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Multimodal treatment program in non-specific low back pain – A case series

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Abstract

Non-specific low back pain (NSLBP) has a high prevalence among the population. NSLBP not only affects individuals but also has an impact on decreasing work productivity and ultimately affecting the economic sector. There are several multimodal that can be given to treat NSLBP. This case series is a preliminary study to determine the effectiveness of the combination of ultrasound therapy, stretching training, lumbar joint mobilization, and lumbopelvic stabilization training in NSLBP in improving pain and reducing back disability. The intervention was given three times in 1 week for four weeks (12 sessions) to 3 respondents. The effectiveness of therapy was assessed using a numeric rating scale (NRS) to measure pain reduction and the Indonesian version of the modified Oswestry disability index (MODI) to assess the decrease in lower back disability in NSLBP. Based on the results of the case series, there was a decrease in the average NRS value from 4.67 to 1.93 (with a difference in the average decrease of 2.74), and there was a decrease in the average MODI value from 32 to 13.67 (with a difference in the mean decrease of 18.33). The results of this case series provide information that the combination of UST, stretching exercise, joint mobilization, and lumbopelvic stabilization exercise is beneficial in reducing pain and disability in NSLBP. This case series is a preliminary study on the multimodal combination in the treatment of NSLBP. It is hoped that further experimental studies will be conducted to prove this combination's effectiveness in treating individuals with NSLBP.

Keywords: multimodal, non-specific low back pain, treatment

INTRODUCTION

Musculoskeletal problems have a high prevalence among the population. Among the types of musculoskeletal problems related to the spine, the most common is low back pain, with a prevalence of 84%. In addition, low back pain that is not treated properly and lasts more than 12 weeks becomes chronic, with an incidence rate of 23% of cases of total low back pain reported. About 85% of chronic back pain has no specific cause

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or diagnosis and is referred to as chronic non-specific low back pain (Ribeiro et al., 2018) .

Non-specific low back pain (NSLBP) is a type of low back pain not attributable to a specific pathology (e.g., fracture, tumor, structural deformity, infection, an inflammatory disorder, osteoporosis, radicular syndrome, or cauda equina syndrome). When assessed using The International Classification of Functioning, Disability, and Health (ICF), problems that arise in non-specific LBP include pain, restriction/limited range of motion in rotation, extension, and flexion, as well as decreased functional ability in carrying out daily activities (Bitenc-Jasiejko et al., 2020).

The standard intervention that can be applied to NSLBP is a combination of electrotherapy (such as ultrasound therapy/UST) and exercise therapy techniques (such as stretching training) (Câmara-Gomes et al., 2022; Haile et al., 2021; Oliveira et al., 2018; Shiri et al., 2018). Thermal effects of UST include: increased tissue temperature, increased local blood flow, and beneficial for increasing the extensibility of collagen fibers which have an impact on reducing pain and increasing flexibility in NSLBP patients (Papadopoulos & Mani, 2020).

In a previous systematic review study, from the 6 RCT studies used, two studies reported long-term effects that did not last from week 8 to 6 months post-intervention of UST in pain score (Haile et al., 2021). Interventions for individuals with NSLBP should be combined with other therapeutic modalities such as manual therapy and training (stretching and muscle strengthening) to provide maximum effect (Oliveira et al., 2018).

Joint mobilization applied to NSLBP increases the distribution of synovial fluid in the joint cartilages and disc, which impacts decreasing joint movement resistance (Tavares et al., 2017). In addition, providing lumbopelvic stabilization training helps stabilize the muscles involved in supporting posture, which has an impact on motor control in NSLBP (Chang et al., 2015). Stretching exercises involving the lumbopelvic supporting muscles such as the lower back, gluteal, hamstring, and quadriceps

muscles have been shown to reduce pain in patients with LBP (Chen et al., 2014).

Based on this background, it is important to combine interventions in individuals with NSLBP. The researcher wanted to know the effectiveness of the combination of UST, stretching training, lumbar joint mobilization, and lumbopelvic stabilization training in individuals with NSLBP in improving pain and reducing back disability.

