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The Use of Transcutaneous Electrical Nerve Stimulation (TENS), Patellar Mobilization, and Quadriceps Setting in Bilateral Knee Osteoarthritis Grade 2 Case in Older Adults

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ABSTRACT

Introduction: Osteoarthritis (OA) is known as degenerative joint disease where there is joint abnormality causing inflammation involving cartilage and surrounding tissue which result in morbidity and functional limitations, especially for older adults.

Method: The aim of the study was to determine the benefits of performing Transcutaneous Electrical Nerve Stimulation (TENS), Patellar Mobilization, and Quadriceps Setting in Bilateral Knee Osteoarthritis Grade 2 on Elderly. The assessment used was Numerical Rating Scale Pain Assessment (NRS), Manual Muscle Testing (MMT), and Western Ontario and McMaster Universities Osteoarthritis (WOMAC).

Discussion: The giving of Patellar Mobilization is able to increase function in older adults and also decrease knee joint stiffness and pain, meanwhile the giving of Quadriceps Setting is also able to increase Quadriceps muscle strength, and the application of Transcutaneous Electrical Nerve Stimulation (TENS) is able to decrease pain caused by OA and increase physical performance in patient with Knee OA.

Conclusion: After doing physiotherapy as many as 4 times using Transcutaneous Electrical Nerve Stimulation (TENS), Patellar Mobilization, and Quadriceps Setting, it is gained the decrease of pressure and movement pain, the increase of right and left leg muscle strength, and also the increase of WOMAC functional Test result after being given *Transcutaneous Electrical Nerve Stimulation (TENS), Patellar Mobilization, and Quadriceps Setting*.

Keywords: Osteoarthritis (OA), *Transcutaneous Electrical Nerve Stimulation (TENS), Patellar Mobilization, and Quadriceps Setting*.



INTRODUCTION

Osteoarthritis (OA) is known as degenerative joint disease where there is where there is joint abnormality causing inflammation involving cartilage and surrounding tissue which result in morbidity and functional limitations, especially for older adults (Abdel-aziem et al., 2018). Knee OA becomes the fourth first cause of abnormality in 2020 with prevalence of 22% sampai 39% both in developed and developing countries, 10% occur in men and 13% occur in women with age less than 60 years or more (Rabea and Mohammad, 2019).

Clinically, osteoarthritis (OA) is signed by pain while holding burden, there is pressure pain, movement limitation on knee, there is crepitation, the presence of local inflammation with various levels, and there is effusion sometimes (Ayanniyi et al., 2017). The risk factors becoming the cause of OA are older age, obesity, genetic, gender which the prevalence of woman suffering OA is higher than those of man because of hormonal factor, and got injured. The diagnosis for OA itself can be made from radiology to see the grade of the OA, and also from the history and specific Tests performed by a physiotherapist (Pratama, 2019).

Knee OA severity classification used Kellgren and Lawrence system using 5 grades: grade 0: T The radiographic results do not show the presence of OA, grade1: almost no joint space constriction and the possibility of osteofit, grade 2: there is osteofit and the possibility of joint space constriction in radiography photo with anteroposterior weight-bearing, grade 3: there some osteofits, joint space constriction, sclerosis, the possibility of bone deformity, grade 4: there is huge osteofit, clear joint space constriction, heavy sclerosis, and deformity of bone (Pratama, 2019).

The objectives of this study was to determine the benefits of giving TENS,

Patellar Mobilization, and Quadriceps Setting in Knee OA bilateral grade 2 in older adults.

Many physiotherapy modalities are used to overcome problem related to OA, which is Patellar mobilization that is able to increase function in older adults and also decrease knee and joints stiffness (Ahmad, 2016). The giving of Quadriceps setting is also beneficial in increasing quadriceps muscle strength (Bokaeian et al., 201). And the application of Transcutaneous Electrical Nerve Stimulation (TENS) tool is able to reduce pain caused by OA and increase physical performance in Knee OA patients (Pratama, 2019).

METHOD

Physiotherapy Intervention Technology

Transcutaneous Electrical Nerve Stimulation (TENS)

The disposition of TENS tool was by giving frequency of 100 hz, duration of 20 minutes, and electrode pad made from self-adhesive in size 5x5 cm put in knee lateral and medial, to reduce pain caused by OA (Pratama, 2019).

