J. Phys. Ther. Sci. 32: **–**, 2020

The Journal of Physical Therapy Science

Original Article

The effectiveness of Ergon Instrument-Assisted Soft Tissue Mobilization, foam rolling, and athletic elastic taping in improving volleyball players' shoulder range of motion and throwing performance: a pilot study on elite athletes

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Abstract. [Purpose] The purpose of this pilot study was to investigate the effectiveness of instrument-assisted soft tissue mobilization (IASTM), foam rolling, and athletic elastic taping on improving elite volleyball players' shoulder range of motion (ROM) and throwing performance. [Participants and Methods] Fifteen elite male volleyball players (mean age: 24 ± 4.54 years; mean height: 177 ± 0.08 cm; mean weight: 81 ± 7.71 kg) received shoulder Ergon IASTM, foam rolling, and elastic taping treatment in random order on both upper extremities once a week for three weeks. Pre-and post-treatment assessments of their shoulders' ROM and functional throwing performance were performed. [Results] Ergon IASTM technique resulted in significantly higher shoulder flexion ROM values than foam rolling and elastic taping. Foam rolling, in turn, showed better results than athletic elastic taping. Moreover, the Ergon IASTM technique resulted in significantly higher OSP values than athletic elastic taping. No significant differences were observed between the therapeutic interventions in terms of FTPI. [Conclusion] This pilot study on elite athletes provides evidence that both IASTM and foam rolling techniques may improve their passive shoulder ROM compared to elastic athletic taping while Ergon IASTM can also enhance their shoulder throwing performance.

Key words: Ergon IASTM, Foam-rolling, Sports taping

(This article was submitted Apr. 26, 2020, and was accepted Jul. 9, 2020)

INTRODUCTION

Volleyball is one of the most popular sports in the world. As such, it boasts a considerably large rnumber of players than many other team sports. It is estimated that more than 200 million people play volleyball on an amateur or professional levelworldwide[1)]. The sport's nature, which involves many intense motions of the upper extremities—especially of the shoulders—and heavy and asymmetric loads on the musculoskeletal system, is responsible for a high prevalence of injuries in all joints, especially in the shoulder joints[2)].

Shoulder injuries are frequent in demanding overhead sports such as volleyball[1–5)], representing 2–20% of all game inju-

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ries[3]. The main aetiology of shoulder injuries is overloading in certain overhead activities[4]. The overhead throwing motion is a highly skilled movement performed at extremely high velocities that impose extraordinary demands on the shoulder joint. Its frequent repetition causes a high incidence of shoulder injuries and pain.

The main shoulder injuries are tendinopathies of the rotator cuff, subacromial impingement syndrome, and gleno-brachial instability. These injuries, combined with damage from direct tissue injuries, are an important predisposing factor for new injuries and functional asymmetries with long-term displacement of mechanical loads on adjacent joints, muscles, or even the opposite extremities[5].

Several therapeutic interventions for neuromuscular stabilization of the shoulder and overhead activitytraining programmes aiming at re-education and reduction of the training volume have been proposed for the control and treatment of factors related to shoulder overuse in volleyball. Popular therapeutic interventions both for the prevention and rehabilitation of sports-related overuse injuries and for optimal warm-up include instrument-assisted soft tissue mobilization (IASTM), foam rolling, and joint stabilization techniques such as athletic elastic taping[6]. However, despite the extensive use of these techniques by sports therapists, their effectiveness has not yet been clarified due to conflicting research findings. Some studies have reported that IASTM and foam rolling can increase range of motion (ROM) and improve athletes'functionality[7–11] and thatathletic elastic taping can support the shoulder joint, thereby increasing its functional efficiency[11]. Other studies, however, do not support thesefindings[12, 13].

In light of these contradictory findings regarding the most effective therapeutic approach for improving functional performance in athletes and preventing sports injuries, this study aimed to assess the effectiveness of IASTM, foam rolling, and athletic elastic tapingon improving shoulder ROM and performance in elite volleyball players.

PARTICIPANTS AND METHODS

Fifteen healthy male elite volleyball players (mean age: 24 ± 4.54 years; mean height: 177 ± 0.08 cm; mean weight: 81 ± 7.71 kg) with at least five years of professional training and playing at the highest level (athletes of 1st Volleyball Division of Hellenic Volleyball Federation) and no shoulder injuries over the previous six months received Ergon® IASTM, foam rolling, and athletic elastic taping treatment in random order on both upper extremities once a week for three weeks. These treatment interventions were chosen to be assessed in the present study, on the basis that soft tissue techniques and athletic taping techniques are the dominant choices of sports physiotherapists for the preparation of professional athletes. The Ergon® IASTM (Ergon Technique, Athens, Greece) is an innovative therapeutic approach that combines static and dynamic manipulations of the body's soft tissue with special clinical equipment (surgical stainless-steel tools) for the treatment of neuromusculoskeletal pathologies. During the IASTM treatment, lasting 10 minutes, the participants were in a seated position. For the foam rolling procedure, the athletes performed self-mobilization in the upright position focusing on the anterior, middle, and posterior surface of the shoulder using a commercially available foam roll (diameter: 8 cm; Blackroll AG, Bottighofen, Switzerland) according to the manufacturer's instructions for this joint. The session lasted 10 minutes (about three repetitions of 60 seconds each for the anterior, middle, and posterior, shoulder surface). For the athletic elastic taping procedure, Dream®Ktape (Sixtus Prato, Italy) was used according to the manufacturer's instructions. All treatment procedures were performed by respective certified physical therapists.

