getting out of the vehicle, walking, and climbing to the bed. When around the knee area of the patient's right leg is palpated, it felt like there was a slight edema and there was a spasm in the hamstring muscles of both legs. Then when the active movement examination was carried out, there was crepitus on knee extension-flexion movements, pain occurs when the patient performs ankle dorso flexion movements, and it is found that there are limitations of motion during right knee flexion when moving actively or passively.

To confirm the diagnosis on the patient's right knee, specific tests as Ballotement test were carried out and the Mc Murray test also Lachman test were carried out too as a comparative diagnosis. Positive results were obtained on the ballotement test and negative results on the Mc Murray test and the Lachman test.

Management and Outcome

Patients receive physiotherapy services for 3 times in 2 weeks with modalities as ultrasound, TENS, and exercise plus a home program that must be done every day by the patient. This therapy is carried out with the aim to reduce pain in the medial right knee, increase the ROM knee of both legs, relax the harmsring muscles of both legs, and strengthen the quadriceps muscles of both legs. The following is a table of physiotherapy modalities and their dosages:

Table 1 Physiotherapy modalities and dosages

Modality	Dose
Ultrasound	Intensity : 1.5 W/cm Frequency : 1MHz Time : 7 minutes Current : Continue mode (Pratama, 2019)
TENS	Performed for 6 weeks with an interval of 2x per week Frequency :100 Hz Time : 2 minutes Intensity : 30 mA (Pratama, 2019)
Quadriceps Setting Exercise	The exercise was carried out for 5 weeks with 2 sets every day with one set of 10 repetitions and contraction resistance for 5 seconds (Anwer & Alghadir, 2014)
Passive Harmstring Stretching	Exercises are carried out for 3 weeks with 8 counts of resistance and 3-5 repetitions. (Anwer & Alghadir, 2014)

Result

After getting physiotherapy for 3 times in 2 weeks, the results are as follows :

The results of measuring pain in the knee with the Numeric Rating Scale (NRS)

Table 2 Numeric Rating Scale score

Item	T0	T1	T2
Silent pain	0	0	0
Tenderness	0	0	0
Motion pain	6	6	5

Pain is measured using the NRS measuring instrument where the patient will be asked the severity of the pain when he is still, when the problem area is pressed and when the knee is moved. The results did not find any silent pain and tenderness in the knee that had problems and the motion pain was found in the knee but the severity of pain was reduced by 1 score at the last meeting therapy session from 6 scores to 5 NRS scores.

The results of measuring muscle strength in the knee with Manual Musle Testing (MMT)

Table 3 Manual Muscle Testing score

KNEE	T0		T1		T2	
	Dx	Sns	Dx	Sns	Dx	Sns
Flexion	3.	4	3	4	4	4
Extension	4	4	4	4	4	4

Manual muscle testing is measured while the patient is in a supine position. From the results shown by the table, it was found that there was an increase in knee muscle strength from a score of 3 MMT increasing to a score of 4 MMT at the last session of therapy meeting. The point is that initially the right knee was only able to move to bend the knee without resistance, increasing its strength to being able to move when added resistance from the therapist.

The results of measuring the range of motion of the knee joint with a goniometer

Table 4 Range of Motion measured by goniometer

KNEE	Dextra	Sinistra
T0	0°-0°-65°	0°-0°-120°
T1	0°-0°-85°	0°-0°-128°
T2	0°-0°-90°	0°-0°-130°

The table above shows the increased range of motion of the joints in the right knee and left knee. On the right knee the knee was only able to flex as much as 65 degrees increased to 90 degrees at the last therapy session.

The result of measuring the level of the leg segment with the meterline

Table 5 Meterline score of Leg Segment

Benchmark	T0		T1		T2	
	Dx	Sns	Dx	Sns	Dx	Sns
From patella to distal 5cm	30.5	30.5	28	29	27.6	28.8
From patella to proximal 5 cm	34	35.5	32.5	32	32	32
From patella to distal 10 cm	32	31.5	30	31	30	31
From patella to proximal 10 cm	28	36.5	36	34	34	34

Anthropometric measurements using a meterline from 5 cm and 10 cm to the distal and proximal areas showed a decrease in the range of motion of the joint which means there is a decrease in edema in the knee area.

Based on the data above, the results obtained are a decrease in pain level, an increase in muscle strength in the limbs, an increase in the range of motion of the joints and a decrease in the circumference of the knee segment which means a decrease in edema in the legs.

Discussion

TENS is a combination of small devices to direct light electrical pulses to nerves in the area of pain. During the handling of stimulation with TENS, electrodes are placed or attached to the skin in the area experiencing pain (trigger point). The electrodes are connected by wires to an electrically powered stimulator. Some TENS units work by blocking pain impulses through stimulation of large nerve fibers. Another type of TENS works by causing the body to release endorphins (neurochemicals that occur naturally in the brain that have pain relieving properties) TENS can reduce knee pain where the activity of nociceptor cells in the dorsal horn when TENS is applied to the somatic area in the form of pre and post inhibition synapses (Kuntono et al., 2013).

