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Effectiveness of manurak massage and infrared towards the pain reduction, rom increase, and the motor function in wrist injury

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Abstract
This research aims to (1) test the effectiveness of the combination of Manurak and infrared therapy on reducing pain, increasing ROM, and motor function, (2) test the effectiveness of Manurak therapy on reducing pain, increasing ROM, and motor function, (3) investigate the difference in effectiveness between the massage combinations. Infrared manurak and giving manurak massage to reduce pain, increase ROM, and motor function in wrist injuries.
This research was a quasi-experimental study with a two-group pretest-posttest experimental design. The research subjects were the subacute and chronic wrist injury patient. The patients were for about 20 persons divided into two treatment groups randomly. Before and after treatment, the subjects were measured for pain levels, range of motion (ROM), and wrist function using VAS, goniometer, and PRWE instruments. The data analysis technique used different tests, both parametric and non-parametric with a significance level of 5% after previously carrying out prerequisite tests.
The results of the research show that 1) the combination treatment of manuract and infrared massage is effective in reducing the pain, increasing ROM and motor function in wrist injuries with a value of sig. 0.003 on 48 hours of pain and inversion. 2) Manurak massage treatment is effective in reducing pain, increasing ROM, and motor function in wrist injuries with a sig value. 0.005 on immediate pain and 48 hours function and a value of sig.0.002 on eversion of ROM. 3) There is no significant difference between the group given a combination of Manurak and infrared massage and the group of only Manurak massage ($p > 0.05$), except for pain indicators for 48 hours after treatment ($p<0.05$). Based on the research results, it is recommended that a combination of massage and infrared can be applied to wrist injuries according to the situation and conditions with a longer duration of the treatment.

Keywords: Manurak and infrared massage, pain, ROM, motor function, wrist

Introduction
Injury is damage to anatomical tissue that causes a person to have difficulty in carrying out activities, injuries can be characterized by pain and limited movement in the joints (Macdonald *et al.*, 2018: 3). Injury is also said to be a response to work that exceeds the body's ability to cope. The causes of injury are generally due to sports, activities with excessive loads, impacts or falls and overuse (Candra *et al.*, 2021: 45; Candry *et al.*, 2023: 147) [3, 2]. The wrist is one of the complex parts of the upper extremity. Composed of bones, muscles, ligaments, and nerves, it allows the hand to bend and rotate. Most human activities involve hand work such as typing, washing, cutting, driving a motorbike, and so on. According to Ferguson et al, (2019: 1) [4] the median prevalence of wrist pain in the general population and non-manual workers in the short term is 6 and 4.2% in the medium term. The median prevalence of wrist pain in physically demanding jobs and athletes is 10% in the short term and 24% in the short to medium term.
The high prevalence of work-related hand injuries can lead to reduced productivity. The prevalence shows that women tend to experience more wrist injuries (Campo *et al.*, 2019: 28) [5]. This is because women's muscle physiology is different from men's, women's muscle fibers tend to be smaller.

Wrist injuries occur when humans feel pain and limited range of motion of the joints. Most of the causes of wrist injuries include lifting heavy loads, extreme movements and fatigue, and repetitive movements. This will interfere with daily activities, especially if the main job uses a lot of hands. Work-related hand injuries result in high-cost health services, require long work breaks and interfere with physical and mental health.

Various treatments for wrist injuries can be given to treat pain and limited movement. The types of treatment that can be given include manurak therapy (manual and movement) developed by Prof. Dr. dr. BM. Wara Kushartanti, M. S. uses three aspects of manual therapy, namely Friction, Tapotement, and Effleurage as well as movements in the form of stretching and PNF. In the chronic phase, muscles experience muscle spasms which cause pain and decreased joint ROM (Ismaningsih *et al.*, 2022: 94) [6]. When meeting patients with very high muscle stiffness, therapists must exert more energy. To be more efficient, a heat therapy modality is needed that can help blood vessel vasodilation so that muscles relax and become elastic faster. One of the heat therapy modalities that is easy and efficient to use is infrared. Infrared is an electromagnetic wave that uses a wavelength of 750-400,000 nm (Adhatama & Pristianto, 2022: 26) [7].

Handling of wrist injuries has been widely carried out, including using manipulative therapy such as massage, heat therapy such as infrared, ESWT and others. Wrist injuries are one of the injuries that are difficult to treat because patients use their hands in their daily activities (Tn & Kecha, 2020: 47) [8]. This makes this injury often recur. Research by Sheereen *et al.*, (2022: 9) [9] shows that previous studies have only looked at the effects of direct massage. So researchers are interested in finding out the combination of massage and infrared with a longer duration than before. As a benchmark for treatment, researchers use the degree of pain, range of motion (ROM), and wrist motion function.

