The Difference between Transcutaneus Electrical Nerve Stimulation and Oscillation Traction in Reducing Knee Osteoarthritis Pain

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Abstract: Osteoarthritis is a chronic disease that affects quality of life and productivity of human body. The purpose of study was to decide differences in administration of transcutaneous electric nerve stimulation with oscillation traction on pain intensity in patients with knee osteoarthritis. This research method is a quasi-experimental design with pre-test and post-test two groups. Respondents were 24 people consisting of two treatment groups with each group totalling 12 people. Statistical test results obtained p-value <0.05 (0.001 <0.05) means that there is an effect of giving transcutaneous electric nerve stimulation with oscillation traction to decrease pain in patients with osteoarthritis of the knee. There are differences in transcutaneous electric nerve stimulation with oscillation traction in reducing pain in patients with osteoarthritis of the knee where pain reduction with TENS intervention falls by 16.7% and oscillation traction decreases by 50%.

1 INTRODUCTION

Degenerative disease is a chronic disease that affects the quality of life and productivity of a person. Degenerative diseases include cardiovascular diseases (heart and blood vessels) including hypertension, diabetes mellitus and cancer, osteoarthritis. One of the many degenerative diseases that have a high mortality rate and affects the life force and productivity of a person is osteoarthritis (Sue, 2019).

Osteoarthritis is a degenerative disease with a fairly high mortality rate, and can affect the quality of life and productivity of a person (Sue, 2019). Knee osteoarthritis is a degenerative disease of the knee joint caused by a variety of factors. A characteristic feature of osteoarthritis is damage to the cartilage or cartilage in the knee joint. This knee joint cartilage is a slippery hard tissue that explain at the end of the bones in knee joint. Cartilage in the joints serves as a facilitator of movement in activities (Noor, 2016). Osteoarthritis (OA) is the most common joint disorder and the leading cause of disability in elders. In 2015, the World Health Organization estimated that 18.0% of women and 9.6% of men 60 years of age or over suffer from symptomatic OA. Among people with symptomatic OA, 80% have some limitation in mobility and 25% are unable to do their major daily activities (Zhang and Niu, 2016). Data in Indonesia according to Setiati, Marcellus, Alwi, 2017, people who suffer from osteoarthritis disorders reached 5% affected at age <40 years, and 30% at age 40-60 years and 65% at age> 60 years.

According to Basic Health Research data RISKESDAS 2018, the prevalence of joint disease in Indonesia is around 7.3% and osteoarthritis (OA) or arthritis is a common joint disease. Although it often occurs with age, or known as degenerative disease, joint disease has occurred in people in the age range of 15-24 years (prevalence rate around 1.3%), the prevalence rate continues to increase in the age range of 24-35 years (3, 1%) and the age range is 35-44 years (6.3%). Data from the hospital. Grandmed, Lubuk Pakam showed cases of osteoarthritis has increased from year to year. In 2017 a total of 4,407 people or 34% of the total 12,960 people while in 2018 a total of 5,472 people or 36.5% of the total 14,976 people visited, the Hospital Physiotherapy Poly Grandmed Medistra, 2018.

Manual therapy will taken from the word manus (hand) and therapy or treatment) so that it can be used as therapy. Especially using hands. Manual therapy is considered the structure and system in human body such as bones, joints, soft tissue, circulation blood,

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lymph and nerves. The main purpose of the therapy manual is to help the body's natural recovery process. The effects of manual physiological therapy include smooth circulation blood, triggers endorphins hormone and relaxes muscles. Accordingly. The whole process can then, reducing perception through the effect of excitatory inhibition pain (gate control), muscle relaxation, improve joint motion, strength, cordination, balance, reducing pain. Janis manual therapy used is a traction method using mechanical devices to remove spinal pressure, arms, legs and neck.

The impact of pain on osteoarthritis was a decrease quality of life expectancy such as the reduced ability of motion of the patient in carrying out daily activities (Price, 2014). The measuring instrument used to measure pain intensity is the Visual Analog Scale (VAS). VAS used very widely in recent decades in studies related to pain with reliable, valid and consistent results. VAS is an instrument used to assess pain intensity using a 10 cm line table with a reading of a scale of 0-10 cm with a range meaning (Vaidehi, Kristian, Stephanie, et all, 2017).