The participants performed a number of upper limb tests before and after each intervention. Those included flexion, internal, and external shoulder ROM measurements with a goniometer and shoulder function evaluations using the Functional Throwing Performance Index (FTPI) and the one-arm seated shot-put performance test (OSP). All measurements were performed by the same examiner, who was blinded to the study's objectives to ensure the validity of the measurements. Shoulder ROM was assessed in the supine position with the scapula stabilized according to a standardized protocol. Prior to testing, the participants performed a standardized warm-up, which consisted of 10 minutes of continuous and progressive warm-up, select dynamic and mobility movements for the upper limbs, and one minute of functional ball throwing. Following the pretests, researchers applied one of the three interventions to both upper extremities of each participant. Post-tests immediately followed the interventions in the same manner as the pretests.The study was conducted in the Therapeutic Exercise and Sports Rehabilitation Laboratory of the University of Patras, Greece. The experimental design of the study was approved by the Ethics Committee of the Physiotherapy Department of the University of Patras (24421/06-03-2019) and the participant signed an informed consent statement.

The average shoulder flexion, internal, and external ROM, FTPI, and OSP values were calculated from five testing sessions for the right (R) and left (L) upper extremities. Bilaterally averaged values for the tests were calculated for each participant as follows: (R+L)/2. The statistics included the paired t-test for pre-and post-treatment comparisons and analysis of variance (ANOVA) with all possible single-degree-of-freedom comparisons after Bonferroni corrections, using SPSS V17. The level of significance was set to $p<0.05$.

RESULTS

The ROM and functional measurement results are displayed in Table 1. The pre-andpost-treatmentcomparisons showed that IASTM and foamrolling resulted in a statistically significant improvement in all shoulder movements ($p<0.05$), in

Table 1. Range of motion and functional measurement results before and after the therapeutic interventions (n=15)

Variable intervention		Right upper extremity		Left upper extremity		Averaged (R + L) / 2	
		Pretest	Post-test	Pretest	Post-test	Pretest	Post-test
Flexion	IASTM	117.72 ± 5.81	132.36 ± 9.75*	113.45 ± 4.74	126.72 ± 7.9*	115.585	129.54*
	Foam rolling	113.81 ± 5.3	121.09 ± 7.89*	111.36 ± 6.72	118.18 ± 4.51*	112.585	119.635*
	Athletic taping	116.09 ± 6.54	109.27 ± 5.98*	111.45 ± 6.5	104.45 ± 6.72*	113.77	106.86*
Internal rotation	IASTM	43.81 ± 5.4	53.9 ± 7.79*	41 ± 5.38	52.18 ± 5.7*	42.4	53.04*
	Foam rolling	44.54 ± 6.12	48.27 ± 7.73	42.27 ± 5.38	47.36 ± 8.89	43.405	47.815
	Athletic taping	46.27 ± 6.73	39.81 ± 8.55*	41.63 ± 4.45	35.45 ± 6.47*	43.95	37.63*
External rotation	IASTM	64 ± 7.15	73.36 ± 6.24*	59.09 ± 6.86	67 ± 6.97*	61.545	70.18*
	Foam rolling	64.63 ± 9.05	70.36 ± 9.82*	56.9 ± 8.47	62.9 ± 7.9*	60.765	66.63*
	Athletic taping	65.36 ± 8.67	55.81 ± 9.79*	60.72 ± 5.55	52.18 ± 6.36*	63.04	53.995*
FTPI	IASTM	13.18 ± 1.83	8.45 ± 1.91	13.18 ± 1.83	12.45 ± 1.96	13.18	10.45
	Foam rolling	13.36 ± 2.15	7.27 ± 2.37	13.36 ± 2.15	13.63 ± 1.74	13.36	10.45
	Athletic taping	11 ± 4.35	7.63 ± 2.57	14.18 ± 2.22	13.18 ± 1.77	12.59	10.405
OSP	IASTM	6.12 ± 0.93	6.57 ± 0.9	5.2 ± 0.52	5.66 ± 0.52*	5.66	6.115
	Foam rolling	5.94 ± 0.79	6.11 ± 0.83	5.2 ± 0.54	5.52 ± 0.49	5.57	5.815
	Athletic taping	5.83 ± 0.77	5.73 ± 0.72	5.04 ± 0.41	5.05 ± 0.63	5.435	5.39

All but the averaged values are mean ± SD. (Units: deg).
*$p<0.05$.

contrast to athletic elastic taping, which significantly reduced shoulder ROM ($p<0.05$). No technique significantly improved performance in terms of FTPI and OSP. Only Ergon IASTM considerably improved the performance of the left upper extremity in OSP and approximated to statistical significance in the averaged value ($p=0.07$).

