

## **Abstract**

### **The use of tensegrity concept in the massage of selected muscles in the context of their contractile and passive properties among men aged 19-24**

## **Introduction**

Massage therapy (MT) is one of the most common alternative therapies which may effectively support the conventional ways of treatment, particularly of/for musculoskeletal disorders. However, the effectiveness of the basic form of MT is limited, which may lead to a situation in which ongoing frequent massage sessions are often required to maintain therapeutic effects. There is a need to develop MT and increase its effectiveness. The use of tensegrity may prove to be an effective way to achieve this aim. Thanks to it, muscle tension may be transmitted within specific muscle chains. Unfortunately, they are not firmly established. Incorporating tensegrity principles into MT may considerably increase its effectiveness.

## **Objectives**

The aim of this study was to examine the usefulness of the tensegrity concept in the massage of the following muscles: deltoid muscle (DM), latissimus dorsi muscle (LDM) and tensor fascia latae muscle (TFLM).

## **Material and Methods**

In the randomised controlled trial 64 men, aged 20(20-21) were recruited. They were randomly allocated to the following groups: tensegrity massage group (TMG), classical massage group (CMG) and control group (CG). Every group consisted of 18 participants. Subjects in TMG received a single massage session based on the tensegrity principle, i.e. apart from DM, LDM and TFLM selected surrounding tissues were treated. In CMG, participants were provided with a classical (Swedish) massage of DM, LDM and TFLM. In CG, subjects did not receive any intervention.

In order to assess the contractile properties of massaged muscle, TMG S2 system was used. The following tensiomyographic variables were taken into consideration: delay time (Td), contraction time (Tc), sustain time (Ts), relaxation time (Tr), muscle displacement (Dm). Additionally, MytonPro device was used to measure muscle passive mechanical properties. The mytonometric parameters which were analyzed include: natural oscillation frequency (F),

stiffness (S), decrement (D), relaxation (R), creep (C). Measurements were taken three times: before, immediately after and 15 min after intervention.

## Results

Mixed model ANOVA was used to reveal the time x group interaction effect, within-subject main effect and between-subject main effect. At the beginning of the study, there were no significant differences between groups ( $p > 0.05$ ).

In DM, statistically significant interaction effects were observed for: Td ( $p < 0.001$ ,  $\eta_p^2 = 0.81$ ), Tc ( $p < 0.001$ ,  $\eta_p^2 = 0.32$ ), Ts ( $p < 0.001$ ,  $\eta_p^2 = 0.5$ ), Tr ( $p < 0.001$ ,  $\eta_p^2 = 0.55$ ), Dm ( $p = 0.002$ ,  $\eta_p^2 = 0.17$ ), F ( $p < 0.001$ ,  $\eta_p^2 = 0.42$ ), S ( $p < 0.001$ ,  $\eta_p^2 = 0.22$ ), D ( $p = 0.002$ ,  $\eta_p^2 = 0.22$ ) and R ( $p < 0.001$ ,  $\eta_p^2 = 0.47$ ).

Significant interaction effects in LDM were shown in the following parameters: Td ( $p < 0.001$ ,  $\eta_p^2 = 0.4$ ), Ts ( $p < 0.001$ ,  $\eta_p^2 = 0.19$ ), Tr ( $p < 0.001$ ,  $\eta_p^2 = 0.44$ ), Dm ( $p = 0.01$ ,  $\eta_p^2 = 0.14$ ), F ( $p < 0.001$ ,  $\eta_p^2 = 0.26$ ) and S ( $p < 0.001$ ,  $\eta_p^2 = 0.55$ ).

In the context of TFLM, the analysis revealed statistically significant interaction effects in: Td ( $p = 0.002$ ,  $\eta_p^2 = 0.21$ ), Tc ( $p = 0.008$ ,  $\eta_p^2 = 0.15$ ), Ts ( $p < 0.001$ ,  $\eta_p^2 = 0.44$ ), Tr ( $p < 0.001$ ,  $\eta_p^2 = 0.29$ ), Dm ( $p < 0.001$ ,  $\eta_p^2 = 0.38$ ), F ( $p < 0.001$ ,  $\eta_p^2 = 0.51$ ), D ( $p = 0.021$ ,  $\eta_p^2 = 0.13$ ) and R ( $p < 0.001$ ,  $\eta_p^2 = 0.34$ ).

## Conclusions

Massage therapy based on the tensegrity principle impacts the contractile and passive mechanical properties of deltoid muscle and tensor fascia latae muscle more effectively than Swedish massage. In terms of latissimus dorsi muscle, the results between the applied interventions were similar.

**Registration:** NCT06493149

**Keywords:** Musculoskeletal Manipulations, Musculoskeletal Therapy, Soft Tissue, Tensiomyography, MyotonPro