To overcome the problem of pain in knee osteoarthritis actions that are given in addition to drugs but also given therapeutic measures with Electroacupuncture (Lucas, Luci, Ricardo, 2018), Exercise (Shim, Jung, Kim, 2016), Balance Exercise (Ashtiani, Akbari, Mohammadi, et all, 2018). Other methods that can given to overcome the problem of pain in knee osteoarthritis are TENS and oscillation traction (Veldman, Glatthorn, Visscher, 2019). TENS is a modality that uses electrical energy that is useful for stimulating the nervous system through the surface of the skin which is proven effective for stimulating various types of pain (Govil M, Mukhopadhyay, Holwerda, et all, 2019). In this case TENS has a sedative effect that stimulates the Posterior Horn Cell (PHC) so that the pain that results in disability will cut. The use of TENS in osteoarthritis pain is primarily intended for modulation of supraspinal and central levels, to obtain the effectiveness of pain reduction with the production endorphins, serotonin and enkepalin.

Traction is a technique used to treat joint dysfunction such as stiffness, reversible joint hypomobility and pain. Traction is a passive movement that doing by physiotherapy at a slow pace so that the patient can stop the movement. Giving traction can stimulate biological activity by flowing synovial fluid which can carry nutrients in the vascular part of the joint cartilage on the joint surface and joint fibrocartilage. Repeated movements in the traction movement will improve microcirculation and a lot of liquid will come out so that the water and matrix moisture content in the tissue can increase and the tissue becomes more elastic. In addition, the traction element motion is almost the same as the physiological motion of the knee joint in flexion motion so that it can add and keep up elasticity of the capsules, ligaments, and muscles (Negara, 2013). Oscillation traction is a mobilization technique that can cause synovial fluid movements and help deliver nutrients to tissues that are avascular and fibro cartilage and prevent pain and static degeneration effects when the joints are swollen or painful and limited. Therefore researchers want to prove whether there is a difference between giving TENS and oscillation traction in reducing pain in knee osteoarthritis. The purpose of this study was to determine the differences in the administer of transcutaneous electric nerve stimulation with oscillation traction on pain intensity in patients with knee osteoarthritis

2 RESEARCH METHODS

This research was taken at the Grandmed Poly Physiotherapy Hospital which is on Jl Raya Medan, No.66, Lubuk Pakam. The research held on February - July 2018. This type of research was a quasi-experimental research design with pre-test and post-test two groups. The research sample consisted of 24 people and divided into 2 groups: group I was given TENS intervention and Group II was given oscillation Traction intervention with a sample of 12 people each.

The data had presented in tabular form after editing, coding and tabulation, then the t-test closed to confidence level of 95% (0.05). All statistical tests were performed with the help of a computer using SPSS 22 software. Research Implementation Flow (Figure 1).

Pain measurement is performed use Verbal Anolog Scale (VAS). VAS has been used in diverse adult populations, including those suffering from rheumatic diseases. VAS is an instrument used to assessment pain intensity using a line 10 cm long (Figure 2) with a scale reading of 0-10 cm with a range of meanings: no pain (0.9 cm), mild pain (1-3 cm) moderate pain (3.1 -7 cm), and severe pain (7.1-8.9 cm). Pain measurement can be done by the respondent himself. Determination of the VAS score is done by measuring the distance between the end of the line on the painless line to the point indicated by

the patient, (Vaidehi, Kristian, Stephanie, et all, 2017).

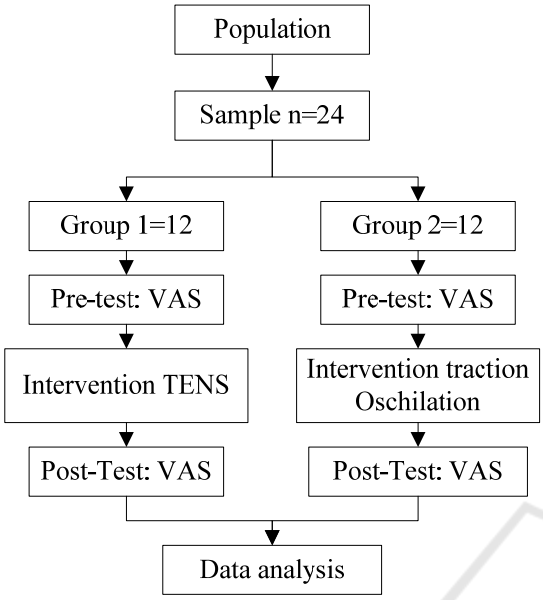

Figure 1: Research Implementation Flow

Pain examination procedure with VAS:

- Explain to the patient about the purpose of the measurement carried out.
- Explain to sufferers that right angle means no pain, middle means moderate pain and left angle means very painful (front VAS)
- Telling the patient to choose or move direction the VAS arrow on the pain scale by the intensity of pain felt when stationary/not moving (silent pain)
- Pressing the patient's body area complained of or other body areas related then told the patient to select / move direct of the VAS arrow on the pain scale by the intensity of pain felt when the area is pressed (tenderness)
- Move the patient's body area complained of or other body areas related then instruct the patient to select or move direct the VAS arrow on the pain scale by the intensity of pain felt when moved by the examiner (motion pain)
- Take notes and then interpret the meaning of pain expressed by the patient by comparing pain gauges available at the back of the VAS Pain measurement in this study was done before and after TENS and oscillation traction treatments Measurement data will be tested by Paired Samplet-test and independent t-test. The flow of this research will be seen in Figure 2.

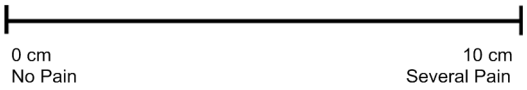

Figure 2: Visual Analogue Scale

Physiotherapy intervention technology given

2.1 *Transcutaneus Electrical Nerve Stimulation*

TENS method (Figure 3) used to reduce pain in knee osteoarthritis was obtained through the gate control theory (Sharvit, 2016). This theory explains sensation of pain will be felt if the impulse / stimulation of pain from the source of pain is successfully delivered by small nerve fibers (S) to the pain center in the central nervous system in the brain (Figure 4) through the pain gate. Pain gates can be closed by inhibiting the respective of C fibers by impulses on large nerve fibers (L) through touch stimulation, pressure, touch, or vibration (TENS stimulation) at the source of pain, so that the pain impulses are not transmitted to the spinal cord and to the brain and finally one does not feel the sensation of pain (Figure 5).

Figure 3: Transcutaneus Electric Nerve Stimulation

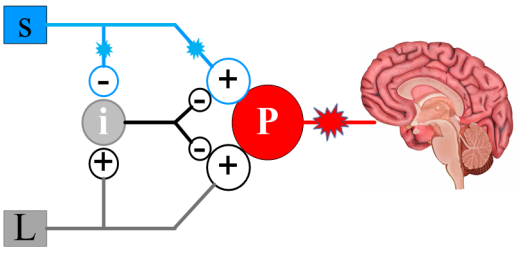

Figure 4: Small Fiber Input (S) = Gate Open

The TENS application technique is performed by placing electrodes / pad around the sensation of pain in the knee (Figure 6a). This method was the easiest and most often used, because this method directly applied to the area of pain without regard to the character and the most optimal location in relation to the tissue that causes pain. Given frequency of 40-150 Hz and low intensity, current regulation between 10-30 mA, short duration (above 50 microseconds), 30 minutes time.

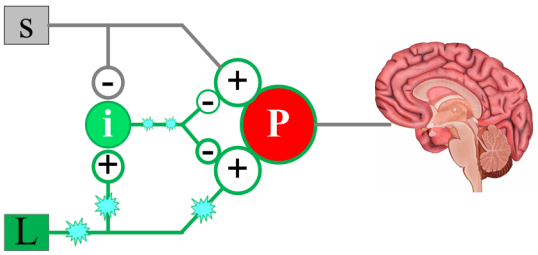

Figure 5: Large Fiber Input (L) = Gate Closed

2.2 Oscillation Traction

Application of traction techniques form of oscillation, stakato, or stretching continuously to increase mobility and reduce pain. Procedures for conducting therapy, position the patient face down, therapist standing distal, fixation of the upper limbs of patients with a band fixed to the bed, both hands holding the tibia and fibula ankle, and perform traction towards the distal (Figure 6b).

(a) (b)

Figure 6: TENS Application Method on the Knee (a), Oscillation Traction Method in the Knee (b)

3 RESULTS AND DISCUSSION

3.1 Characteristics of Respondents

The data distribution of respondents based on the age of majority aged 48-60 years amounted to 5 people or 88.3% in both the TENS group and the oscillation traction group as in Table 1. This is consistent with the existing theory that the aging process is very influential in the process of knee osteoarthritis. Elisabet, JC 2011) Whereas respondents based on gender, the majority are female, amounting to 9 people or 75% of the total 12 respondents from the two intervention groups.

