SPORT TK-EuroAmerican Journal of Sport Sciences

https://revistas.um.es/sportk Online ISSN: 2340-8812

Received: **01/01/2023.** Accepted: **15/01/2023.** Published: **01/01/2024**

Neuromuscular taping reduced pain intensity after the eccentric activity in senior high school students

Septyaningrum Putri Purwoto[1*], Adi Pranoto[2], Fajar Hidayatullah[1], Khoirul Anwar[1], Heni Yuli Handayani[1], Haryo Mukti Widodo[1], Fajar Hamdhan Utama[1], Agus Himawan[1], Muhammad Zainal Arifin[3], Tri Setyo Utami[3]

[1] STKIP PGRI Bangkalan, Bangkalan, Indonesia.

[2] Doctoral Program of Medical Science, Faculty of Medicine, Airlangga University, Surabaya, Indonesia.

[3] State University of Surabaya, Surabaya, Indonesia.

* Correspondence: Septyaningrum Putri Purwoto; septyaningrum@stkippgri-bkl.ac.id

ABSTRACT

Neuromuscular taping is one method that can be used to reduce the impact of pain after eccentric activity. The purpose of this study was to determine the effect of neuromuscular taping on the pain intensity after eccentric activity. This was an experimental study with the design of a randomized post-test control group. The 14 samples obtained were then randomly divided into two groups. Neuromuscular taping treatment (NMT) was used before performing eccentric activities. The eccentric activity performed was shoulder flexion-elbow extension. After 24 hours of recovery, the pain intensity was measured using a visual analog scale. The results of the Mann Whitney u test showed that there was no significant difference in pain intensity ($p \geq 0.05$). The conclusion of this study was that the neuromuscular taping after eccentric activity did not reduce the pain intensity after 24 hours of recovery. However, there was a tendency that the neuromuscular taping treatment group showed lower pain intensity so NMT decreased the pain intensity after eccentric activity.

KEYWORDS

NMT Decompression Technique; Eccentric Activity; VAS; Pain Intensity

1. INTRODUCTION

Eccentric activity is a type of physical activity that involves contractions of one or several muscles that experience lengthening and are accompanied by an increase in muscle strength (Chen et al., 2017). Burnley et al. (2010) added that eccentric activity is a type of resistance activity. Eccentric

activity often causes muscle breakdown. Muscle damage (muscle damage) accounts for 88% of all muscle injuries, in mild degrees (4-7 days) 24%, moderate degrees (8-28 days) 51%, severe degrees (≥ 28 days) 13%. Acute muscle damage cases reach 10-55% of all sports injuries due to eccentric muscle contraction (Maffulli et al., 2015). Cases of muscle pain delayed after eccentric activity peaked in the first 24-72 hours and disappeared after 5–7 days (Cheung et al., 2003). Regarding this, not many people understand it, besides that, a special method is needed to overcome it. Muscle breakdown starts 24 hours after eccentric activity and peaks 48 hours after eccentric activity. Among them include soreness, decreased muscle strength, decreased range of motion (ROM), increased inflammatory response, increased amount of serum creatine phosphokinase in the blood (Burnley et al., 2010). Muscle damage due to eccentric movements is the most common, namely pain.

Eccentric movements cause pain due to muscle lengthening to produce maximum strength (Burnley et al., 2010). During eccentric movements the muscle sarcomere lengthens resulting in mechanical stress and the release of calcium ions. Mechanical stress that occurs in the sarcomere results in damage to myofibrils and cytoskeletal proteins. In addition, mechanical stress will also disrupt the excitation contraction sequence, resulting in protein leakage into the extracellular and into the circulation. The result is an increase in damaged protein in the blood and triggers an inflammatory response (Jackman, 2011). The secretion of calcium ion (Ca^{2+}) substance is caused by the stretched reticulum of the sarcoplasm. As a result, the concentration of Ca^{2+} in the cytoplasm of muscle cells increases, thereby disrupting intracellular calcium ion homeostasis. Increasing the concentration of Ca^{2+} in the cytoplasm can activate calpain proteases and proteolytic enzymes that can degrade cell membranes and muscle intracellular proteins (Zhang et al., 2008). Protein degradation increases rapidly, the level of protein degradation will beat the rate of protein synthesis, resulting in an increase in the breakdown of muscle protein (muscle protein breakdown) which causes a negative net muscle protein balance resulting in muscle degeneration. These changes in the ultrastructure generally cause physiological symptoms such as pain (Cooke et al., 2010).

