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Acute effects of instrument assisted soft tissue mobilization vs. foam rolling on knee and hip range of motion in soccer players

Goran Markovic, Ph.D. [a,b,*]

[a] *Motor Control and Human Performance Laboratory, School of Kinesiology, University of Zagreb, Croatia*
[b] *Research Unit, Motus Melior Ltd., Zagreb, Croatia*

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Summary The aim of the present investigation was to evaluate the acute effects of foam rolling (FR) and a new form of instrument-assisted soft tissue mobilization (IASTM), Fascial Abrasion Technique ™ (FAT) on hip and knee range of motion in soccer players. Twenty male soccer players randomly allocated into FR and FAT group ($n = 10$ each). Passive knee flexion and straight leg raise tests were measured before, immediately after and 24 h after intervention (FR or FAT). The FR group applied a 2-min quadriceps and hamstrings rolling, while FAT group received a 2-min application of FAT to the quadriceps and hamstrings muscles. Both groups significantly improved knee and hip ROM ($p < 0.05$), with higher gains observed in FAT group (10–19% vs. 5–9%). At 24 h post-treatment, only FAT group preserved most of the gains in ROM (7–13%; $p < 0.05$). These results support the use of the newly developed IASMT, Fascial Abrasion Technique ™ and FR for increasing lower extremity ROM of athletes.

Introduction

Muscle tightness and restricted lower extremity range of motion (ROM) are common in team sports like soccer and Australian football. A number of studies have shown that reduced hip and knee range of motion increases the risk of thigh muscle injuries in sports involving sprinting (Bradley and Portas, 2007; Gabbe et al., 2005; Henderson et al., 2010; Witvrouw et al., 2003). In addition, it has been demonstrated that reduced joint ROM in lower extremities decreases movement efficiency (Rabin et al., 2014; Willems et al., 2014). Thus, maintaining and regaining normal ROM is vital for injury prevention and performance gains.

A common modality that has been used for improving joint ROM in sports and exercise settings is stretching, static stretching in particular. It is well known that both acute and chronic stretching exercise improve lower

* School of Kinesiology, University of Zagreb, Horvacanski zavoj 15, 10000 Zagreb, Croatia. Tel.: +385 13658666.
E-mail address: gmarkov@kif.hr.

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extremity ROM (for review, see Behm and Chaouachi, 2011; Decoster et al., 2005). Furthermore, recent reviews of literature suggest that stretching could be effective in reducing muscle strains (McHugh and Cosgrave, 2010; Small et al., 2008). However, there is compelling evidence that pre-exercise static stretching could also impair neuromuscular performance (Behm and Chaouachi, 2011; Simic et al., 2013). Aside from stretching, self-myofascial release with foam roller (FR) or stick roller (SR) (Button et al., 2015; Halperin et al., 2014; MacDonald et al., 2013; Mohr et al., 2014; Sullivan et al., 2013), and instrument assisted soft-tissue mobilization (IASTM; Laudner et al., 2014; Vardiman et al., 2015) have been recently used in clinical and sports practice for joint ROM enhancement.

Regarding self-myofascial release, the results consistently show that the use of both FR (MacDonald et al., 2013; Mohr et al., 2014) and SR (Button et al., 2015; Halperin et al., 2014; Sullivan et al., 2013) acutely improve lower extremity ROM in healthy young adults, without compromising neuromuscular performance. Regarding IASTM, limited previous studies provided conflicting findings (Laudner et al., 2014; Vardiman et al., 2015). Laudner et al. (2014) showed that the application a Graston technique (i.e. one of several IASTM techniques) to the posterior shoulder provides acute improvements in both glenohumeral horizontal adduction ROM and internal rotation ROM among baseball players. In contrast, Vardiman et al. (2015) applied the same instrument to human plantar flexors and reported no change in dorsiflexion ROM and muscle strength following treatment. Thus, more studies are needed to clarify the acute effects of IASTM on joint ROM.

