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THE EFFECT OF STATIC AND DYNAMIC STRETCHING TECHNIQUES TO INCREASE SPINE RANGE OF MOVEMENT (ROM) ON LOW BACK PAIN (LBP) PATIENTS

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Abstract

Exercise-based therapy has been proven to be an important component in low back pain (LBP) treatments. The treatment of LBP through exercise (active treatment) is more recommended than the standard care (inactive treatments) because it implicitly diminishes the deconditioning syndrome. However, effect of stretching exercise including static and dynamic for LBP patients have not fully elucidated. The objective of this study is to determine the effect of static and dynamic stretching to spine range of movement (ROM) for LBP patients. Twelve LBP patients are divided into two groups namely a group with static stretching and a group with dynamic one. The treatments were performed for 4 weeks, 3 days/weeks. The static and dynamic stretching were performed three times in every session with rest interval of 1 minute in between them. Goniometer was used to measure the spine ROM on the second and fourth weeks. Results show that 4-week static and dynamic stretching increases spine flexion, extension and spine lateral movements. Furthermore, dynamic stretching treatment gave more optimum effects than static stretching to increase spine ROM. The findings suggest that 2 and 4 weeks stretching treatment can increase spine ROM on LBP, in which the dynamic stretching is more effective than the static one.

Keywords: Static stretching, Dynamic stretching, Range of movement, Low back pain.

1. Introduction

Musculoskeletal system including muscle and bone is an important orgran to build human body. Bone connected by joints and together with muscle becomes the main organ to human movement. Flexibility is the ability to move muscles and joints through their full range of motion and the important physical fitness variable and appropriate level are necessary to promote and maintain the functional autonomy [1, 2]. Previous studies show the benefits of flexibility exercise to increase human health level especially range of movement (ROM) [3].

Various types of stretching exercises are used according to individual preference of athletes or trainers. Ballistic, proprioceptive neuromuscular facilitation (PNF), static and dynamic stretching are the most used stretching techniques [4]. Previous studies showed that prolonged static stretching can compromise isometric and isokinetic force output [5-7], furthermore, dynamic stretching may have either no adverse effect or improve subsequent muscle strength performance [8, 9], although the overall increases were of small to moderate magnitude [5]. One of the important focuses from stretching is increasing the length of a musculotendinous units in order to increasing the distance between a muscle origin and insertion. In order to increase ROM, physicians have to select the appropriate methods or technique to increase muscle tension based on the tightness. Previous study indicated that static stretching increased ROM, muscle stiffness and muscle tendon stiffness [10]. The similar result also showed by the previous study which indicated that the dynamic stretching increase ankle ROM [11]. The above result indicated that both methods of stretching potentially and ability to increase ROM.

Report of World Health Organization (WHO) on WHO Technical Report Series No 919/2003 with theme “The Burden of Musculoskeletal Conditions at The Start of The New Millennium” showed that musculoskeletal conditions are extremely common and include more than 150 different diseases and syndromes, which are usually associated with pain and loss of function. Furthermore the pain and loss function because the effect of lower back pain syndrome [12]. In developing countries including Indonesia, low back pain (LBP) generally occurs and becomes the cause of disability and financial burden [13] . The epidemiology of low back pain has been extensively researched in adults but is less well understood in adolescents [14]. Estimates of the prevalence of low back pain in adolescents vary widely, but a recent systematic review concluded that the 1-week prevalence was 17.7%, and 12-month prevalence was 33.6% [15]. Low back pain impacts significantly on adolescents, as over nine in ten report disability that may include reduced physical activity, school absenteeism, and limitations in daily activities [16-18].

Exercise-based therapy is an important component of LBP treatment. Dynamic loading of the spine during exercise therapy facilitates the diffusion of nutrition [19], has anabolic effects on intervertebral disc matrix [20], and slows matrix degradation [21]. These results indicated that the treatment of LBP through exercise training is better than standard care (inactive treatments) provided by the physician because it implies diminishing the deconditioning syndrome. An exercise therapy program is expected to counteract the impairment of spine erector muscle aerobic power. This improvement in the aerobic fitness of the erector spine muscle should imply alterations in muscle oxygenation. It has already been shown that training improves the oxygenation parameter in locomotors muscles during exercise [22]. However, effect of stretching exercise including static and dynamic for LBP patient have not fully elucidated and thus investigated in this study. The current investigation purpose is to know whether static and dynamic stretching has ability to increase ROM on LBP patient.

Furthermore, we are also interested in determining the best methods between the both stretching to increase ROM on LBP patients.

