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The Addition of Contract Relax Stretching Method is Better in Increasing The Range of Motion of Knee Osteoarthritis

Rudianto[1], Tjokorda Gde Bagus Mahadewa[2], Sugijanto[3]

[1]Master Program in Sports Physiology-Medical Faculty, University of Udayana, Bali

[2] Neurosurgery Department-Medical Faculty,University of Udayana, Bali, and

[3]Physiotherapy Faculty, University of Esa Unggul, Jakarta

Abstract: ***Knee osteoarthritis is a degenerative and chronic joint diseases due to bone and cartilage damage that can decrease the range of motion (ROM) and limit daily activities. To accelerate ROM improvement of the knee joint, authors added contract relax stretching (CRS) on the standard roll-glide (RG) and transverse friction (TF) methods. The purpose of this study to prove the addition of CRS intervention on the RG and TF mobilization further increase the knee ROM. This research was an experimental cohort study with pre-test and post-test control group design at Pelabuhan I Hospital, Medan. The research subjects were 22 people who were divided into two groups; namely the treatment group and the control group. The treatment group was given additional intervention of CRS and a control group given standard intervention. ROM improvemenet in the treatment group with a mean degree of $89.55^0 \pm 6.105^0$ before the intervention and after the intervention was $144.55^0 \pm 4.719^0$ with p = 0.001 and the control group with an average $90.91^0 \pm 5.394^0$ before the intervention, and after the intervention was $138.18^0 \pm 6.030^0$ with p = 0.001. Analysis between the treatment and control group after the intervention using independent t-test, p value = 0.012 (p<0.05). It was concluded that the addition of CRS intervention on the standard method, further increase the ROM in patients with knee osteoarthritis.***

Keywords: contract relax stretching, roll-glide, transverse friction, range of motion, knee osteoarthritis

1. Introduction

Osteoarthritis of the knee is a chronic disease that begins with decreased levels of proteoglycans and collagen in the joint cartilage resulting in broken subchondral trabecular bone or repetitive micro fractures. It stimulates the formation of Callus, so subchondral bone becomes more rigid and less effective as a shock absorben.[1,2] As pathological phenomena, inflammation appears and there is a formation of osteophytes and changes in the synovial as secondary changes. Histologically, there is a hypertropi and synovial hyperplasia due to infiltration of fibrin, lymphocytes and monocytes. Then, fibrotic tissue in the capsule and ligaments appears with a negative impact in the range of motion. Consequently, knee osteoarthritis starts the process of decay and flaking of the joint cartilage that causes the cartilage surface fluctuated due to decreased cartilage elasticity and increased rigidity.[3,4,5] The muscles that forming the knee joint will have double loads, not only as an active stabilizer, but also as a passive stabilizer so susceptible to muscle spasm and contracture as well thus risk of friction between tissues resulting in inflammation and adhesion.[6]

Osteoarthritis is the result of an imbalance catabolism exceeds anabolism in the metabolic chondrocyte process thus increase production of proinflammatory cytokine offending cartilage homeostasis.[7,8] The combination of metabolic imbalance, both to joint cartilage and subchondral bone were simultaneously narrowing gap joints and osteophyte formation, thus limiting daily activities due to pain and decreased ROM.[9,10] The prevalence of knee osteoarthritis in Indonesia, who were diagnosed radiologically, reached 10% in men and 18% in women. There were mostly aged 40-60 years and about 5% at age less than 40 years.[11] At Hasan Sadikin hospital-Bandung, in 2007 and 2010, were found about 74.48% of 1297 rheumatism cases (2007), among them 69% were women and who suffer from knee osteoarthritis were 87%. In 2010, between 2760 rheumatism cases about 73% were knee and hip osteoarthritis.[12] Australian Physiotherapy Association recommends, treatment of knee osteoarthritis by combining exercise with a manual therapy, the combination has the effect of reducing pain and improve the quality of life, with the evidence base level I and II.[13] In accordance to this, the authors added CRS, as a specific interventions for contractile tissue in knee osteoarthritis, to the standard intervention.