METHOD

This case series is a preliminary study to find out the effectiveness of the combination of ultrasound therapy, stretching training, lumbar joint mobilization, and lumbopelvic stabilization training in NSLBP in improving pain and reducing back disability. This study is a case series that conduct on three respondents. This case series is a preliminary study to find out the effectiveness of the combination of ultrasound therapy, stretching training, lumbar joint mobilization, and lumbopelvic stabilization training in NSLBP in improving pain and reducing back disability. Research subjects were selected based on inclusion and exclusion criteria. The inclusion criteria included: (1) the age of the patient was between 18 – 50 years, (2) the value of the Numeric Rating Scale (NRS) examination was from 3 – 8 (moderate), (3) experienced acute – subacute cases (4 – 12 weeks). While the exclusion criteria included: spinal pathologies such as fractures, tumors, inflammatory pathologies such as ankylosing spondylitis, pressure on nerve roots (disk herniation and spondylolisthesis with emphasis on nerve roots, spinal stenosis), cancer, autoimmune diseases, and pregnancy.

The intervention was given three times in 1 week for four weeks. Ultrasound therapy was applied using a gel with a dose: frequency = 3 MHz, intensity = 0.4 W/cm^2, pulsed ratio = 1:2, area = 4 treatment areas, duration = 12 minutes for 4 treatment areas. (Watson, 2017) Stretching training was applied to the lower back, gluteal, piriformis, hamstring, and quadriceps muscles. Each muscle is stretched with the active stretching technique. The training is done with 8-10 repetitions for two sets (Chen et al., 2014). Joint mobilization is carried out with manipulation techniques for 5-6 repetitions

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8 (2) 2022 | 217-225

with techniques to increase the range of motion of the joints in the direction of extension, rotation, and side bending (Kisner & Colby, 2012). The lumbopelvic stabilization training is divided into four stages: week 1, week two, and week-3 and week-4. The training method is designed to refer to Princeton University Pelvic Stabilization and Lumbar/Core Strength Module (Princeton University, 2017). In week one, the patient was given training in (1) supine abdominal draw-in, (2) double leg bridge, and (3) press-ups. Then week two, repeated training in week one was added with the training of (1) prone cobras, (2) side bend, and (3) supermans. Likewise, in week 3, repeating the training in week one and week two plus training of (1) side plank static holds, (2) prone bridging on elbows with single leg hip extension, and (3) single leg bridge. In the 4th week, the patient does all kinds of training (Hecimovich et al., 2018).

The effectiveness of therapy was assessed using a numeric rating scale (NRS) (Chiarotto et al., 2019) to measure pain reduction and the Indonesian version of the modified Oswestry disability index (MODI) (Wahyuddin et al., 2016) to assess the decrease in lower back disability in NSLBP.

RESULT

The results of respondent characteristics and evaluation of therapy are listed in table 1 and table 2.

Table 1. Respondent Characteristics

Variables	Frequency (n=3)	Percentage (%)
Gender		
Male	2	66.67
Female	1	33.33
Age (mean±SD)		
38 years		
40 years	39.67±1.53	
41 years		
Body mass index		
Normal	1	33.33
Overweight	2	66.67
Numeric Rating Scale (NRS)	4.67±0.57	
Length of experience NSLBP (weeks)	5.33±0.57	

Based on the respondent characteristics in Table 1, three respondents participated in this preliminary study. 66.67% of respondents are male, and 33.33% are female, with an average age of 40. The pain score on the initial measurement with a mean of 4.67, with the duration of back pain, experienced for up to 5 weeks.

Table 2. Therapeutic Evaluation Results

Variables	Pre-Test (n=3)	Post-Test (n=3)
Numeric Rating Scale (NRS)	4.67±0.57	1.93±0.66
Modified Oswestry Disability Index (MODI)	32±2.64	13.67±3.78

Based on the results in Table 2, there was a decrease in the average NRS value from 4.67 to 1.93 (with a difference in the average decrease of 2.74), and there was a decrease in the average MODI value from 32 to 13.67 (with a difference in the mean decrease of 18.33).