2. Experimental Methods

2.1. Subject

Twelve patients in a hospital which have diagnosed to have LBP problem participated in this study. The test procedure was conducted in the measurement of the ROM of the sample by goniometer on spine flexion, spine extension, spine lateral right and spine lateral left. Afterwards, the subjects read and signed the informed consent form about the test procedures, and any possible risks and discomfort that might ensue.

2.2. Experimental procedures

Before the procedure started, each subject was given information about stretching including static (Fig. 1) and dynamic stretching (Fig. 2). When the subjects attended the hospital on the next time, they were measurement of ROM of spine flexion, spine extension, spine lateral right and left was conducted to determine pre-test data". Samples were randomly divided into two groups: static stretching and dynamic stretching. The both groups performed a warm up with little jogging around 3 minutes to get them ready before treatment.

2.3. Static stretching exercise

Each static stretching exercise (Fig. 1) was performed three times for 4 minutes/set to the level of mild discomfort, but not painful, as acknowledged by the subject. The rest interval between repetition was 1 minutes. Accordingly, the total static stretching time interval was 14 minutes ± 1 minute. The samples received the treatment for 3 times/weeks for 4 weeks (12 times treatments). Post-test data analysis performed on 2 weeks and 4 weeks after treatment respectively.

Fig. 1. The static stretching methods for increase spine ROM.

2.4. Dynamic stretching exercise

Similar with the static stretching exercises, they performed three-time dynamic stretching for 6 minutes/set and the rest interval between the repetition was 1 minute (Fig. 2). The total dynamic stretching time interval was 21 minutes ± 1 minutes. The samples got the treatment for 3 times/weeks for 4 weeks (12 times treatments). The samples received the treatment for 3 times/weeks for 4 weeks (12 times treatments). Post test data analysis performed on 2 weeks and 4 weeks after treatment respectively.

Fig. 2. The dynamic stretching methods for increase spine ROM.

2.5. Statistical analysis

Statistical analysis was performed by one-way analysis of variance (ANOVA) to assess the main effect of static and dynamic stretching (pre-test vs post-test). The Tukey-post hoc test was used for analysis to identify of difference between pre-test and post-test result on every groups. All data were expressed as mean ± standard deviation (SD). The level of significance was established at $p < 0.05$.

3. Results and Discussion

3.1. Static stretching increase spine range of movement (ROM)

This current study assessed the effect of static stretching to increase ROM of spine by measuring alteration angle of spine flexion. Fig. 3A showed the change in spine flexion before, after 2 weeks and 4 weeks treatment. This result indicated that static stretching has ability to increase ROM of spine flexion. Similar with spine flexion, our current study also showed that static stretching increase ROM of spine flexion (Fig. 3B), spine lateral left (Fig. 3C) and spine lateral right (Fig. 3D), respectively.

