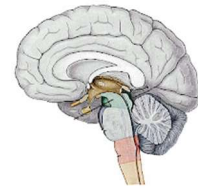


Contents lists available online at:

Jurnal Kesehatan Mesencephalon

Journal homepage:

<https://ejournal.stikeskepanjen-pemkabmalang.ac.id/index.php/mesencephalon>

The Comparison Close Kinetic Chain Exercise And Open Kinetic Chain Exercise After Infra Red To Increasing Functional Ability In Primary Osteoarthritis Genu At Bhayangkara Kediri Hospital

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ARTICLE INFO**Keywords:**

Close Kinetic Chain Exercise,
Open Kinetic Chain Exercise,
Functional Ability, primary
genu osteoarthritis

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ABSTRACT

Osteoarthritis is a degenerative health disorder characterized by stiffness and inflammation of the joints, characterized by damage to the cartilage, which can cause pain in the joints of the hands, neck, back, lower body, back and often the knee joints. Pain in genuine osteoarthritis can last a long time causing limitations in the ability to function functional activities. One non-pharmacological method is kinetic chain exercise. This study aims to determine the comparison of close kinetic chain exercise and open kinetic chain exercise after giving infrared to increase functional ability in conditions of primary genu osteoarthritis. This research uses a quasi experimental design with a pre and post test two group design approach. The sample for this research was 30 respondents. 15 respondents were treated with close kinetic chain exercise after giving infrared and 15 respondents were treated with open kinetic chain exercise after giving infrared. There is an effect of close kinetic chain exercise after administering infrared on increasing functional ability in primary genu osteoarthritis conditions at Bhayangkara Kediri Hospital with a significance of $0.001 < \alpha (\alpha=0.05)$. There is an effect of open kinetic chain exercise after administering infrared on improving functional abilities in primary genu osteoarthritis conditions at Bhayangkara Kediri Hospital with a significance of $0.006 < \alpha (\alpha=0.05)$. There is a difference in the effect of close kinetic chain exercise after giving infrared and open kinetic chain exercise after giving infrared on increasing functional ability in primary genu osteoarthritis conditions at Bhayangkara Kediri Hospital with a significance value of $0.035 < \alpha (\alpha=0.05)$. Close kinetic chain exercise after giving infra red is more effective than open kinetic chain exercise after giving infra red in improving the ability of primary genu osteoarthritis conditions at Bhayangkara Kediri Hospital in 2023.

INTRODUCTION

Osteoarthritis is a degenerative health disorder in which stiffness and inflammation in the joints is characterized by damage to the cartilage, which in turn can cause pain in the joints of the hands, neck, back, lower body, back and often the knee joints. (Kalim & Wahono, 2019). Genuine osteoarthritis is divided into two types, namely primary and secondary osteoarthritis. Primary osteoarthritis, or what can be called idiopathic osteoarthritis, has no definite (unknown) cause and is not caused by systemic disease or local changes in the joints. However, primary osteoarthritis is often associated with the aging or degeneration process. (Rahmaniyah, et al, 2022).

According to research at the Dutch Institute for Public Health, the prevalence of osteoarthritis genu in those aged 75 years is 50%, and in those aged 45 years and over is 19.2%. (Khairuruizal, 2019). Osteoarthritis genu affects 151 million people worldwide and is known to reach 24 million people in Southeast Asia. The radiological prevalence of genu osteoarthritis in Indonesia reaches 15.5% in men aged 40 to 60 years and 12.7% in women (Sasono, et, al., 2020). Based on data from patients suffering from genu osteoarthritis at Bhayangkara Kediri Hospital from January 1 2022 to December 31 2022, it was found that 1141 patients had problems with impaired functional activity abilities in genu osteoarthritis patients.

In primary genu osteoarthritis, pain is the most frequent symptom. Pain is caused by thinning of the joint pads, the pain will disappear when resting. However, over time pain will appear at rest if the osteoarthritis gets worse. If pain often occurs even when at rest, crepitus often occurs during activity and swelling is a type of arthritis symptom. (Pratama, 2019). This causes a decrease in quality of life and daily living activities. As many as 80% of patients with genu osteoarthritis suffer from decreased mobility while 20% of them suffer from the inability to carry out daily activities such as walking, climbing stairs, sitting and standing, wearing socks and shoes. Thus, stability problems in genu osteoarthritis can cause limitations in carrying out activities, with society, as well as limitations in work, recreation, or exercise (Susanti & Wahyuningrum, 2021).