Materials and Methods

The type of Quasi Experimental research with a two-group pretest-posttest design. Subjects were divided into two groups with 2 different treatments. Group 1 will be given Manurak and Infrared massage treatment and group 2 will only be given Manurak massage treatment. Each group will be given one treatment. Before and after treatment, data on pain, ROM and wrist joint motion function were taken.

The population in the study were patients at the Health and Sport Center Therapy Clinic, Yogyakarta State University. The sample of this study was patients who experienced complaints of wrist injuries.

This study used a random sampling technique, namely determining the sample randomly. The calculation of the number of samples used a simple size calculator by entering some of the data used. Based on the data that has been entered, the results of the sample calculation were 20 people where each treatment group consisted of 10 people.

In order for the collection of research data to be measured properly in the process, three measuring instruments were used, namely Goniometer, VAS (Visual Analogue Scale), and PRWE (The Patient-Rated Wrist Evaluation). The description of the measuring instrument is as follows:

Goniometer

The goniometer is used to measure the angle of the wrist joint movement with the standardization of ROM degrees. The wrist joint has a standard ROM degree, in the standard flexion movement the ROM degree is 80°-90°, extension movement 80°-90°, effervescence movement 30°-50°, and inference movement 30°.

VAS (Visual Analogue Scale)

The pain examination in this study used a visual analogue scale with a range of 1-10. The pain scale data collection was carried out by the subject by shifting the mark on the visual analogue scale according to the pain felt. If the value is greater, the intensity of the pain is greater, and vice versa. How to use this VAS is by shifting or increasing or decreasing according to the intensity of the pain felt. The results of the validity and reliability test based on research (10) comparing VAS with NRS on pain assessment were (rho=0.937 $P<0.001$).

PRWE (The Patient-Rated Wrist Evaluation)

PRWE is a 15-item questionnaire designed to measure wrist pain and impairment of daily living activities. PRWE allows patients to rate the level of wrist pain and disability from 0 to 10, and consists of 2 subscales (Hoang-kim *et al.*, 2011: 256) [11].

Results

Based on the research objectives, it is stated that this study has three objectives. The first research objective is to determine the effectiveness of the combination of Manurak and infrared massage in reducing pain, increasing ROM and motion function of wrist injuries. The second objective is to determine the effectiveness of Manurak massage in reducing pain, increasing ROM and motion function of wrist injuries. The last objective is to determine the difference in effectiveness between the combination of infrared Manurak massage and Manurak massage in reducing pain.

Descriptive Analysis

The research sample will be further described based on gender, injury phase, and side of the injured hand.

Table 1: Samples based on injury phase and side of the injured hand

Treatment	Sub-Acute	chronic	Right	Left
Infrared Combination	5	5	6	4
Manurak Massage	4	6	6	4
Amount	9	11	12	8

Based on table 1 above, it is known that in the sub-acute phase there were 9 people and in the chronic phase there were 11 people. The chronic phase received a larger number than the sub-acute phase because most patients had a history of wrist injuries that had been around for a long time and a higher risk of re-injury. Based on the side of the injured hand, it is known that 12 people were injured on the right hand and 8 people on the left hand. On the side of the injured hand, the right hand is more than the left hand because most activities and jobs use If depicted in a bar chart as shown in the following picture:

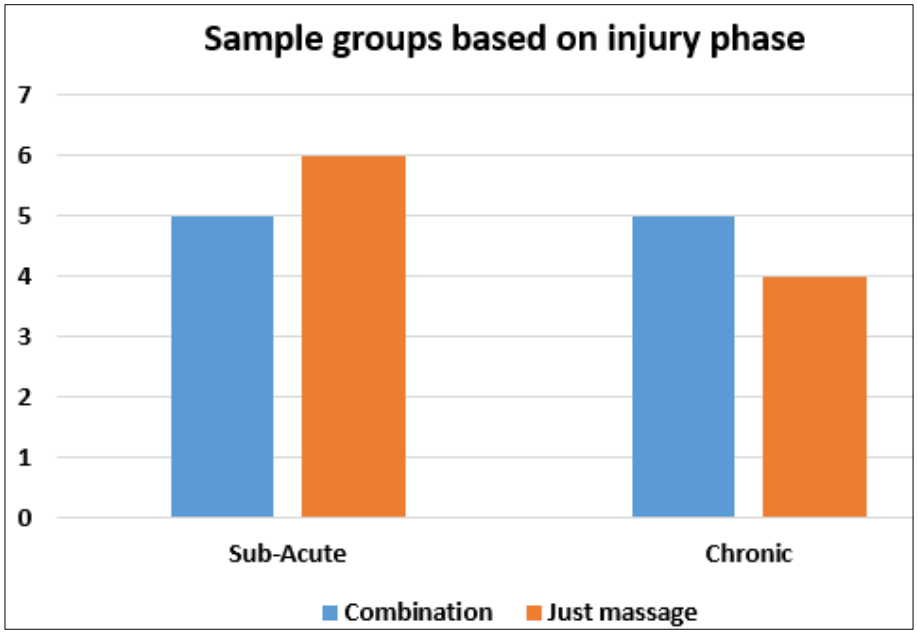

Fig 1: Sample Bar Chart by Injury Phase

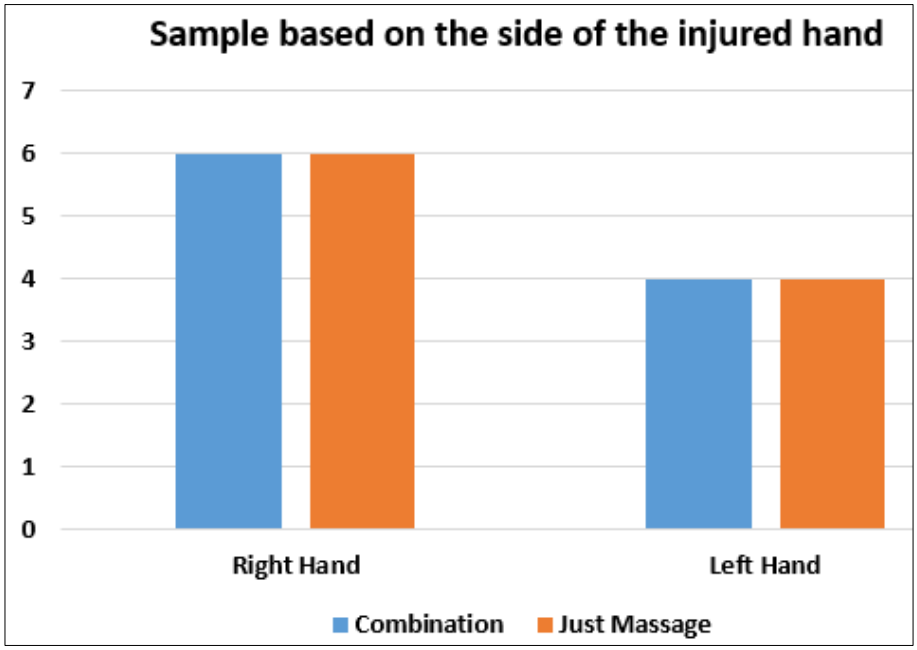

Fig 2: Sample bar Chart based on injured hand side

Prerequisite Test

Prerequisite tests are conducted to determine the data processing method to be used in the hypothesis test. The first prerequisite test conducted is the data normality test to determine whether the data distribution is normal or not. If the data is normally distributed with a p value> 0.05, then the hypothesis test analysis will use a parametric test. Conversely, if the data is not normally distributed, the hypothesis test analysis uses a non-parametric test.

Table 2: Normality Test of the Combination of Manurak and Infrared Massage

Indicator	Sig.	Information
Immediate pain	0,466	Normal
24-hour pain	0,095	Normal
48-hour pain	0,036	Not Normal
flexion	0,425	Normal
extension	0,304	Normal
inversion	0,000	Not Normal
eversion	0,744	Normal
24-hour motion function	0,447	Normal
48-hour motion function	0,709	Normal

Based on the table above, direct pain, 24-hour pain, flexion, extension, eversion, 24-hour and 48-hour movement function have a significance of $p>0.05$ so that it can be concluded that the data is normally distributed. Data analysis used in these components uses parametric analysis, while 48-hour pain and inversion ROM have a sig. $P<0.05$ value so that the data is not normally distributed.

Table 3: Normality Test of the Difference between the pretest and posttest data of Manurak Massage

Indicator	Sig.	Information
Immediate pain	0,025	Not Normal
24-hour pain	0,215	Normal
48-hour pain	0,061	Normal
flexion	0,993	Normal
extension	0,526	Normal
inversion	0,300	Normal
eversion	0,170	Normal
24-hour motion function	0,014	Not Normal
48-hour motion function	0,347	Normal

Based on the table above, 24-hour pain, 48-hour pain, flexion, extension, inversion, eversion, and 48-hour movement function have a significance of $p>0.05$ so that it can be concluded that the data is normally distributed. Data analysis used in these components uses parametric analysis, while pain immediately after treatment and 24-hour movement function have a sig. $P<0.05$ value so that the data is not normally distributed.