Blow (2012) stated that using neuromuscular taping during eccentric movements can reduce the effects of pain. Research conducted by Purwanto (2014) states that to reduce the impact due to eccentric activity by giving curcumin. Previous research by Ilmi et al. (2018) used manipulation of sports massage techniques. In addition, previous research conducted by Ozmen et al. (2016) namely by installing kinesiotaping and stretching techniques. However, research on the effect of neuromuscular taping decompression technique on pain reduction after eccentric activity is still unclear. On the basis of the above background, the researchers wanted to reveal the effect of

neuromuscular taping decompression techniques on reducing pain intensity. The purpose of this study is to determine the effect of neuromuscular taping on the pain intensity after eccentric activity.

2. METHODS

2.1. Study Design and Participants

This was an experimental study with the design of a randomized post-test control group. The population was taken from SMAN 1 Driyorejo, Gresik, East Java, Indonesia students for the 2018/2019 academic year. The sample size required in this study was calculated based on the formula of Lameshow (1997) with a total of 7 people per group, so that the total sample amounted to 14. The study sample was selected using consecutive sampling technique and based on inclusion criteria for the sex of men and not athletes, body weight 50 – 60 kg with body height 1.60 – 1.75 m (BMI: 19.5 – 19.6 kg/m^2), age between 15 – 16 years, arm length 54 – 58 cm, and willing to follow a series of processes research.

2.2. Procedure and Measurements

The neuromuscular taping treatment used was the neuromuscular taping decompression technique given to the treatment group on the right biceps muscle before doing eccentric activity (flexi shoulder - loaded elbow extension). The application of the decompression technique uses a leukotape measuring 5 x 35 cm (2 cm anchor) with a "Y" shape. The eccentric movement is a movement of short head of biceps muscle lengthening in the shoulder flexion - right hand elbow extension by holding 4-5 kg of dumbbells for 20 seconds in one repetition. Movement of flexi shoulder - elbow extension with weights is used as a test protocol with a load weight of 9% of body weight (Bompa & Haff, 1994) with resistance time obtained from the smallest time from the initial test flexi shoulder motion - elbow extension with load. Eccentric activity has the potential to cause pain (Hedayatpour et al., 2018). Pain intensity is a measurement of pain perception received by the short head of biceps muscle in the right hand after doing the flexi shoulder movement - elbow extension by holding a 4-5 kg dumbbell load for 20 seconds which is done after 24 hours of recovery via a scale 1-10 visual analogue scale which is measured using the VAS score.

2.3. Statistical Analysis

In this study, for data analysis using Statistical Package for the Social Sciences (SPSS) version 21.0 software. Characteristics of study subjects were evaluated using the Independent Samples t Test, while the Mann Whitney U Test was used to evaluate pain intensity between the two

groups. All data are displayed with mean ± standard deviation (SD). Statistical analysis used a significant level ($p \leq 0.05$).

3. RESULTS

In the first part of this section, the subject's characteristics are explained using a descriptive test based on the subject's mean ± standard deviation (SD). Characteristics data are from the total sample from both the treatment group and the control group. Table 1 will present the results of an overview of the characteristics of the research subject.