Ultrasound is one of the various physiotherapy modalities that can play a role in the rehabilitation program. Therapy using ultrasound produces high-frequency vibrations that can be adjusted in a pulsed or continuous form. Pulsed ultrasound produces a non-thermal effect and is generally recommended for acute pain and in the inflammatory phase (Oo et al., 2017). Continuous ultrasound provides a deep enough penetrating effect to increased capillary permeability and tissue metabolism, enhancement of fibrous tissue extensibility and elevation of the pain threshold leading pain relief effect. So indeed, the studies used continuous ultrasound reported significant improvements in pain parameters (Cakir et al., 2014).

There is a significant difference in pain measurement results between before and after therapy after an increase in quadriceps muscle strength and hamstring muscle stretching. It breaks the pain cycle by reducing muscle spasms, increasing muscle strength and increasing circulation, which lowers the concentration of metabolites. Increased quadriceps muscle strength also improves range of motion and functional performance of the leg. The increase in range of motion of knee extension will secondary to pain reduction, which is responsible for the improvement in muscle function. There is an increase in range of motion due to the influence of stretching exercises, which increase muscle flexibility, leading to reduced muscle shortening, decreased pain and increased range of motion. Maintained with strengthening exercises will improve daily living activity that brings to improvement of functional performance (Hafez et al., 2013).

Conclusion

After receiving physiotherapy treatment with TENS modalities, ultrasound as well as quadriceps setting and passive hamstring exercises plus the home program that has been done we found out there are decreased in pain, decreased edema, increased quadriceps muscle strength and increased joint range of motion.

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References

- Anwer, S., & Alghadir, A. (2014). Effect of isometric quadriceps exercise on muscle strength, pain, and function in patients with knee osteoarthritis: A randomized controlled study. *Journal of Physical Therapy Science*, 26(5), 745–748. <https://doi.org/10.1589/jpts.26.745>
- Cakir, S., Hepguler, S., Ozturk, C., Korkmaz, M., Isleten, B., & Atamaz, F. C. (2014). Efficacy of therapeutic ultrasound for the management of knee osteoarthritis: A randomized, controlled, and double-blind study. *American Journal of Physical Medicine and Rehabilitation*, 93(5), 405–412. <https://doi.org/10.1097/PHM.0000000000000033>
- Erratum to: 2019 American College of Rheumatology/Arthritis Foundation Guideline for the Management of Osteoarthritis of the Hand, Hip, and Knee (*Arthritis & Rheumatology*, (2020), 72, 2, (220-233), 10.1002/art.41142). (2021). *Arthritis and Rheumatology*. <https://doi.org/10.1002/art.41761>
- Hafez, A. R., Al-Johani, A. H., Zakaria, A. R., Al-Ahaideb, A., Buragadda, S., Melam, G. R., & Shajji, J. K. (2013). Treatment of knee osteoarthritis in relation to hamstring and quadriceps strength. *Journal of Physical Therapy Science*. <https://doi.org/10.1589/jpts.25.1401>
- Jiemesha, I., & Angliadi, E. (2014). Pengaruh Transcutaneous Electrical Nerve Stimulation Dengan Dan Tanpa Terapi Latihan Terhadap Nyeri Dan Kinerja Fisik Pada Penderita Osteoarthritis Lutut. *Jurnal Biomedik (JBM)*. <https://doi.org/10.35790/jbm.6.3.2014.6325>
- Kuntono, H. P., Haryanto, P., & Parjoto, S. (2013). Pengurangan Nyeri Menggunakan Latihan Otot Quadriceps dan TENS dengan Latihan Otot Quadriceps dan Fisiotaping pada Osteoarthritis Lutut. *Terpadu Ilmu Kesehatan*, 3, 163–167. Retrieved from <http://jurnal.poltekkes-solo.ac.id/index.php/Int/article/download/212/189>
- Oo, W., Linklater, J. M., Saarakkala, S., Samuels, J., Conaghan, P. G., Daniel, M., ... Hunter, D. J. (2017). Clinimetrics of Ultrasonography in Osteoarthritis: A Systematic Literature Review. *Osteoarthritis and Cartilage*. <https://doi.org/10.1016/j.joca.2017.02.408>
- Pratama, A. D. (2019). Intervensi Fisioterapi pada Kasus Osteoarthritis Genu di RSPAD Gatot Soebroto. *Jurnal Sosial Humaniora Terapan*, 1(2), 21–34. <https://doi.org/10.7454/jsht.v1i2.55>
- Yildiz, S. K., Ozkan, F. U., Aktas, I., Silte, A. D., Kaysin, M. Y., & Badur, N. B. (2015). The effectiveness of ultrasound treatment for the management of knee osteoarthritis: a randomized, placebo-controlled, double-blind study. *Turkish Journal of Medical Sciences*.