Patellar Mobilization

The giving of patellar mobilization can reduce pain and increase function and life quality in knee OA patient (Sit et al., 201). It is stated in other journal that patellar mobilization given for 8 weeks with two sessions per week can increase movement as many as 11%, reduce pain as many as many as 33%, and increase walking speed as many as 11% than conventional therapy without Patellar Mobilization (Ahmad, 2016).

Quadriceps Setting

The giving of quadriceps setting for 5 weeks with 2 sets per day, each set consists of 10 repetitions and given contraction resistance for 5 minutes can increase quadriceps muscle strength and



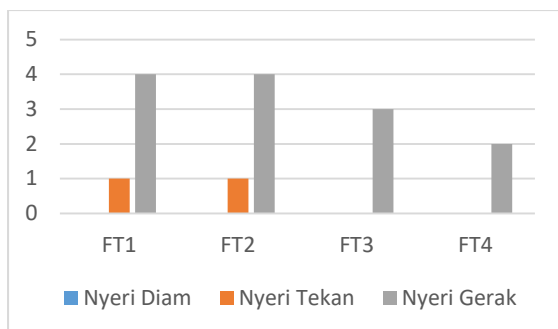
improve functional status in Knee OA patients (Pratama, 2019).

RESULT

Result of Pain Test Using *Numerical Rating Scale* (NRS).

Test of pain in OA cases was carried out using the NRS with a value of 0 (no pain), values 1-3 (mild pain), values 4-6 (not so severe pain), and values 7-10 (severe pain). Figure 1.

Graphic below showed there was pressure pain reduce in right and left knee area from FT1 up to FT3. Then the giving of TENS, Patellar Mobilization, and Quadriceps Setting was also able to reduce mobility pain in right and left area based on FT2: 4 became FT4: 2.



Picture 1. Pain Testing

The result of Functional Test using WOMAC (Western Ontario and McMaster Universities Osteoarthritis).

Functional Test on OA patient was done by using WOMAC consisting of 3 Tests which were pain, stiffness, and physical function where each Test consisted of many items. For value information, namely 0: none, 1: mild, 2: moderate, 3: severe, and 4: extreme.

Based on the WOMAC result done, there was a functional increase in knee OA patient after performing TENS, Patellar Mobilization, and Quadriceps Setting. WOMAC value interpretation from minimum to maximum in pain Test: 0-20, stiffness: 0-8, physical function: 0-68, and WOMAC total value interpretation was 0-

24: mild, 24-48: moderate, 48-72: severe, and 72-96: extreme.

Based on the WOMAC result for right and left leg muscle pain Test, it was obtained the result in FT1: 12, FT2: 11, FT3: 10, FT4: 9, WOMAC on stiffness was FT1: 4, FT2: 4, FT3: 3, FT4: 2, and WOMAC on physical function was FT1: 37, FT2: 32, FT3: 2, and FT4: 22. And the WOMAC total value was FT1: 53, FT2: 47, FT3: 40, and FT4: 33.

Result of muscle strength using MMT (*Manual Muscle Testing*)

Muscle strength testing on bilateral knee OA patient showed that there was an increase of right and left leg muscle strength after given TENS, Patellar Mobilization, and Quadriceps Setting with the value of FT1: 3, FT2: 3, FT3: 3, and FT4: 4.

CASE PRESENTATION

Patient initialed Mrs. DR was an elderly woman aged 66 years old. She has been diagnosed bilateral knee OA grade 2 since January, 4th 2020 with photo evidence and X-ray impression as follows:



- There were osteophytes on the medial and lateral condyles of the left tibia,



right lateral condyle of the tibia, left femur and left patellar condyle.

- No signs of osteoarthritis were seen.
- Supports the appearance of bilateral knee osteoarthritis, especially left.
- The left knee joint was relatively untightened.

The patient had a history of comorbidities named lumbar HNP (Herniated Nucleus Pulposus). When the patient did physiotherapy, it was not only focus on OA but also on HNP. Due to covid-19 pandemic, patients was active again in January 2021. Patient had a personal and family disease history which were Diabetes Mellitus. In an inspection conducted by the author, the patient had used worn braces on both knees.