Table 1. Characteristics of participants

Parameters	n	Control group	Treatment group	*p*
		Mean ± SD	Mean ± SD	
Age (years)	7	15.71±0.49	15.43±0.54	0.298
Body weight (kg)	7	53.86±5.90	52.00±5.30	0.547
Body height (m)	7	1.66±0.01	1.68±0.04	0.150
Arm lenght (cm)	7	55.70±1.10	55.86±1.50	0.841
Load weight (kg)	7	4.70±0.50	4.57±0.50	0.591
Load bearing time (s)	7	22.57±1.30	22.43±1.90	0.872

The characteristics of the research subjects in Table 1 indicate that the control and treatment groups have the same characteristic variations. This means that there is no significant difference in the characteristics of research subjects ($p \geq 0.05$).

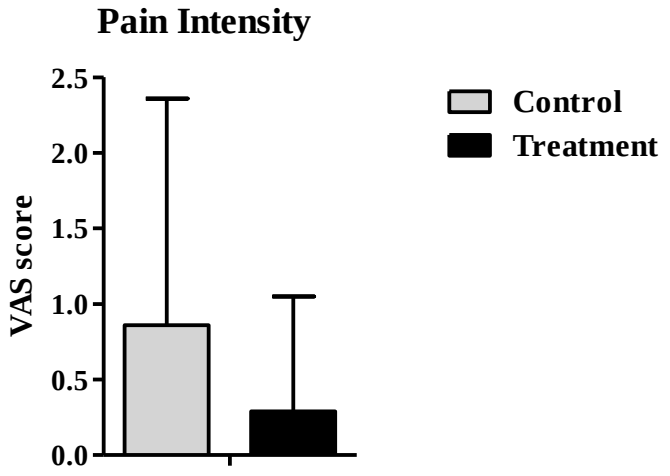

Figure 1. Pain intensity analysis results between treatment group vs. control group

Based on Figure 1, the results of the Mann Whitney U Test analysis showed that the mean VAS score after 24 hours of recovery in the treatment group was lower than the control group (0.29±0.76 vs. 0.86±1.50), but there was no significant difference between the treatment and control groups ($p \geq 0.05$).

4. DISCUSSION

The results of our study showed that the mean VAS score after 24 hours of recovery in the treatment group was lower than the control group (Figure 1), but there was no significant difference between the treatment and control groups ($p \leq 0.05$). This indicates that the application of neuromuscular taping decompression technique during eccentric movement activity up to 24 hours of recovery has not provided maximum results in reducing the pain scale in the muscles. So that the maximum result from the placement of neuromuscular taping is possible can be seen with the additional rest time after eccentric activity. Another factor that causes the effect of neuromuscular taping to be not seen in the area of movement is the intervention of pain-making movements, namely the flexi shoulder-elbow flexion movement which is the third liver system (Okuno & Fratin, 2014). This movement gives the muscle force that is exerted which is the product of the length of the arm and the weight of the load. The average sample body weight is 52-53, so the rounding load obtained is 4-5 kg. The mean length of the sample arm was 55 cm. so that the force exerted by the muscle is very large, namely 220-275 Newton on the short head of biceps muscle as the muscle that experiences an elongation contraction.

In addition, the shoulder-extension elbow flexion motion with weight bearing is an isotonic muscle contraction with an eccentric work type so that the muscle lengthens with constant tension for 20 seconds. Isotonic muscle contraction with an eccentric work type is a muscle contraction with constant load from the beginning to the end of the movement with both ends/ muscle attachments (origo and insertion) away from each other in the sense that the muscles are more elongated (Suryadi, 2014). Eccentric muscle movements (muscle lengthening) occur as braking or resistance forces against concentric movements in many movements to protect the joint structure from damage or injury (Hody et al., 2019; Bubbico & Kravitz, 2010).

