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Original Research

Deep Cervical Muscle Exercise Versus Soft Tissue Mobilization In Non-Specific Neck Pain

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ABSTRACT

Background: *Neck pain is a common health problem in the working population. When studied by the International Classification of Functioning, Disability and Health (ICF), the problems that arise in non-specific neck pain include: neck pain, limited joint motion, and decreased functional ability in carrying out daily activities. The aim of this study was to compare the effectiveness of combination ultrasound therapy (UST) and deep cervical muscle exercise (DCME) versus combination ultrasound therapy (UST) and soft tissue mobilization (STM) on non-specific neck pain.*

Methods: *This research was experimental with a randomized pre-test and post-test control group design, in which the study participants were divided into two groups randomly. The study participants were 20 people who were divided into the control group (n = 10) who were given the combined intervention of UST and DCME while the treatment group (n = 10) were given the combined intervention of UST and STM. Therapeutic evaluation measurement tools include: pain scale in the form of numeric rating scale and neck disability in the form of neck disability index. The research was carried out in the independent physiotherapy practice in Denpasar and Badung. The intervention was given 3 times in 3 weeks.*

Results: *The results showed a decrease in neck pain and disability in each intervention group (p <0.05). However, there were no significant differences when compared between groups.*

Conclusion: *Based on these results, it can be concluded that the combination of UST and DCME has the same results as the combination of UST and STM in reducing neck pain and disability in non-specific neck pain.*

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INTRODUCTION

Neck pain is a common health problem in the working population. Nearly a third of workers experience neck pain in their lifetime. Research in the UK shows that as

many as 25% of women and 20% of men experience neck pain. It was reported that 34% of respondents experienced neck pain in Norway in 10,000 adult population. Every year as many as 11-14.1% of the active population experience a decrease in work capacity caused by neck pain (Matijević-Mikelić, et al., 2012).

The diagnosis of non-specific neck pain can be established by performing a physical examination which includes: palpation, joint range of motion, and muscle strength (Misailidou et al., 2010). Non-specific neck pain is included in the type of non-radicular pain, so if the radicular pain provocation test is negative, then the pain is due to non-specific neck pain. Tests that can be applied include: spurling test, neck traction/distraction, Valsalva maneuver, and shoulder abduction test, as well as upper limb tension test (Tsakitzidis et al., 2009).

When examined by the International Classification of Functioning, Disability and Health (ICF), the problems that arise in non-specific neck pain include: neck pain, limitation of joint motion, and decreased functional ability in carrying out daily activities. Therefore, it is important to do physiotherapy treatment in overcoming these problems. Treatment that can be given to treat non-specific neck pain includes the provision of electrotherapy modalities along with exercise therapy or manual therapy techniques. Previous studies have described the benefits of a combination of UST and stretching using muscle energy techniques and obtained beneficial results in reducing pain and disability in individual with mechanical neck pain (Nugraha, et al., 2020).

The provision of electrotherapy in the form of the application of ultrasound therapy (UST). Ultrasound frequency of 1 MHz will penetrate about 3-5 cm in the tissue under the skin, while ultrasound 3MHz will penetrate about 1 – 2 cm under the skin tissue (Matijević-Mikelić et al., 2012). An increase in tissue temperature of 1ºC (1.8ºF) can increase the metabolic rate. An increase of 2ºC (3.6ºF) to 3ºC (5.4ºF) reduces muscle spasm, pain, and increases blood flow. Meanwhile, an increase of 4ºC (7.2ºF) or more is needed to increase the extensibility of collagen and reduce sympathetic activity (Michlovitz et al., 2012).

In addition, forms of exercise therapy or manual therapy techniques that can be given include deep cervical muscle exercise and soft tissue mobilization. Exercise therapy is an important component in the management of non-specific neck pain. Some current research focuses on deep cervical muscle training. Craniocervical-flexor muscle training is able to improve neuromuscular ability and control in deep craniocervical flexor muscles, such as the longus coli and longus capitis (O'Leary et al., 2012).

In addition, cervical extensor muscles such as the semispinalis and multifidus are important muscles in stabilizing the vertebrae. Isometric training at the cervical level of the two vertebrae target the semispinal muscles. Research has shown that giving deep cervical muscle exercise to non-specific neck pain can improve functional ability, pain intensity, craniovertebral angle, and neck muscle strength (Suvarnnato et al., 2019).

Soft tissue mobilization incorporates precise direction and control of the patient, isometric contractions, designed to improve musculoskeletal function and reduce pain. This method has applications aimed at normalizing soft tissue structures such as shortened muscles (tension/ hyper tonus), but indirectly has implications for joints related to shortened muscles, so this method can also be used to help improve joint mobility through its effect on dysfunctional soft tissues (Chaitow, 2013). The combination of UST and deep cervical muscle exercise or the combination of UST and soft tissue mobilization has the opportunity to manage non-specific neck pain problems.