Close kinetic chain exercise is an active movement exercise that involves several muscle groups at once and several joints (multiple joints) while open kinetic chain exercise is an active movement exercise that involves only one muscle and joint (single joint) and without movement in the proximal segments. (Khairuruizal, 2019). Infrared is electromagnetic radiation physical therapy with light rays that are longer than visible light rays from microwaves. The heat effects emitted by infrared have been shown to increase tissue expansion, improve joint range of motion, reduce pain and improve healing of soft tissue lesions (Ojeniweh, et al, 2015). So researchers are interested in carrying out research with the title "Comparison of close kinetic chain exercise and open kinetic chain exercise after giving infrared to increase functional ability in primary genu osteoarthritis conditions at Bhayangkara Kediri Hospital.

METHODS

This research uses a quasiexperimental design with a pre and posttest two group design approach in 2023. The sample for this research is 30 respondents. 15 respondents to the close kinetic chain exercise treatment after giving infrared and 15 respondents to the open kinetic chain exercise treatment after giving infrared, with a purposive sampling technique.

RESULTS AND DISCUSSION

The results of this study presented the characteristics of Primary Genu Osteoarthritis. Table 1 shows that the gender results are 50% for men and women respectively. The average age of respondents was 63.2 years with the youngest age being 57 years and the highest age being 72 years.

Table 1. Characteristics of Primary Genu Osteoarthritis Subjects

Characteristics	Parameter	Amount	Percentage (%)
Sex	Man	15	50
	Woman	15	50
Age	Mean	63,20	
	Standart deviation	4,536	
	Minimum	57	

Maximum	72
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Tabel 2. Effect of Close Kinetic Chain and Open Kinetic Chain after giving infrared to patients with Primary Genuine Osteoarthritis

Statistic	Effect of Close Kinetic Chain after giving infrared to patients with Primary Genuine Osteoarthritis	Effect of Open Kinetic Chain after giving infrared to patients with Primary Genuine Osteoarthritis
Signifikasi paired T test	0,001	0,006

In Table 2, the effect of the intervention, the significance result of the Paired T test is $0.001 < \alpha$ ($\alpha=0.05$), so there is an effect of Close Kinetic Chain after giving infrared to improve the ability of Osteoarthritis Genu conditions and the significance result of the Paired T test is $0.006 < \alpha$ ($\alpha=0.05$), then there is an influence of the Open Kinetic Chain after giving infrared to improve the ability of Osteoarthritis Genu conditions at Bhayangkara Kediri Hospital.

Table 3 Differences between Open Kinetic Chain Exercise and Close Kinetic Chain Exercise after infrared administration on functional abilities in patients with primary genu osteoarthritis

Differences between Open Kinetic Chain Exercise and Close Kinetic Chain Exercise after infrared administration on functional abilities in patients with primary genu osteoarthritis	Nilai
Signification Independent Samples Test (2 tailed)	0,035

In table 3, it can be seen that the significance of the Independent Sample Test is $0.035 < 0.05$, so it can be interpreted that there is a difference in the use of Open Kinetic Chain Exercise and Close Kinetic Chain Exercise after administering infrared to the Functional Ability of primary genu osteoarthritis patients at Bhayangkara Kediri Hospital.

1. The effect of Close Kinetic Chain after giving infrared to improve the ability of Primary Genuine Osteoarthritis conditions

Based on the data, it can be seen that the results of the Paired T test show the influence of the Close Kinetic Chain after giving infrared to improve the ability of Primary Genuine Osteoarthritis conditions with a significance of $0.001 < \alpha$ ($\alpha=0.05$).

Close kinetic chain exercise is very useful for training lower leg muscles, especially for improving functional ability in genu osteoarthritis. Because in principle close kinetic chain exercise is an exercise that strengthens agonist and antagonist muscles simultaneously and is a physiological exercise for the lower limbs and the role of each muscle itself, namely the quadriceps muscle as an eccentric contract to control knee flexion or a concentric contract to extend the knee. The hamstrings and soleus function to stabilize the tibia. This is what ultimately causes an increase in functional ability in sufferers of genu osteoarthritis by increasing muscle strength and flexibility, resulting in the achievement of increased joint range of motion and muscle strength which helps in body function and activity. (Babatunde, 2019). The combined use of Infrared provides a heating / thermal / heating effect

on superficial areas, namely the epidermis and dermis, resulting in vasodilation which increases blood circulation in these areas. This causes the supply of oxygen and nutrients to the irradiated area to increase, helping to reduce pain. The sedative effect on nerve endings helps reduce muscle spasms. Apart from that, the use of infrared can have a therapeutic effect by relieving pain, relaxing muscles and increasing blood supply (Widowati, 2019).