Recently, a new form of IASTM, Fascial Abrasion Technique (FAT ™), has been introduced. Contrary to already known IASTM techniques that apply tools with smooth surface, FAT ™ uses an instrument (FAT-Tool) with a textured finish that grips surface tissue allowing for deep and effective tissue mobilization, with less direct pressure required. Consequently, treatment time of a particular area can be prolonged compared with treatments utilizing Graston or similar tools (Laudner et al., 2014), without creation of bruising on the treated tissue. It is theorized that these attributes maximize the ability of the FAT-Tool to (1) loosen areas of increased fascial tension, (2) soften and reduce the viscosity of tissue through accumulation of friction-related heat, and (3) stimulate an environment of improved fluid dynamics, including improved blood flow and lymphatic circulation.

To our best knowledge, no study compared self-myofascial release and any form of IASTM technique regarding their effectiveness in improving ROM. The purpose of this study was to compare the acute effects of FR and a new form of IASTM, FAT™, on hip and knee range of motion in soccer players. We also tested the residual effects of selected soft-tissue treatments 24 h after their application.

Methods

Subjects

To compare the effects of FR and FAT on hip and knee range of motion, 20 regional-level male soccer players (age: 19 ± 2 years; mass: 73.3 ± 4.5 kg; height: 179 ± 5.6 cm; mean ± SD) volunteered to participate. They were randomly allocated into FR (n = 10) and FAT group (n = 10). Before participation, an explanation of the study was given, and the subjects were asked to read and sign an informed consent. The experiment was performed during off-season (i.e. a short active break between 2 competitive seasons). None of the subjects had a history of thigh muscle injuries during the last 2 years, verified by a medical history exam. All subjects were asked to (a) maintain a normal diet, (b) refrain from alcohol, nicotine, and caffeine consumption at least 48 h before and during the testing sessions, (c) refrain from use of pain reliever and analgesics for the duration of the study, and (d) not participate in any vigorous physical activity 48 h before and during the study. The study was approved by the School of Kinesiology, University of Zagreb Institutional Review Board.

Experimental procedure

The experiment consisted of 2 testing sessions, separated by 24 h. Subjects performed a standardized warm-up at the beginning of both testing sessions. This warm-up consisted of 5-min cycling on cycle ergometer at 75 W and 70–80 rev/min, walking lunges (2 × 5 each leg), walking knee to chest (2 × 5 each leg), side squats (2 × 5 each leg), deep squats (2 × 5), standing toe-touches (2 × 8), and static stretching of quadriceps and hamstring muscles (2 × 30 s each). During the first testing session, the warm up was followed by an initial measurement of hip and knee ROM (Pre-test), a short intervention (either FR or FAT), and a final measurement of hip and knee ROM (Post-test). The second testing session consisted only of warm up and measurement of hip and knee range of motion (24 h Post-test). Both testing sessions were performed at the same time of day (i.e. between 4 p.m and 6 p. m.) to avoid possible confounding circadian effects.

Acute effects of each soft-tissue treatment (i.e. FR and FAT) on knee and hip ROM were evaluated using the two common ROM/muscle length tests: supine passive knee flexion test and passive straight leg raise test (Norkin and White, 2009). Subjects wore only underwear during performance of both tests. Both tests were measured on a dominant leg before, immediately after, and 24 h after treatment using the Pro 3600 digital inclinometer (SPI-Tronic, Garden Grove, CA). This device provides real-time digital reading of angles with respect to either a horizontal or vertical reference. This device is accurate up to 0.1° as reported by the manufacturer. Two measurements of supine knee flexion test, followed by two measurements of passive straight leg raise test were taken each time to the nearest degree (°), and the highest scores achieved were used for analysis. Both tests proved to be reliable in previous studies (ICC > 0.90) (Gogia et al., 1987; Youdas et al., 2005). The rest period between tests was about 1 min.

Supine passive knee flexion test

The subject was placed in supine position, with both knees extended and hips in 0 degrees of flexion, extension, abduction, adduction, and rotation. The examiner held the subject's ankle in one hand and anterior thigh with the