The benefits of each of these combinations need to be investigated further to see how effective it is in reducing neck pain and disability in non-specific neck pain.

MATERIALS AND METHOD

The research method used by the researcher in this study was a randomized control trial with a pre and post-test control group design. This research has passed the ethical test with the number 1682/UN14.2.2.VII.14/LT/2020. The research was carried out in an independent practice of physiotherapy in Denpasar City and Badung Regency.

The time of this research was carried out in August – October 2020. The target population in this study were individuals who complained or were clinically diagnosed with non-specific neck pain. The accessible population in this study were individuals who complained or were clinically diagnosed with non-specific neck pain in independent physiotherapy practices in Denpasar City and Badung Regency.

The research sample was selected based on inclusion and exclusion criteria. The inclusion criteria included: (1) patients belonging to the mechanical neck pain category based on physiotherapy examination procedures, (2) patient age between 18-50 years, (3) Numeric Rating Scale (NRS) examination scores from 3-8 (moderate), (4) experiencing acute – subacute cases (4 – 12 weeks). While the exclusion criteria included: (1) patients who were positive for pain radiating to the arm based on the results of the spurling's compression test in cervical flexion position or lateral cervical flexion, or proven HNP based on the results of MRI photos, (2) Patients who were positive for pain radiating to the arm based on the results of the TOS examination, and (3) patients who have a history of fracture, severe trauma (whiplash injury), rheumatoid arthritis or ankylosing spondylitis, cancer, tuberculosis infection, symptoms of VBI (vertebrobasilar insufficiency), and upper cervical or lower cervical instability.

To determine the sample size in the RCT study, the G*Power application is used. Effect size is determined through research (Suvarnnato et al., 2019). The value of α error probability is set to 0.05 and power (1- error probability) is set to 0.95. Based on the calculation results, the number of samples obtained is 7 people. To avoid drop out, the sample was added by 30% to 9.1 or 10 samples. Then there are 10 samples for each group. The total number of samples in both groups is 20 respondents.

The independent variables in this RCT study were a combination of ultrasound therapy intervention and deep cervical muscle exercise as well as a combination of ultrasound therapy and soft tissue mobilization interventions. While the dependent variable is pain as measured by a numeric rating scale and neck disability as measured by the neck disability index.

The control group was given UST intervention and deep cervical muscle exercise, while the intervention group was given UST and soft tissue mobilization. Ultrasound therapy is applied using a gel. The therapy frequency is 1MHz with a duration of 5-7 minutes and uses 5cm ERA (Nugraha, et al., 2020). Deep cervical muscle exercise was applied using a sphygmomanometer developed at a pressure of 20 mmHg, then the sample pushed the head in the prone and supine lying position and held for 10-15 seconds. This movement is repeated 10 times with 3-5 rest periods per session (Kim, JY. and Kwag, KI., 2016).

Soft tissue mobilization was applied with isometric contraction of the patient in the direction of rotation and lateral cervical flexion, maintained contraction for 6 seconds, then relaxed and after relaxation performed soft tissue mobilization. The implementation procedure includes. The patient is in a supine sleeping position, with the

head slightly flexed, lateral flexion and cervical rotation on the existing range of motion. The therapist's hand is under the patient's occiput and the other hand is on the patient's chin.

The patient is asked to hold the therapist's hand lightly toward the agonist and antagonist, while the resulting isometric contraction is maintained for 3-5 seconds. Post-contraction the patient is asked to relax while the patient is asked to breathe regularly. The therapist's hand moves the cervical-head in lateral flexion and rotation of the new range of motion. This technique is performed 3 times for each visit, the frequency of therapy is 3 times a week with an interval of 1 day. The number of therapy is 9 times (Nugraha, et al., 2020).

Data analysis was carried out, including: (1) Normality test of neck pain and disability data before and after treatment using the saphiro-wilk test to determine the normality distribution of the data, (2) Comparative analysis in the form of data analysis to examine differences in neck pain and disability, namely before and after treatment in each group. Based on the normality test, the data were normally distributed, the comparative analysis was carried out using the dependent sample t-test, (3) Differential test of data analysis to examine differences in pain and neck disability between the two groups. Different test was performed using independent sample t-test.

RESULTS

The research results are described in the following table:

Table 1. Distribution of Respondents Characteristics in Control and Treatment Groups

Characteristics	Control Group (n=10)	Treatment Group (n=10)	p value
Sex *f* (%)			
Male	2 (20)	2 (20)	-
Female	8 (80)	8 (80)	
Age (years)			
Mean ± SD	40,00±4,11	39,80±4,02	0,914
Pain			
Mean ± SD	5,96±0,36	5,93±0,36	0,855
Neck Disability			
Mean ± SD	27,50±4,03	27,80±5,75	0,259

As a prerequisite for determining the statistical test to be used in testing the hypothesis, a normality test was used using the Shapiro Wilk test. The results of the analysis are listed in Table 2.