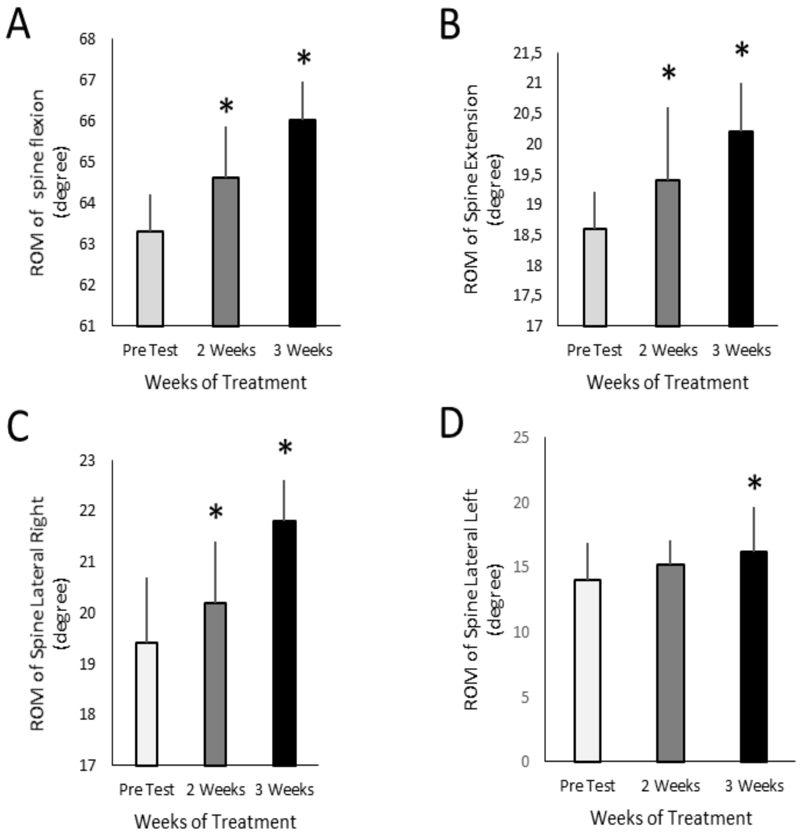

Fig. 3. ROM on pre-test, 2 weeks and 4 weeks after static stretching treatment. One-way ANOVA revealed that 4 weeks static stretching treatment increased ROM of spine flexion (A), spine extension (B) and spine lateral right (C) and left (D) (*, significant different with pre-test, $p < 0.05$).

Range of movement (ROM) which indicated whether human movement is appropriate or not dependent on available in synovial joints. Previous study indicated that ROM may be limited by 2 anatomical entities: joints and muscles. Joint restraints include joint geometry and congruency as well as the capsule ligamentous structures that surround the joint. Furthermore, this research showed that muscle provides both passive and active tensions: passive muscle tension is dependent on structural properties of the muscle and surrounding fascia, while dynamic muscle contraction provides active tension. Structurally, muscle has viscoelastic properties that provide passive tension. Active tension results from the neuroreflexive properties of muscle, specifically peripheral motor neuron innervation (alpha motor neuron) and reflexive activation (gamma motor neuron) [23]. Indeed, the benefits of stretching have been reported by previous experiments which indicated that increasing of the joint will correlated with increase of ROM. static stretching often results in increases in joint ROM. Interestingly, the increase in ROM may not be caused by increased length (decreased tension) of the muscle; rather, the subject may simply have an increased tolerance to stretching [24, 25]. The current result showed 4 weeks static stretching treatment has ability to increase spine ROM (Fig. 3). Furthermore, the treatment for 2 weeks static stretching also showed similar effect (Figs. 3A, B, C). Our result different with the previous study which showed that needed 6 weeks to get benefit effect of static stretching to increase hamstring flexibility [26]. This result indicated that increasing of spine flexibility is faster than hamstring flexibility. Based on the above result we speculated that 2 weeks treatment is enough to increase tolerance of static stretching of spine. This current result indicated that static stretching has ability to increase spine ROM on the low back pain patients.

3.2. Dynamic stretching increase spine range of movement (ROM)

To determine the effect of dynamic stretching to increase spine ROM, we measured the effect of 2 weeks and 4 weeks treatments dynamic stretching on spine flexion, extension, spine lateral left and right. Our results indicated that 4 weeks treatments increase ROM spine (Figs. 4A, B, C, D). Furthermore, the similar effect seems look on 2 weeks treatments (Figs. 4A, B, D) but not for ROM of spine lateral right (Fig. 4C). This result showed that dynamic stretching has ability to increase spine ROM.

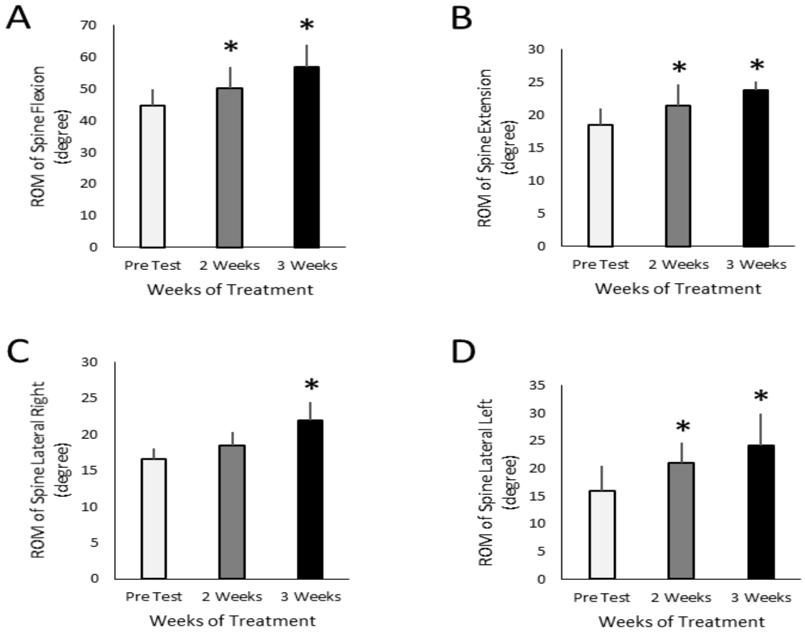

Fig. 4. ROM on pre-test, 2 weeks and 4 weeks after dynamic stretching treatment. One-way ANOVA revealed that 4 weeks static stretching treatment increased ROM of spine flexion (A), spine extension (B) and spine lateral right (C) and left (D) (*, significant different with pre-test, $p < 0.05$).