No significant differences between the pre- and post-test bilaterally averaged shoulder ROM and functional values were found in the three therapeutic interventions. Ergon IASTM treatment increased average shoulder ROM values, while the athletic elastic taping decreased average ROM values. These adaptations were best observed in the shoulder flexion ROM, where the Ergon IASTM technique resulted in significantly higher values than foam rolling ($p=0.001$) and athletic elastic taping ($p=0.000$). Foam rolling, in turn, showed better results than athletic elastic taping ($p=0.000$). Ergon IASTM and foam rolling resulted in significantly higher internal ($p<0.05$) and external ($p<0.05$) rotation values than athletic elastic taping, with no significant differences between them ($p>0.05$). Moreover, the Ergon IASTM technique resulted in significantly higher OSP values than athletic elastic taping ($p=0.013$).There was no significant difference between IASTM and foam rolling in this respect ($p=0.282$). No significant differences were observed between the therapeutic interventions in terms of FTPI ($p>0.05$).

DISCUSSION

This study evaluated the efficacy of popular myofascial release techniques (Ergon IASTM, foam rolling, and athletic elastic taping) in improving shoulder ROM and functional performance in terms of throwing motion and accuracy in elite volleyball players. The findings show that Ergon IASTM and foam rolling can significantly increase the passive ROM of athletes' shoulder girdle, whereas Kinesio Taping appeared to affect it negatively. Moreover, Ergon IASTM resulted in significantly higher flexion ROM values than foam rolling and Kinesio Taping. Ergon IASTM and foam rolling resulted in significantly higher internal and external rotation than Kinesio Taping, with no significant differences between them.

These findings support the results of several original studies and reviews. The positive effects of IASTM techniques on ROM have been reported by two systematic reviews[14, 15], which found that IASTM can improve functionality and significantly increase ROM immediately after application. Foam rolling has also been reported to lead to an increase in range of motion. However, in this study, IASTM resulted in relatively greater improvements in passive shoulder ROM that foam rolling and significantly greater than Kinesio Taping. This may be due to improved fascial layer sliding, increased skin temperature, and decreased collagen resistance after IASTM treatments. It can also be attributed to neurophysiological mechanisms, as IASTM has been reported to stimulate intrafascial mechanoreceptors, leading to altered proprioceptive input to the central nervous system, which results in a global decrease in the muscle tone of the involved muscle groups[16]. The superiority of Ergon IASTM to foam rolling can further be explained by the fact that techniques using narrow-surface equipment are more targeted and can penetrate deeper, thus better mobilizing soft tissue than wider-surface equipment. These positive short-term ROM adaptations after IASTM, and particularly the superiority of such techniques to foam rolling, have also been reported by Simatou et al.[7], who found that Ergon IASTM of the lateral myofascial line is more effective in increasing hip adduction

ROM than foam rolling and stretching.

In this study, IASTM considerably improved the performance of the left upper extremity in terms of OSP and showed significantly higher bilaterally averaged OSP values than Kinesio Taping. However, no significant differences were observed between IASTM and foam rolling in these respects. Furthermore, no significant differences were observed between the three treatments in terms of FTPI. This finding is surprising, as one would expect that the observed improvement in shoulder ROM would also be associated with an improvement in functional performance indicators such as throwing accuracy. Kinesio Taping has been reported to enhance functional performance by improving neuromuscular joint performance. Such functional adaptations are not evident in this study.

The observed non-significant improvement in high-level athletes' throwing accuracy can be attributed to the limitations of this study, especially to the passive application of the investigated techniques. Both Ergon IASTM and athletic elastic taping were passively applied, with no movement of the shoulder girdle, and foam rolling was not performed in a way that simulated ball-throwing movements. A dynamic application of these techniques during functional movements may lead to neurophysiological adaptations that improve functional shoulder performance. The observed non-significant effects may also be explained by the relatively small sample size of the study. The importance of our findings, if confirmed by future studies, is quite apparent in the fields of elite athlete's preparation and sports injury prevention, given that sufficient shoulder ROM is a necessity of optimal performance and injury prevention in volleyball. Therefore its seems reasonable to suggest that IASTM and foam rolling techniques should be part of preparing an athlete to participate in the elite-level sports activities as they appear to be associated with improved shoulder functionality.

In conclusion, this pilot study on high-level athletes provides evidence that the application of soft tissue techniques such as IASTM and foam rolling can lead to greater improvements in passive range of motion than Kinesio Taping. The Ergon IASTM technique can also improve the shoulder's throwing ability. However, further research is needed to confirm these findings. Future studies should also evaluate dynamic and functional applications using larger athlete samples.

Conflict of interest

None.

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