Evaluation of the local and distant effect of the foam rolling on the biomechanical parameters of myofascial tissues

Abstract

The development of industrial society underlies modern civilization. This process takes place at an unprecedented pace, and its effects are felt in all aspects of human life. One of the most significant manifestations of the changes taking place in the everyday life of a typical modern man is a static (usually sitting) position that he takes for a large part of the day. Paradoxically, the very demanding static conditions of the functioning of the musculoskeletal system lead to numerous pathologies developing within it. The changes observed within the myofascial tissues are significant from the point of view of both muscular activity and motor control. Changes in the biomechanical parameters of myofascial tissues occurs not only as a result of direct damage, excessive use, or in the process of adaptation to increased load in the process of sports training but also as a result of inactivity and prolonged (physiological and psychological) stress. For these reasons, tools are being sought with which it will be possible to regulate the values of biomechanical parameters of myofascial tissues depending on the needs. Among the tools often used both for working with patients and athletes, the Foam Rolling (FR) has gained popularity. The best-proven aspects of FR include the effect on a short-term increase in the range of motion in the joints and on post-workout regeneration. The effects of FR influence on the biomechanical parameters of myofascial tissues presented in the literature are ambiguous, and the methodological inconsistency makes it difficult to clearly assess this tool, as well as to define the mechanisms of its influence on the tissues and determine the optimal parameters of the procedure itself. Therefore, the aim of this study was to assess: the impact of FR application on the biomechanical parameters of myofascial tissues, additionally differentiated due to the treatment time parameter used; the appropriate therapeutic factor (comparison of the interaction of FR with the isolated elements of this application: the starting position taken and the position combined with the rolling movement but without the use of a roller) and an attempt to define the type of possible impact (local/distant/consistent with the course of the myofascial chains / consistent with the course of the specific regions of neural influence) in order to clarify the mechanism behind the described changes.

The basis for the experiment was the author's systematic review of the most commonly used parameters of the FR published in 2019 and verification of the credibility of the research tool used – MyotonPRO, carried out before the start of the actual experiment, as part of a pilot study. The main experiment was registered in the Australian New Zealand Clinical Trial Registry (ANZCTR) on November 30, 2019, under the number: ACTRN12619001615178. Prior to enrollment, the minimum required group sizes were estimated based on the results of the pilot study for test power (1-β) = 0,15,

significance level P = 0,05, and assumed effect size f = 0,15. Of the 148 subjects reported from the general population, 96 subjects were selected for purposeful selection and then randomly assigned to six groups. Setting up two meetings (the first to explain the purpose of the experiment and the technique of FR application and filling in the documentation, the second for the actual research) due to the pandemic have been combined. In the main examination, six points were marked on the body of the subject in the prone position. Two applications using the MyotonPRO tool were separated by an intervention consistent with the subject's group (sit for 30 or 120 seconds, movement imitating the application of FR without a roller for 30 or 120 seconds, application of FR to the group of hamstrings muscles of the dominant lower limb for 30 or 120 seconds) and a minute devoted to preparing the subject for repeated measurements.

The pilot study confirmed the results available in the literature showing a good to an excellent level of intraclass correlation coefficient of the MyotonPRO tool (except for one parameter for one measurement point where the level of moderate confidence was reached). The values of this parameter along with the values of the smallest detectable difference and standard error of measurement were also controlled in each group during the main experiment. In order to investigate the differences in variability between the groups and thus the influence of the studied factors on the effects of FR (tested factors: TIME, INTERVENTION), multivariate analysis of variance (MANOVA) and the following analysis of variance (ANOVA) were used for each of the six measurement points and four parameters of the MyotonPRO tool. The conservative Pillai-Barlett test was used to verify the hypothesis of electronic testing in the MANOVA model. If a significant assumption of this MANOVA test was obtained, then (if a significant assumption of the ANOVA was obtained) the *post hoc* Tukey's test was applied. If the results were statistically insignificant at any of these steps, the procedure was diminished.

There were no significant differences in biomechanical values between the final and baseline measurement for any of the study groups (no significant intragroup differences in repeated measures). There were no significant between-group differences for the TIME and INTERVENTION factors. The values of parameter changes showed significant differences between the application point FR and distant points in two cases, however, the observed differences are not applicable in practice.

In the light of the results obtained in this study, the hypotheses about the significant impact of FR on the biomechanical parameters of myofascial tissue cannot be confirmed. The use of this form of self-therapy did not cause any greater changes than the FR-like movement without the use of a roller, and even the FR starting (sitting) position alone. The results described in this paper do not contradict the best-proven aspects of the impact of the FR (such as immediate, short-term changes in range of motion observed after FR). The obtained results can be analyzed only through the prism of people meeting the selection criteria - young, healthy men. It cannot be ruled out that people with musculoskeletal disorders (perhaps those with increased stiffness due to these disorders) would react differently and biomechanical parameters, e.g. stiffness, would change (return to the initial level) after the application of FR.