Based on research data, the average age of Primary Genuine Osteoarthritis respondents at Bhayangkara Kediri Hospital in 2023 is 63.2 years. The minimum age is 57 years and the maximum age is 72 years. Osteoarthritis is the most prominent joint disorder and has a disabling impact. The prevalence of osteoarthritis is currently increasing along with increasing life expectancy. The existence of this disorder in Indonesia has a prevalence rate of 5% in men and 12.7% in women, based on radiological examination of the knee joint. Based on WHO data, the life expectancy for Indonesian humans is 68 years, the estimated number of people suffering from disabilities due to osteoarthritis ranges from one to two million people. (Njoto, 2022). Osteoarthritis is greatly influenced by increasing age. Based on its prevalence, osteoarthritis is rare in people under 40 years of age and common in people over 60 years of age. However, changes in joint cartilage due to aging are different from changes in osteoarthritis. The relationship between age and osteoarthritis here is more related to the stability of the joints and muscles than the joints themselves. As we age, cartilage thins and muscles weaken and these changes affect the stability of major joints such as the knee joint. Several studies show that the development of genu osteoarthritis is preceded by muscle weakness. (Apley & Solomon, 2018).

According to the researchers' assumptions, conditions improved after the Close kinetic chain intervention was carried out and the respondents were previously given infrared radiation. Infrared which has a thermal effect will cause vasodilation of blood vessels which results in smooth blood flow. After the blood supply becomes smoother, Close Kinetic Chain therapy is carried out which functions to strengthen the agonist and antagonist muscles simultaneously. with the correct procedures according to the respondent's abilities, it will be possible to reduce pain intensity, joint stiffness and improve genu joint function

2. The effect of the Open Kinetic Chain after giving infrared to improve the ability of Primary Genuine Osteoarthritis

Based on the data, it can be seen that the results of the Paired T test show the influence of the Open Kinetic Chain after giving infrared to improve the ability of Primary Genuine Osteoarthritis conditions with a significance of $0.006 < \alpha$ ($\alpha=0.05$).

In line with research conducted by Kholifah (2022), the average functional ability score of respondents after a combination of TENS and Open Kinetic Chain was 31.172. Research conducted by Berampu (2022) found that the average functional ability after open kinetic chain was 27.32. Open kinetic chain is an open movement chain where the distal part of the leg is free to move, while the proximal part remains. (Babatunde, 2019). Open kinetic chain is an active movement exercise that involves only one muscle and joint (single joint) and without movement in the proximal segment. Open kinetic chain exercises can be done with or without additional weights. Open kinetic chain exercises can be done in a sitting or sleeping position by flexing and extending the knee joints against a load (manual or with a tool). Because weight training for osteoarthritis sufferers has the potential to cause pain, weight gain is given gradually according to the patient's tolerance (Hendrik, 2022). Open

kinetic chain movements basically contract the quadriceps muscles where little or no joint movement occurs and there is no change in muscle length. So that increasing muscle strength is focused on one muscle only, thus preventing muscle shrinkage or increasing blood circulation and increasing muscle tone in one quadriceps group where increasing strength can increase the functional ability of the knee joint. Examples of movements in the open kinetic chain include swinging the legs when walking (swing phase), kicking or throwing a ball (Jewiss et al., 2017).

Providing infrared therapy before intervention occurs because mild heating of superficial tissue with infrared radiation causes a sedative effect on sensory nerve endings. Pain may be due to metabolic results, increased blood circulation helps reduce pain, relaxes muscles and thereby reduces muscle spasms. Reduced pain also induces relaxation in the muscles and helps eliminate muscle spasms that occur in inflammation, and causes vasodilation in the tissue. This causes the production of more white blood cells and nutrients than usual, speeds up metabolic processes, and reduces inflammation (Widowati, 2017).

According to researchers' assumptions, increased blood circulation due to infrared administration will help in the therapy process with Open Kinetic Chain. Open Kinetic Chain gradually and according to patient indications can change the local environment in the matrix fibers to become more regular. When the mendaji movement is regular, it will stimulate increased lubrication which can increase the production of amino acids which will be synthesized with slow movements to reduce deposits. So it can repair cartilage to strengthen lower leg muscles which in the end result can increase functional activity

3. Differences between Open Kinetic Chain Exercise and Close Kinetic Chain Exercise after infrared administration on functional abilities in patients with primary genu osteoarthritis

Based on the data, it can be seen that the significance of the Independent Sample Test is $0.035 < 0.05$, so it can be interpreted that there is a difference in the use of infrared and Open Kinetic Chain Exercise and infrared and Close Kinetic Chain Exercise on Functional Ability in patients with primary genu osteoarthritis at Bhayangkara Kediri Hospital.