Homogeneity Test

Homogeneity test is a prerequisite test that aims to determine whether the data is homogeneous or not homogeneous. Data is said to be homogeneous when it has a significance of $p>0.05$ while not homogeneous when the data has a significance of $P<0.05$. Below is a table of the results of the homogeneity test in the treatment group of infrared manurak massage combination and only manurak massage.

Table 4: Results of the Levene Test of Homogeneity in both groups

Indicator	Levene Test Statistic	Sig.	Information
Immediate Pain	1.174	0,293	Homogeneous
24-Hour Pain	1.870	0,188	Homogeneous
48-Hour Pain	6.438	0,021	Not Homogeneous
Flexion	0.148	0,705	Homogeneous
Extension	0.480	0,497	Homogeneous
Inversion	4.555	0,047	Not Homogeneous
Eversion	10.555	0,004	Not Homogeneous
24-Hour Motion Function	0.930	0,348	Homogeneous
48-Hour Motion Function	4.965	0,039	Not Homogeneous

Based on the results of the difference test in the table, the indicators of pain, flexion, extension, inversion, eversion, and function have a significance of $P<0.05$ so that it can be concluded that there is a significant difference in effectiveness between before and after being given a combination of Manurak and infrared massage treatment.

Hypothesis Results

Hypothesis testing conducted in this study is a test of the difference of each treatment and a comparison test of the two different treatments. The test of the difference of each treatment uses a paired t test if the data is normally distributed, on the other hand using the Wilcoxon difference test if the data is not normally distributed.

Table 5: Results of Hypothesis Testing of the Combination of Manurak and Infrared Massage

Indicator	Analysis	Sig.	Information
Immediate Pain	*Paired t-test*	0,000	Significant
24-Hour Pain	*Paired t-test*	0,000	Significant
48-Hour Pain	*Wilcoxon t-test*	0,003	Significant
Flexion	*Paired t-test*	0,000	Significant
Extension	*Paired t-test*	0,000	Significant
Inversion	*Wilcoxon t test*	0,003	Significant
Eversion	*Paired t-test*	0,000	Significant
24-Hour Motion Function	*Paired t-test*	0,000	Significant
48-Hour Motion Function	*Paired t-test*	0,000	Significant

The results of the effectiveness test in the table show that the indicators of pain, flexion, extension, inversion, eversion, and function have a significance of $P<0.05$, so it can be concluded that there is a significant difference in effectiveness between before and after being given Manurak massage treatment.

Table 6: Manurak massage hypothesis test results

Indicator	Analysis	Sig.	Information
Immediate Pain	*Wilcoxon t-test*	0,005	Significant
24-Hour Pain	*Paired t-test*	0,000	Significant
48-Hour Pain	*Paired t-test*	0,000	Significant
Flexion	*Paired t-test*	0,000	Significant
Extension	*Paired t-test*	0,000	Significant
Inversion	*Paired t-test*	0,000	Significant
Eversion	*Paired t-test*	0,002	Significant
24-Hour Motion Function	*Wilcoxon t-test*	0,005	Significant
48-Hour Motion Function	*Paired t-test*	0,000	Significant

The next hypothesis test is a comparative test of the effects between the combination of manurak and infrared massage and only manurak massage. The results of the hypothesis test are as follows:

Table 7: Results of Hypothesis Test Comparison of infrared manurak massage combination and only manurak massage

No	Indicator	Analysis Techniques	Sig.	Information
1	Immediate Pain	*Mann- Whitney test*	0,344	Not Significant
2	24-Hour Pain	*Independent t-test*	0,791	Not Significant
3	48-Hour Pain	*Independent t-test*	0,008	Significant
4	Flexion	*Independent t-test*	0,870	Not Significant
5	Extension	*Independent t-test*	0,822	Not Significant
6	Inversion	*Mann- Whitney test*	0,595	Not Significant
7	Eversion	*Independent t-test*	0,495	Not Significant
8	24-Hour Motion Function	*Mann- Whitney test*	0,677	Not Significant
9	48-Hour Motion Function	*Independent t-test*	0,836	Not Significant

Based on Table 7, it can be observed that the results of the difference test of all indicators between the combination treatment of infrared manurak massage and only manurak massage on the indicators of direct pain, 24-hour pain, flexion, extension, inversion, eversion, 24-hour and 48-hour motor function obtained a significance value of $p > 0.05$ so that it can be concluded that there is no significant difference between the combination treatment of infrared manurak massage and only manurak massage. While the 48-hour pain indicator obtained a significance value of $p<0.05$, so there is a significant difference between the combination treatment of infrared manurak massage and only manurak massage.