Traditionally, static stretching is preferred than dynamic stretching to increase ROM especially to LBP patients. However, a previous study or previous studies showed that dynamic stretching also has benefits to improve muscle strength [9], muscle power [8]. Whether dynamic stretching improves joint ROM and reduces the risk of injury has not been fully investigated, only limited previous studies which determined the effect of dynamic stretching on ROM. Japanese researcher showed that dynamic stretching have ability to be effective in increasing ankle joint flexibility [27]. Joint ROM depends on both mechanical and neural factors [11]. Joint ROM is mechanically affected by the stiffness of the muscle-tendon unit (MTU), which is related to exercise performance and the risk of MTU strain injuries [28] neural factors influence joint ROM through stretch tolerance or the pain tolerance threshold. However, although DS has been reported to increase joint ROM, there is a dissociation between joint ROM and the mechanical or neural factors affecting it [29]. Furthermore, the previous study strengthened the effect of dynamic stretching to increase on joint range of motion (ROM) and stiffness of the muscle-tendon unit (MTU) [30]. Indeed, our current result showed that 2 weeks and 4 weeks treatment of dynamic stretching increase spine ROM (Fig. 4) without increasing pain and risk factors on low back pain patients. This result was strengthened by the previous study which evaluated effect of dynamic stretching for therapy low back pain [31]. Based on our result, we speculated that dynamic stretching is potentially to increase spine ROM on low back pain patients.

3.3. Dynamic stretching is preferable than static stretching to increase spine range of movement (ROM)

Furthermore, we interested to know which is the more optimum method between static and dynamic to increase ROM spine on low back pain patient. In order for that we compare between the both methods and our result indicated that dynamic stretching method more preferable to increase spine flexion (12 cm vs 2,4 cm, Fig. 5), spine extension (5,4 cm vs 1,6 cm, Fig. 5), spine lateral left (8,2 cm vs 1,8 cm, Fig. 5) and spine lateral right (6,4 cm vs 2,4 cm, Fig. 5), respectively.

Several authors have compared static and dynamic stretching on ROM [32, 33]. Both static and dynamic stretching appear equally effective at improving ROM acutely or over time with training [34]. To determine the best methods to increase spine ROM on low back pain patient we compare the both stretching methods and our result showed that dynamic stretching reach peak magnitude higher than static stretching (Fig. 5). The current result is strengthened by the previous study which indicated that active or dynamic stretching more effective to improve angkle-dorsoflexion range of movement (ADFROM). This current result showed that dynamic more effective to increase spine ROM and potentially to apply on low back pain patients.

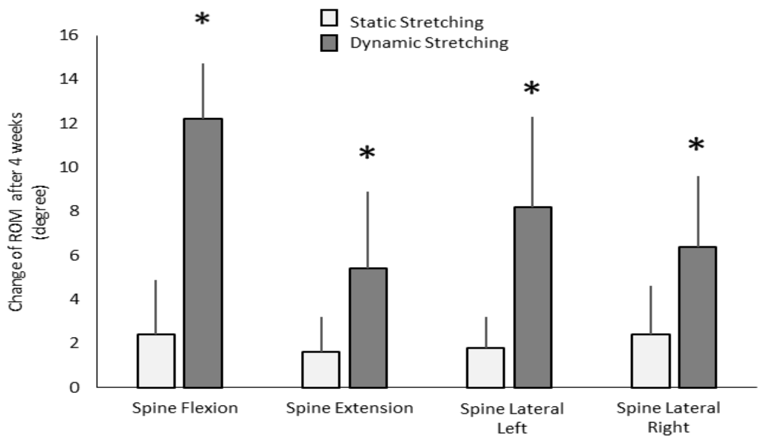

Fig. 5. Change of ROM after 4 weeks stretching treatment. One-way ANOVA revealed that 4 weeks dynamic stretching treatment more effective to increased ROM of spine flexion, spine extension and spine lateral left and right (*, significant different with static stretching, p < 0.05).

4. Conclusion

We demonstrated two methods to increase spine ROM on LBP patients. Experimental result showed that 4 weeks treatments using both methods were effective to increases spine ROM on patient LBP. Furthermore, this study indicated that dynamic stretching is more effective than static one.

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