DISCUSSION

Knee OA and HNP are two chronic oxidative stress disease causing disability through sequential events from mechanical wear affecting the matrix tissue. The condition of degeneration in the elderly is due to the mechanism of cellular aging induced by oxidative damage or called oxidative stress, cells in the elderly have an impaired capacity for matrix repair and synthesis, thus tissue redox homeostasis is lost. As a result, suppression of oxidative damage disrupts poorly integrated antioxidant defense networks (Alberto Alexandre and Andrea Alexandre, 2015).

The cartilaginous structures of the intervertebral discs and articular joints contain a large proportion of proteoglycans and type II collagen, i.e. produce a tissue capable of creating hydrostatic pressure, resisting compressive loads and providing flexibility. Local inflammation results from mechanical overload or low-grade systemic inflammation, characterized by increased levels of inflammatory cytokines, leading to cell and chondrocyte death, increased shear stress, decreased levels of proteoglycans, and type II

collagen, leading to loss of joint space, subchondral sclerosis, and the presence of osteophyte formation, all of which are causes of pain and stiffness (Rustenburg et al., 2018).

Knee OA and HNP with conditions are not identical, but their composition and degeneration process are very similar, influencing the local mechanobiological environment of cells after birth that is able to have a greater influence on their behavior than their embryonic origin (Rustenburg et al., 2018).

Estrogen levels on elderly women or those who have gone through menopause are significantly lower than normal levels, so women will be more sensitive to joint changes. Besides, living in a cold and humid environment can increase prevalence of OA (Sun et al., 2019).

Transcutaneous Electrical Nerve Stimulation (TENS)

Actually, TENS can reduce pain caused by blocking system or gate control. Where patient with OA was given TENS, defense mechanism along the central nervous system inhibit the pain caused by OA. The blocking system has already entered the main door in substantia gelatinosa so that it inhibits nociceptive cells to send information to the central nervous system, so that the pain caused by OA is not sent to the central nervous system. With the blocking system, TENS is able to reduce or even eliminate pain caused by OA and can improve physical performance in patients with Knee OA (Pratama, 2019).

Patellar Mobilization

Joint mobilization not only initiates local physiological mechanisms but also involves central mechanisms such as the facilitation of inhibitory pathways in the spinal cord or descending inhibitory pathways from higher levels in the brainstem, that serotonergic and



noradrenergic receptors in the spinal cord mediate the analgesia produced by mobilization of the knee joint, so that it provides local and broad hypoalgesic effects, increases knee flexion ROM, increases knee flexor and extensor muscle strength, and improves physical function for patients with knee OA (Alkhafae & Alshami, 2019).

In a systematic review, it is stated that anterior and posterior mobilization of the tibiofemoral and patellar joint is recommended if pain is present. Tibiofemoral mobilization is effective in controlling pain that which can help improve joint play and knee flexion movement (Rabea and Mohammad, 2019).

Quadriceps Setting

The study showed that there is a decrease in pain and an increase in functional activity independently from the increase of quadriceps muscle strength in knee OA case. It seems that the increase of quadriceps muscle strength may not be the cause of improvement of pain and functional activity in knee OA. The average change in Quadriceps muscle strength and functional activity increased significantly. Several studies have shown that administering exercise or exercise therapy can reduce disability and improve functional activity by increasing muscle strength and increasing cardiovascular capacity. In addition, improvements in muscle strength, proprioception, and balance function may have a major effect on performance of functional activities. It seems that pain reduction is a major factor that directly and indirectly affects functional activity. Muscle strength may not be the main factor in exercise therapy or exercise in knee OA, but more attention to other muscle performance factors such as muscle activation patterns, and exercise therapy factors such as biomechanical factors (Bokaeian et al., 2018).

CONCLUSION

After doing physiotherapy on bilateral knee OA cases 4 times using TENS, Patellar Mobilization, and Quadriceps Setting modalities with the patient initials Mrs. DR showed decreased tenderness and movement, increased right and left leg muscle strength, and increased WOMAC functional Test results after being given TENS, Patellar Mobilization, and Quadriceps Setting.

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