DISCUSSION

The combination of UST, stretching exercises, lumbar joint mobilization, and lumbopelvic stabilization training reduced lower back pain and disability in 3 NSLBP respondents. The intervention was carried out for 12 sessions (3 times a week for four weeks). The training is carried out with the concept of gradually increasing the intensity, especially in lumbopelvic stabilization training.

A previous systematic review explained that UST evidence of chronic NSLBP had a small effect on improving low back function in the short term compared with placebo (Ebadi et al., 2014). Meanwhile, a recent systematic review that included 699 patients proved that UST was able to reduce visual analog scale scores in chronic NSLBP (Haile et al., 2021). UST is an electrophysical agent utilizing acoustic energy at a frequency of 1.0 – 3.0 MHz. The US beam produces longitudinal waves that cause thermal changes in the tissue. Thermal effects on the US include: increased tissue temperature, increased local blood flow, and increased extensibility of collagen fibers (Papadopoulos & Mani, 2020).

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8 (2) 2022 | 217-225

The effectiveness of stretching training in increasing joint range of motion in NSLBP can be explained by the two mechanisms involved, namely biomechanical and neurophysiological. Biomechanically, stretching exercise can reduce passive stiffness that triggers the effect of elastic deformation on non-contractile intrasarcomeric proteins, intramuscular connective tissue, and extracellular matrix generated by mechanical loading in stretching training. Neurophysiologically, stretching exercise reduces fibrosis and adhesion between connective tissue, improves intrafascicular gliding, facilitates axoplasmic flow, and minimizes the deposition of chemical neurotransmitters that play a role in pain processes and spasms in soft tissues (Câmara-Gomes et al., 2022).

Joint mobilization positively influences neuroimmune responses in neuromusculoskeletal conditions (Lutke Schipholt et al., 2021). Joint mobilization applied to NSLBP increases the distribution of synovial fluid in joint cartilage and discs, which results in decreased joint movement resistance (Tavares et al., 2017). Mobilization and manipulation procedures are beneficial in reducing pain and improving function in chronic NSLBP. This is supported by moderate quality evidence, which concludes that manipulation techniques are better than mobilization. In the meta-analysis, it was also suggested that either joint mobilization or manipulation is a safe procedure, and it is recommended to combine it with other modalities (Coulter et al., 2018).

In NSLBP, there are also changes in spinal mobility and stability, decreased coordination and sensory-motor function, and the ability to control body balance. When the human body is exposed to unexpected loads, the muscles must be able to respond quickly to maintain balance and stable posture. Lumbo-pelvic stabilization exercise becomes the main focus in stabilizing the muscles involved in supporting posture, such as core muscles (Chang et al., 2015). This is supported by a meta-analysis study showing that lumbopelvic stabilization training reduces pain and long-term disability in individuals with low back pain (Smith et al., 2014).

When assessed using The International Classification of Functioning, Disability, and Health (ICF), problems that arise in non-specific LBP include pain, restriction/limited range of motion in the lumbar region, as well as decreased functional ability to carry out daily activities (Bitenc-Jasiejko et al., 2020). Interventions for individuals with NSLBP should be combined with other therapeutic modalities such as manual therapy and training (stretching and muscle strengthening) to provide maximum effect (Oliveira et al., 2018). Further experimental studies are needed to prove this combination's effectiveness in treating individuals with NSLBP.

CONCLUSION

This case series is a preliminary study on the multimodal combination in the treatment of NSLBP. Based on this case series, it can be concluded that the combination of UST, stretching exercise, joint mobilization, and lumbopelvic stabilization exercise is beneficial in reducing pain and disability in NSLBP. It is hoped that further experimental studies will be conducted to prove this combination's effectiveness in treating individuals with NSLBP.

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