The purpose of this study were: 1) to prove the additional intervention as CRS to standard improve ROM in knee osteoarthritis patients; 2) to prove that additional intervention as CRS to standard is better than standard intervention (RG and TF) only, in knee osteoarthritis patients.

2. Material and Methods

This research was conducted at the Pelabuhan I Hospital, Medan precisely in physiotherapy policlinic on March 7, 2016 to April 2, 2016. This study was a cohort study using pre-test and post-test control group design and was approved by ethics committees of Faculty of Medicine, Udayana University. Value range of motion was measured with a goniometer. All patients had been informed consent to join this research. Sample selection based on inclusion and exclusion criteria then were randomized by random sampling

technique, divided into two groups: a control group (roll-glide and transverse friction) and the treatment group (contract relax stretching, roll-glide and transverse friction).
The control group was given RG, begins low grade (grade 2) then raised to high grade (grade 3 and 4), the duration of 3 times of 3 minutes for 3 times per week and TF grade 3, duration of 2 minutes, also 3 times per week to determine the increase of ROM. Group treatment was given CRS submaximal contractions by repetitions 5 times, with long contractions of 6 seconds per one repetition with a frequency for three times a week, then continued by RG and TF as control group above. Before the measurements were made, the goniometer must be prepared, measured region should be free of clothing. Implementation of the knee ROM measurement as follows: movement of knee flexion; the initial position of the patient was prone position, the initial position of 0 degrees, the physiotherapist stands in the lateral position the patient's knee. Goniometer with the fulcrum position static point on the lateral epicondyle femur. Patients were asked to move to the end of the knee flexion capability without any suppression motion by physiotherapist, then goniometer was moved to the end of the patient motion, then the data were recorded in sheets, before and after the intervention.

The data obtained were analyzed by the following statistics descriptive analysis for analyzing age, gender, occupation, body mass index, grade osteoathritis, knee flexion ROM. Test of normality data by Shapiro Wilk, homogeneity test data by Levene's test. Hypothesis testing: a. Test for the increased ROM in each group for pre and post-test data, using paired t-test; b. Test of the increased ROM between groups for post-test data comparison, using independent sample t-test.

3. Results

In table 1, the characteristics of age, weight, height, body mass index, grade of osteoarthritis prior to the intervention of the two groups were almost the same and there were no significant differences.

Table 1: Characteristic of study subjects

Variable	Treatment	Control	p
	Mean± SD	Mean±SB	
Age (year)	58.36 ± 4.272	58.27 ± 3.196	0.96
Body Weight (Kg)	64.0 ± 7.880	64.0 ± 7.497	0.89
Height (m)	1.60 ± 9.228	1.60 ± 8.231	1.0
IMT (Kg/m^2)	24.72 ± 1.348	24.55 ± 1.694	1.0
Grade OA (%)	2.45 ± 0.522	2.45 ± 0.522	1.0

Table 2: Normality and homogeneity test for knee range of motion (ROM)

ROM Flexy Knee's joint	*Shapiro Wilk Test*		*Levene's test*
	Control	Case	
	P	*p*	
Pre-test	0.26	0.32	0.45
Post-test	0.10	0.39	
difference	0.18	0.10	

Base on normality test and Levene's test for pre-test, post-test and the difference of knee's joint ROM were considered no difference (p>0.05) (Table 2).

Table 3: ROM improvement of each group

ROM of Knee		Mean ± SD	*p*
Treatment	Pre-test	$89.55^0 \pm 6.105^0$	<0.001
	Post-test	$144.55^0 \pm 4.719^0$	
Control	Pre-test	$90.91^0 \pm 5.394^0$	<0.001
	Post-test	$138.18^0 \pm 6.030^0$	

In table 3, mean differences of ROM pre-test and post-test in each group were significance better (p<0.001) after treatment (paired t-test). Between post-test of both groups were tested by independent t-test with p=0.012 (table 4). This refer to conclusion that treatment and control groups both improved ROM significantly and treatment group better significantly compare to control group (p=0.012).