In line with research conducted by Berampu (2022), the independent test value $p = 0.153$ ($p > 0.153$) was greater than 0.05, which means that there was a significant difference in functional activities in group 1 and group 2 with closed kinetic chain exercise intervention which was better overall. significantly compared to the open kinetic chain exercise intervention group in improving functional activity abilities in knee osteoarthritis, seen from the mean difference between the closed kinetic chain exercise intervention group and the open kinetic chain exercise intervention group. The closed kinetic chain exercise intervention group had a mean difference of 27.32 which was greater than the open kinetic chain exercise group which had a mean difference of 22.34. In Kholifah's research (2022), group I obtained a value of $P = 0.006$, meaning $P < 0.05$ (smaller than 0.05), while group II obtained 0.002. So it can be concluded that there is a significant effect on administering TENS with Open Kinetic Chain and TENS with a combination of Close Kinetic Chain on increasing functional ability in osteoarthritis knee patients. Khairuruizal's research (2019) There is a difference in the effect between the combination of Hold Relax and Open Kinetic Chain exercises and the combination of Hold Relax and Close Kinetic Chain exercises on increasing the functional ability of knee osteoarthritis patients.

Close kinetic chain is a movement in which both proximal and distal ends of the movement chain are fixed. In close kinetic chain exercises, movement in one joint can cause stimulation of the distal and proximal joints in a predictable way. Close kinetic chains also use muscles as stability to control joints, or proximal or distal structures for targeted joints. In this exercise, there will be joint approximation and a low level of shear force in joint movement, for example in the knee there will be slight anterior or posterior translation at the tibiofemoral joint (Kisner, 2013). Close kinetic chain exercise has contraction and relaxation phases. In the contraction phase, tension increases as the muscle origin and insertion approach each other. In the relaxation phase, the tension decreases and the origin and antagonist muscles move away from each other. In every movement, agonist and antagonist muscle groups are involved together. With each contraction, intramuscular pressure increases by means of circulation which can supply the tissues with oxygen and remove metabolic waste. This exercise is to increase muscle endurance using this exercise.

Close kinetic chain exercise mechanism to increase proprioceptive sensation in the knee joint so that joint stability increases. By increasing joint stability, you can improve motor coordination and sense of movement in the joints. Changes in muscle contraction in Close kinetic chain exercise will stimulate the Golgi tendon organs which carry information on mechanical changes which are transmitted to the afferent fibers. Close kinetic chain movement techniques are movement exercises in accordance with the anatomical plane of the knee joint, namely flexion-extension movements and movements aimed at daily activities (Activity Daily Living or ADL) such as squatting to standing and toileting. Good flexibility and muscle strength will support the ability to move in carrying out daily activities (Hendrik, 2022).

Close kinetic chain exercise is very useful for training lower leg muscles, especially for improving functional ability in genu osteoarthritis. Because in principle close kinetic chain exercise is an exercise that strengthens agonist and antagonist muscles simultaneously and is a physiological exercise for the lower limbs and the role of each muscle itself, namely the quadriceps muscle as an eccentric contract to control knee flexion or a concentric contract to extend the knee. The hamstrings and soleus function to stabilize the tibia. This is what ultimately causes an increase in functional ability in sufferers of genu osteoarthritis by increasing muscle strength and flexibility, resulting in the achievement of increased joint range of motion and muscle strength which helps in body function and activity. (Babatunde, 2019).

According to researchers' assumptions, closed and open kinetic chain exercises have the same effect on the functional abilities of knee OA patients. When providing both training methods, internal factors such as age and OA grade need to be taken into account. Close kinetic chains are better for increasing strength, while open kinetic chains are better for improving movement coordination. Providing close kinetic chains is more effective for muscle strength in primary genu osteoarthritis because physiological training simultaneously strengthens agonist and antagonist muscles. By training several muscles, several muscles will become stronger. There is an increase in functional ability in sufferers of genu osteoarthritis by increasing muscle strength and flexibility, resulting in the achievement of increased range of motion in joints and muscle strength which helps in the body's functional movements and activities. Meanwhile, Open Kinetic Chain is a form of exercise with one joint movement, only movement occurs in the distal segment without movement of the proximal segment

CONCLUSIONS AND RECOMMENDATIONS

There is a difference in the effect of close kinetic chain exercise after giving infrared and open kinetic chain exercise after giving infrared on increasing functional ability in primary genu osteoarthritis conditions at Bhayangkara Kediri Hospital. Close kinetic chain exercise after giving infrared is more effective than open kinetic chain exercise after giving infrared in improving the ability of primary genu osteoarthritis conditions at Bhayangkara Kediri Hospital.

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