Discussion

Therapy can be done in a non-pharmacological way in the form of massage therapy. Manurak massage is a massage that combines manipulation and movement. Manurak is an abbreviation of manual (press, hit, rub) and movement (mobilization, stretching, and PNF). This massage has the benefits of muscle relaxation, reducing pain, and repositioning joints. Manual techniques in the form of pressing movements are the initial sequence of treatment, namely by pressing the trigger point area or the area at the center of the pain. This is in accordance with research by Sulistyaningsih & Putri, (2020: 7) [12] that pressing the trigger point area can lengthen myofascial with the aim of releasing tissue adhesions and reducing pain through gate control theory, improving the quality of fascia tissue fluid, tissue flexibility and joint function. The second technique is punching or tapotement. Tapotement is a rhythmic light punching movement given to the muscle. The goal is to encourage or accelerate blood flow and push out the remaining combustion from its hiding place. This rhythmic punching movement can also stimulate peripheral nerves in the area that is the trigger point (Arovah, 2011: 83). And finally, the movement in the form of passive stretching movements assisted by a therapist, the purpose of this movement is to obtain the maximum joint range effect. Stretching is done to trigger tense muscles to relax again (Câmara-Gomes *et al.*, 2022: 15) [14]. Manurak therapy has the advantage of being able to be done anywhere without having to undress. However, this method has the disadvantage that it will leave a painful effect because it uses a trigger point technique that presses directly on the center of pain so that patients tend to be less comfortable. The final treatment in the study was to provide stretching and pnf movements which aim to increase flexibility. Physiological stretching exercises will increase blood circulation so that more oxygen will be supplied to the cells which causes pain to decrease, increase joint range, and function. This is in accordance with research (Wahyuni *et al.*, 2022: 25) [15] that stretching can increase joint range of motion, reduce pain levels, and increase muscle strength. Therefore, stretching can be combined with massage to obtain maximum healing results for wrist injuries. Another treatment given is a combination of infrared and manurak massage. Infrared is a therapeutic modality in the form of heat rays that provide a continuous muscle relaxation effect. This treatment has advantages, including providing a comfortable effect due to the delivery of infrared rays. Not only that, the heat from infrared can increase the sensitivity of muscle spindles, it also increases the rate of Golgi tendon organ bursts which work as motor neuron inhibitors. The increase in the burst rate will result in a reduction in motor neuron bursts which will then reduce muscle spasms and pain [16]. This is in accordance with research that infrared provides a physiological effect to reduce pain due to muscle spasms by a sedative effect on the superficial nerve endings (Rahmawati *et al.*, 2021: 81) [17].

Heating in infrared will also cause vasodilation (widening of blood vessels) so that it can smooth blood flow (Made *et al.*, 2021: 75) [18]. There was no significant difference between the two treatments, which is contrary to the third hypothesis of the researchers. The researchers interpreted that this happened because of the possibility of giving a suboptimal duration of infrared. The application of infrared is also influenced by several factors such as the frequency of infrared radiation, tissue conductivity, thickness of the patient's tissue and skin, and refraction of infrared [19]. In addition, groups with unequal numbers of men and women also affect the results of the study. Other things can be influenced by many factors including a person's biological, social, and psychological factors (Pradita *et al.*, 2021: 50) [20]. The biological factors of pain response depend on the individual's pain sensitivity. Women tend to feel more pain than men because women have the hormones estrogen and progesterone which play a role in pain sensitivity (Hidayati *et al.*, 2021: 54) [21]. Psychological factors are related to the experience of pain and anxiety levels that affect an individual's pain control. Factors that can affect research results need to be considered again so that research results can be better.

Conclusion

Based on the results of the research that has been done, it can be concluded that: 1) Giving a combination of Manurak and infrared massage is effective in reducing pain, increasing ROM and motion function of wrist injuries. 2) Giving Manurak massage is effective in reducing pain, increasing ROM and motion function of wrist injuries. 3) There is no difference in effectiveness between the combination of Manurak and infrared massage and Manurak massage in reducing pain, increasing ROM and motion function of wrist injuries.

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