Table 4: ROM difference between groups (post-test)

ROM of Knee		Mean ± SD	*p*
Treatment	Post-test	$144.55^0 \pm 4.719^0$	0.012
Control	Post-test	$138.18^0 \pm 6.030^0$	

4. Discussion

In this study, there were 22 patients who suffered from knee osteoarthritis with limitation of ROM. Age at treatment group had a mean of 58.36 ± 4.27 and control group was 58.27 ± 3.19 and having similar age range to previous study.[14] The treatment and control groups had a mean: 50.25 ± 6.35, with symptoms of movement disorders and dysfunction of the knee joint. The subjects mostly women, may be related to the problem of aging, hormonal inbalance, so they were in peri and post-menopausal period.[15] Body mass index (BMI) in each group i.e., treatment group had a mean of 24.72 ± 1.348 kg/m^2 and the control group had a mean of 24.55 ± 1.694 kg/m^2. In this study, there was no classification of obesity (≥ 30 kg/m^2). However, previous studies conducted by Kerti, it was said that the cause of osteoarthritis factors other than aging, is also a history of nutritional status (≥25 kg/m^2) as a high risk factor.[16] According to Gul *et al*., who conducted knee therapy for common osteoarthritis grade 2 and 3 that similar to this study.[17] Most of the subjects in this study were women who had previously worked as an administrative assistant in the harbor which has a multi-storey building, the shoes that they used were high heels, those had close relationship with knee joint osteoarthritis induced by the activity and the work environment.[18]

Mobilization roll-glide is the technique of intervention in improving joint motion and function through repetitive movements that stimulates an increase in synovial fluid and nourish the avascular tissue. This process release the scar tissue which inhibits the joint free range of motion. The roll-glide mobilization have secondary effects as increase muscle elasticity to further ease joint range of motion.[19,20]
According to Patel *et al*., that mobilization combined with stretching can improve range of motion, reduce pain and improve function by starting the mobilization of grade 2 is then raised progressively to grade 4.[21] Transverse friction

by Joseph *et al*., can eliminate the microstructure of abnormal tissue due to soft tissue damage as well as stimulate the formation of more physiological tissue. Transverse friction combined with the roll-glide for 9 minutes may reduce pain and improve movement and joint function.[3,22]

Contract relax stretching is intended to improve elasticity and increase ROM through the process of autogenic inhibition and reciprocal inhibition to facilitate the Golgi tendon organs and muscle spindles through nerve fibers of type 1b, 1a and II, which send messages to the spinal cord resulting in the association and interaction at the spinal level, linked by connector neurons and neuron adjuster. Further impulses were sent back to the effector muscle, i.e agonist and antagonist muscles, instructed synergistic muscle relaxation for ease stretching.[23,24] Research by Haritha *et al*., 2015, and Karnati & Mohammed, 2015 said that the isometric contraction of the agonist muscles will provide relaxation to the antagonist muscles and stetching reduce pain and improve ROM due to the muscle flexibilities.[25,26] This process changes the visco-elasticity of the muscles, after stretching will increase the length of the sarcomere and neuromuscular relaxation.[27]

According to Yildirim *et al*., 2016, the increase ROM in the joints through the techniques of stretching, in neurophysiology aspect mediated by two specific tissues of the muscles those are Golgi tendon organ units and muscle spindle. Stretching decrease activation of afferent nerves in type II muscle spindle and a decrease motor neuron excitability Ib fibers in the Golgi tendon unit.[28] Transverse friction combined with contract relax stretching have the effect to accelerate the specific tissue damage recovery of osteoarthritis and help to re-establish the elasticity and strength of muscle tendons so that the joints are free to move.[29]

5. Conclusion

Comparison after intervention between treatment groups with the control group obtained value of $p = 0.012$ ($p < 0.05$). It can be concluded that the addition of contract relax stretching intervention on the roll-glide and transverse friction further enhance the ROM than just using only roll-glide and transverse friction in patients with knee osteoarthritis.

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7. Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper

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