Table 2. The Normality Test Results Before and After Intervention

Data Group	Normality Test[a]	
	Control Group (p value)	Treatment Group (p value)
Pain (pre-test)	0,26	0,356
Pain (post-test)	0,673	0,694
Neck disability (pre-test)	0,241	0,119
Neck disability (post-test)	0,204	0,366

Based on Table 2, it was found that the pre-test and post-test data were normally distributed. Based on the results of the normality test, the test used for hypothesis testing is a parametric statistical test.

The mean reduction in neck pain and disability scores before and after the intervention in the control group and the treatment group was tested by paired sample t-test. The test results are listed in Table 3.

Table 3. Analysis Results of Neck Pain and Disabilities Score

Data Group	Pre-test	Post-test	95% CI		p value
	Mean±SD	Mean±SD	Lower	Upper	
Pain					
Control group	5,96±0,36	2,52±0,54	3,27	3,61	0,000
Treatment group	5,93±0,36	2,48±0,37	3,34	3,55	0,000
Neck Disability					
Control group	27,50±4,03	14,80±4,44	11,87	13,53	0,000
Treatment group	27,80±5,75	17,40±3,47	7,16	13,64	0,000

Based on Table 3, the results of the decrease in the value of neck pain and disability in the control and treatment groups with a p value of <0.05, which means that there is a significant difference in the reduction of neck pain and disability before and after the intervention.

Comparison of the decrease in the value of the difference in neck pain and disability between before and after the intervention in the two groups was tested by independent sample t-test. The test results are listed in Table 4 below.

Table 4. Test Results of *Independent sample t-test*

Category	Group Data	Mean±SD	p value
Pre-Test (Pain)	Control group	5,96±0,36	0,855
	Treatment group	5,93±0,36	
Post-Test (Pain)	Control group	2,52±0,54	0,848
	Treatment group	2,48±0,37	
Difference (Pain)	Control group	3,43±0,16	0,729
	Treatment group	3,41±0,07	
Pre-Test (Neck Disability)	Control group	27,50±4,03	0,259
	Treatment group	27,80±5,75	
Post-Test (Neck Disability)	Control group	14,80±4,44	0,162
	Treatment group	17,40±3,47	
Difference (Neck Disability)	Control group	13,20±0,92	0,856
	Treatment group	13,10±1,45	

Based on Table 4. shows the results of the calculation of the average difference in the value of neck pain and disability, namely (p>0.05), which means that there is no significant difference between the two groups.

DISCUSSION

Based on the results of this study, the combination of UST and deep cervical muscle exercise was significantly effective in reducing pain (p=0.000) and neck

disability (p=0.000) in non-specific neck pain. Craniocervical-flexor muscle training is able to improve neuromuscular ability and control in deep craniocervical flexor muscles, such as the longus coli and longus capitis (O'Leary et al., 2012). In addition, cervical extensor muscles such as the semispinalis and multifidus are important muscles in stabilizing the vertebrae. Isometric training at the cervical level of the two vertebrae target the semispinal muscles. Research has shown that giving deep cervical muscle exercise to non-specific neck pain can improve functional ability, pain intensity, craniovertebral angle, and neck muscle strength (Suvarnnato et al., 2019).

In the treatment group, the combination of UST and soft tissue mobilization also showed significant results in reducing pain (p=0.000) and neck disability (p=0,000) in non-specific neck pain. Soft tissue mobilization incorporates precise direction and control of the patient, isometric contractions, designed to improve musculoskeletal function and reduce pain. This method has applications aimed at normalizing soft tissue structures such as shortened muscles (tension/hypertonus), but indirectly has implications for joints related to shortened muscles, so this method can also be used to help improve joint mobility through its effect on dysfunctional soft tissues (Chaitow, 2013). This is also in accordance with previous research which explains that the provision of soft tissue mobilization was able to increase the global rating of change score (p=0.003) and persisted on day 2-4 of follow-up (p=0.027). In addition, improvements also occurred in the increase in range of motion which was evaluated through a patient-specific functional scale (p = 0.007) (Costello et al., 2016).

Exercise therapy is an important component in the management of non-specific neck pain. The results of this study show that the combination of ultrasound therapy and deep cervical muscle exercise has the same good results as the combination of ultrasound therapy and soft tissue mobilization in reducing neck pain (p=0,729) and disability (p=0,856) in non-specific neck pain. This could be because the therapy sessions were too short, the follow-up procedure was not carried out in the following week so that researchers did not know the effectiveness of long-term therapy, and the methods of applying therapy were still varied.

CONCLUSION

Based on the discussion above, it can be concluded that the combination of ultrasound therapy and deep cervical muscle exercise has the same good results as the combination of ultrasound therapy and soft tissue mobilization in reducing neck pain and disability in non-specific neck pain.

It is recommended for the next research to conduct research with a longer total duration of therapy and follow-up related to long-term measurements.

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