This will thought to be related to the hormone estrogen, where adult women have less calcium in bone than in adult men and after menopause the estrogen hormone disappears quickly, causing women to lose calcium in bones faster than men of equal age. The rapid disappearance of the hormone estrogen causes an increase in osteoclast activity, reduced osteoblastic activity in bone, reduced bone matrix and reduced intake of calcium and bone phosphate (Ebru , Ersin, Ozdıncler, et all, 2018). The data confirms that with age a person is more at risk for inflammation or calcification of the joints, especially in the knee joints because the knee joint is the most mobile joint and supports weight. Whereas for the sexes that suffer the most osteoarthritis, they are women, it is due to the monopouse process which causes hormonal changes.

Table 1: Characteristic of Respondents.

Information	Group TENS		Group Oscillation Traction	
	n	%	n	%
Age				
35-47	3	25 %	2	17%
48-60	9	75 %	10	83%
Total	12	100%	12	100%
Sex				
Male	3	25 %	3	25 %
Female	9	75 %	9	75 %
Total	12	100%	12	100%

3.2 Pain Measurement Results before and after Giving TENS and Oscillation Traction

Pain measurement showed that the average VAS pain scale felt by respondents before the TENS intervention was 6 (moderate pain) and after the TENS intervention, the average value was 5 (sweat pain) or decreased by 16.7%. While the average VAS pain scale before the oscillation traction intervention was 6 (moderate pain) and after the intervention, the average pain was a value of 3 (sweat pain) or decreased by 50% (Table 2).

Table 2: VAS Pain Scale before and after intervention TENS dan Oscillation Traction.

VAS					
Traksi Osilasi			TENS		
n	Before	After	n	Before	After
1	6	4	1	5	4
2	7	5	2	6	5
3	6	3	3	7	6
4	7	4	4	6	5
5	6	2	5	7	6
6	4	2	6	5	4
7	5	2	7	6	5
8	6	3	8	5	4
9	5	2	9	7	6
10	7	3	10	6	5
11	6	3	11	6	5
12	7	3	12	6	5
VAS Average Value	72/12= 6	36/12= 3		72/6=6	60/12=5

3.3 The Differences in TENS and Oscillation Traction in Reducing Pain in Knee Osteoarthtritis

The results of data process used paired t-test, before and after intervention in the oscillation traction group, obtained a mean of 4,500 with p value = 0,000 < (0,000 <0,05), it can be concluded that there is an influence of oscillation traction administration on pain reduction in sufferers of knee osteoarthtritis. While giving TENS intervention obtained a mean of 1,500 and p-value < (0,001 <0.05), it can be concluded that there is an effect of TENS administration in reducing pain intensity in patients with knee osteoarthritis.

3.4 The Difference between TENS and Oscillation Traction

Based on the results of data processing that has been done using the Independent t-test, then the TENS intervention and oscillation traction obtained p-value <(0.001 <0.05), it was concluded that the hypothesis in the study accepted, namely: " There is a difference in the administration of TENS with traction oscillation of pain intensity in patients with osteoarthritis of the knee. in experimental animals decreased during spinal transection, this indicates an extrasegmental role in the eventδ fibers and type C fibers. Intake of small diameter fibers activates T cells which will be felt as complaints of pain. If large-diameter fibers were activated, this will also activate T cells but at the same time the impulses will also activate SG which has an impact on reducing the intake of T cells from small-diameter fibers in other words, the intake of large-diameter fiber impulses will close the gate and inhibits the transmission of pain impulses so that pain is felt to be reduced. (3) Extra-segmental mechanism. TENS that induce small-diameter afferent activity also produce extrasegmental level analgesia through activation of structures that form the path of desenderent inhibition such as periaqueductal gray matter (PAG), Nucleus Rape Magnus (NRM) and nucleus rape gigantocellularis (NRG). Analgesia produced by TENS stimulation of A-δ fibers and small-diameter A-β and A-αThe results of this study are consistent with research conducted by Parjoto S (2012) that TENS produces analgesia at the extrasegmental level through structural activities that form the paths of desenderent inhibition such as periaquedutal gray (PAG), raohe magnus nucleus and raphegiganto celluraris nucleus. The mechanism of pain reduction with TENS according to Johnson M is (1) Peripheral mechanism. Electrical stimulation applied to nerve fibers will produce impulses that run in both directions along the nerve axons concerned. In sensory nerves, impulses that travel proximal were called prodromic impulses, while impulses that travel distally are known as antidromics. Antidromic impulses will crash, reduce or eliminate afferent impulses that come from damaged tissue or the source of pain. (2) Segmental Mechanisms. Conventional TENS produces analgesia mainly through the segmental mechanism by activating A-ser fibers which in turn inhibits nociceptive neurons in the posterior horn of the spinal cord. This refers to the gate control theory which states that the gates consist of inhibitory international cells known as gelatinous substances and T cells that relay information from a higher center and both are located in the posterior horn of the spinal cord. The level of T cell activity was determined by the balance of intake from large diameter A-The researchers' assumption is that the stimulation of alternating electric currents with the intensity, frequency and time that has been set the stimulation of nosiceptor so that pain can be inhibited. Barriers that are made in the form of electric current stimulate innervation so that the spinal level this is accordance with the gate control theory is very instrumental in pain inhibition, for each person has a different frequency of pain tolerance.