Research conducted by Dewi et al. (2019) proved that insertion of neuromuscular taping decompression techniques can reduce pain intensity. The decrease in pain intensity after eccentric activity is probably due to the insertion of a neuromuscular taping decompression technique. The pain intensity is decreased by giving neuromuscular taping decompression technique by activating

the neuromuscular taping during functional activities, so as to provide a sense of comfort in the area that is attached. In addition, neuromuscular taping can provide a stimulus that can be converted into nerve impulses. This is consistent with Rosalina (2016) explanation that neuromuscular taping can provide an intense stimulus that is received by mechanoresptor and converted into nerve impulses. The neuromuscular taping decompression technique is activated by elongated (eccentric) muscle activity. This will further protect the muscle cells during contraction. The decompression technique can result in the mechanism of the skin becoming elevated and stimulation of the receptors on the skin. The mechanism of the skin that is lifted is caused by the installation of an elastic tape (leukotape) which produces wrinkles/ taping waves on the skin. This condition can provide more space in the interstitial tissue underneath, improve blood circulation and facilitate absorption of fluids, which can reduce pressure in the subcutaneous area. Reduced subcutaneous pressure will result in good muscle elasticity and affect muscle strength in eccentric (stretched) conditions. The mechanism of stimulation of skin receptors through the mechanoreceptor pathway will provide two stimulations, namely exteroceptively and proprioceptively. The exteroceptive effect will respond to an increase in local microcirculation in the taping area, reduce blood flow and static lymph, and accelerate the absorption of edema. While the proprioceptive effect is exerted by the central nervous system through sensory nerve fibers types 1a, 1b, II, and IV. Eksteroceptive and proprioceptive stimulation responds to a good increase in muscle strength. Therefore the two mechanisms produced by the decompression technique will inhibit sarcomere elongation, thereby reducing muscle soreness caused by eccentric movements (Blow, 2012).

The reduction in pain that occurs due to the placement of neuromuscular taping affects to a different degree. At the sensory level, neuromuscular taping can stimulate receptors in the cutaneous, muscle, and joint, including nociceptors so that they can control pain. These nociceptors that are sensitive to stimulation will release a number of chemicals such as hydrogen ions, potassium ions, polypeptide ions, histamine, and prostaglandins. Furthermore, this stimulated receptor will respond to the somatosensory system of the cerebral cortex through the spinal cord from afferent nerve fibers (Rahayu, 2018).

5. CONCLUSIONS

Based on the results of the study, it can be concluded that the application of neuromuscular taping decompression technique can reduce pain intensity 24 hours after performing eccentric

activity in students. Based on these conclusions, it can be recommended for further research by measuring VAS 48 hours after eccentric activity. In addition, it is suggested to apply neuromuscular taping decompression technique to athlete subjects.

6. REFERENCES

Blow, D., (2012). *Neuromuscular Taping from Theory to Practice*. Milan: Arti Grafiche Colombo-Gessate.

Bompa, T. O., & Haff, G. G. (1994). *Periodization Theory and Methodology of Training Fourth Edition*. Human Kinetics Publisher.

Bubbico, A., & Kravitz, L. (2010). Eccentric Exercise: A Comprehensive Review of a Distinctive Training Method. *Fitness Journal*, *7*(9), 50–59.

Burnley, D. E., Angela, N. O., Sharp, R. L., Bailer, S. W., & Alekel, D. L. (2010). Impact of Protein Supplements on Muscle Recovery After Exercise-induced Muscle Soreness. *Journal Exercise Science Fitness*, *8*(2), 89–96. https://doi.org/10.1016/S1728-869X(10)60014-7

Chen, T. C., Lin, M. J., Lai, J. H., Chen, H. L., Yu, H. I., & Nosaka, K. (2018). Low-intensity elbow flexion eccentric contractions attenuate maximal eccentric exercise-induced muscle damage of the contralateral arm. *Journal of Science and Medicine in Sport*, *21*(10), 1068–1072. https://doi.org/10.1016/j.jsams.2017.12.012

Cheung, K., Hume, P., & Maxwell, L. (2003). Delayed onset muscle soreness: treatment strategies and performance factors. *Sports Medicine*, *33*(2), 145–164. https://doi.org/10.2165/00007256-200333020-00005

Cooke, M. B., Rybalka, E., Stathis, C. G., Cribb, P. J., & Hayes, A. (2010). Whey protein isolate attenuates strength decline after eccentrically-induced muscle damage in healthy individuals. *Journal of the International Society of Sports Nutrition*, *7*, 30. https://doi.org/10.1186/1550-2783-7-30

Dewi, T. N., Yuli, P., Septian, U. E, & Surya, A. (2019). The Effect of Giving Ultrasound Therapy and Neuromuscular Taping in Improving Functional Activities in The Knee Osteoarthritis Case. *Sport and Fitness Journal*, *7*(2), 64–71.

Hedayatpour, N., Izanloo, Z., & Falla, D. (2018). The effect of eccentric exercise and delayed onset muscle soreness on the homologous muscle of the contralateral limb. *Journal of*

Electromyography and Kinesiology, *41*, 154–159. https://doi.org/10.1016/j.jelekin.2018.06.003

Hody, S., Croisier, J. L., Bury, T., Rogister, B., & Leprince, P. (2019). Eccentric Muscle Contractions: Risks and Benefits. *Frontiers in Physiology*, *10*, 536. https://doi.org/10.3389/fphys.2019.00536

Ilmi, M. A., Purwanto, B., & Tinduh, D. (2018). Effect of Sport Massage Manipulation on Pain Intensity After Eccentric Activities. *Postgraduate Journal of Bioscience, 20*(2), 1–6.

Jackman, S. R. (2011). Whole Body and Muscle Response to Protein and Branched Chain Amino Acid Feeding Following Intense Exercise. Dissertation. Inggris: University of Birmingham.

Lameshow, S. (1997). *Sample Size in Health Research*. Yogyakarta: Gajah Mada University Press.

Maffulli, N., Angelo, D.B., Francesco, O., Alessio, G.V., Antonio, F., Michele, B., Paola, B., et al. (2015). Muscle Injuries: A Brief Guide to Classification and Management. *Translational Medicine*, *12*(4), 14–18.

Okuno, E., & Fratin, L. (2014). *Biomechanics of the Human Body*. New York: Springer.

Ozmen, T., Yagmur Gunes, G., Dogan, H., Ucar, I., & Willems, M. (2017). The effect of kinesio taping versus stretching techniques on muscle soreness, and flexibility during recovery from nordic hamstring exercise. *Journal of Bodywork and Movement Therapies*, *21*(1), 41–47. https://doi.org/10.1016/j.jbmt.2016.04.001

Purwanto, B. (2014). The Mechanism of Curcumin's Action in Preventing Damage to Skeletal Muscles of Mice That Performs Momentary Eccentric Activities. Dissertation. Surabaya: Airlangga University.

Rahayu, U. B. (2018). Pain Management Using Neuromuscular Taping. In U. B. Rahayu (Ed.), A Multi Professional Approach Using the NeuroMuscular Taping (NMT) Application in Cases. Indonesia NeuroMuscular Taping 2nd Symposium. Solo: Muhammadiyah University Press.

Rosalina, Y. (2016). *The Effect of Routine Physiotherapy and Neuromuscular Taping (NMT) on Pain Reduction in Knee Osteoarthritis Cases.* Thesis. Surakarta: Universitas Muhammadiyah Surakarta.

Suryadi, A. (2014). *Effects of Giving Glutamine on Muscle Strength and Joint Range of Motion After Eccentric Activities.* Thesis. Surabaya: Airlangga University.

Zhang, B. T., Yeung, S. S., Allen, D. G., Qin, L., & Yeung, E. W. (2008). Role of the calcium-calpain pathway in cytoskeletal damage after eccentric contractions. *Journal of Applied Physiology*, *105*(1), 352–357. https://doi.org/10.1152/japplphysiol.90320.2008

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

This research received no external funding.

COPYRIGHT