Oscillation traction interventions as they have effects on pain relief in knee joint osteoarthritis. Because the oscillation traction technique will

increase the joint surface movement which will reduce the clamping of soft tissue, reduce contractures, reduce muscle spasms so that blood flow occurs smoothly, and there is a propioceptive increase that affects the increased mobility of the knee joint area which causes the effectiveness and elasticity of the movement to increase, so that knee was used again to increase functional degrees (French, Brennan, White, et all, 2017). This is in line with research according to Alkhawajah, Alsham. (2019) with mobilization of traction by giving traction to the tibiofemoral joints, the joint surfaces move away, so that the distance between joints that were narrowed in the condition of tibiofemoral joint osteoarthritis can be widened so that pain due to sensory nerve endings the pressure around the joints can reduced, if the level of pressure decreases, the level of irritation of the sensory nerves will decrease, the impulse of the nociceptor nerve will decrease, and pain can reduced.

Provision of traction can stimulate biological activity by flowing synovial fluid which can carry nutrients in the vascular part of the joint cartilage on the joint surface and joint fibrocartilage. Repetitive movements in the traction movement will improve microcirculation and a lot of liquid will come out so the water dam and matrix content in the tissue. Joint distance that narrows with traction will widen the distance between the joints so that the tissue previously depressed by exist of osteophytes will relax and will not irritate the surrounding tissue and sensory nerve endings so that pressure will decrease and pain can be reduced. With repetitive movements that will improve local blood circulation of capsules, ligaments, and also in the muscles, besides that it will increase quantity of protein in the synovium fluid due to the sedative effect there will be an increase in circulation so that metabolism in the tissue increases, irritation decreases and pain even reduced

Effects of oscillation traction, (1) Physical effects: giving oscillation traction can stretch the joints so that it stimulates biological activity in the joints by moving synovial fluid. Synovial fluid activity can increase the process of exchange of nutrients to the surface of the joint cartilage and fibrocartilage so that syinovial fluid increases. (2) neurological effects: can stimulate joint receptors, namely mechanoreceptors so that they inhibit stimulation of nociceptor stimuli in the spinal cord via spinal level modulation. (3) stretching effect: Can stretch painless capsuloligament through the release of abnormal collagen crosslink fibers so as to increase the scope of joint and functional motion of the joints and keep up tissue elasticity around the joints. (4) arthrokinematic effect: stretch physiological movements of the joints. (5) mechanical effects: traction with a small amplitude on the joint surface causes synovial fluid activity. Synovial fluid activity that delivers nutrients to the cartilage and fibrocartilage, can reduce pain, and increase the scope of joint motion, (Hameed, Waqas, Akhtar at al, 2017). The researchers' assumption is that by giving oscillation traction can further inhibit or reduce pain, this is due to the process of withdrawal and the creation of a joint space that causes topping of impact due to cartilage damage to the joints which causes the knee joints to become loose and there is pressure on the bones against bones, therefore we need interventions that can restore joint space so that there is no friction between joints.

4 CONCLUSIONS

Based on the results of the statistical tests and the discussion above, it can be concluded that

- Giving TENS affects the reduction of pain in patients with osteoarthritis of the knee where the average pain value using VAS before the action is 6 (moderate pain) and after TENS intervention, it becomes 5 (sweat pain) or decreased by16.7%
- Giving oscillation traction affects the reduction of pain in patients with osteoarthritis of the knee where the average pain value using VAS before the action is 6 (moderate pain) and after the intervention, the average pain value becomes a value of 3 (sweat pain) or falls by 50%.
- TENS and oscillation traction can be used as a reference for making standard operating procedures (sops) for managing osteoarthritis of the knee. for the next researchers to use a larger number of samples in order to obtain maximum results.

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