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ORIGINAL RESEARCH

Immediate effects of hamstring stretching alone or combined with ischemic compression of the masseter muscle on hamstrings extensibility, active mouth opening and pain in athletes with temporomandibular dysfunction

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KEYWORDS
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Summary *Objective:* To assess the immediate effects of hamstrings stretching alone or combined with ischemic compression of the masseter muscle on hamstrings extensibility, active mouth opening and pain in athletes with temporomandibular dysfunction and hamstrings shortening.
Methods: Forty-two participants were randomized to receive the stretching technique ($n = 21$) or the stretching plus the ischemic compression ($n = 21$). Outcome measures were: hamstrings extensibility, active mouth opening, pressure pain thresholds and pain intensity.
Results: Both interventions improved significantly active mouth opening (group 1: 35.7 ± 6.7 to 39.1 ± 7.6 mm, $p < 0.001$; group 2: 34.0 ± 6.2 to 37.6 ± 5.6 mm, $p < 0.001$), active knee extension (group 1: 33.1 ± 8.5 to $40.8 \pm 8.2°$, $p < 0.001$; group 2: 28.9 ± 6.5 to $35.5 \pm 6.4°$, $p < 0.001$) and pain. No significant differences were found between interventions.

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Conclusion: Hamstrings stretching induced an acute improvement in hamstrings extensibility, active mouth opening and pain. Moreover, the addition of ischemic compression did not induce further improvements on the assessed parameters.

Introduction

The term temporomandibular dysfunction (TMD) has been used as an umbrella term that integrates clinical features of the masticatory muscles and/or temporomandibular joint and associated structures (De Rossi et al., 2014). It is a multifactorial condition characterized by decreased mandibular range of motion, pain or tenderness, joint crepitus and functional limitation (De Rossi et al., 2014; Rashid et al., 2013). It affects more than 25% of the general population, being more frequent in women between 20 and 45 years of age (Maluf et al., 2010).

The treatment of the TMD is multidisciplinary, and initially should be based on the use of conservative, evidence-based, therapeutic modalities (De Rossi et al., 2014). Manual physical therapy plays an important role in the management of TMD, namely on disability, range of motion and pain (Furto et al., 2006). Among the techniques of manual therapy, myofascial and trigger points therapy is receiving increasing attention as a means to improve muscle function, joint movement and pain (Armijo-Olivo et al., 2016; Maluf et al., 2010; Rodriguez-Blanco et al., 2015). In this regard, several studies showed positive effects of neuromuscular techniques (Rodriguez-Blanco et al., 2015), static stretching exercises (Maluf et al., 2010), and mandibular therapeutic exercise (Armijo-Olivo et al., 2016) in the treatment of myofascial trigger points of the masticatory muscles. Similarly, there are also studies showing positive effects on pressure pain thresholds and active mouth opening for interventions directed at sites distant from the temporomandibular joint, such as manipulation of the atlanto-occipital joint and inhibition techniques of the suboccipital muscles (Mansilla-Ferragut et al., 2009; Oliveira-Campelo et al., 2010). From a holistic point of view, the "fascial connection theory" (Moon and Lee, 2011) and the "tensegrity theory" (Huijing and Jaspers, 2005) provided a good theoretical basis for understanding the functional connection between the temporomandibular joint and other parts of the body and how the restriction of movement of a body part may implicate dysfunction in distal parts, changing the balance of mechanical forces in the body. Recently, some authors (Rodriguez-Blanco et al., 2015) have argued in favour of an anatomical relationship between the hamstrings, the cervical spine and the temporomandibular joint based on the continuity of the neural system and on a functional relationship between hamstring and masticatory muscles through the concept of muscle chains. Furthermore, authors have shown that stretching of the hamstring musculature produced an immediate increase in pressure pain thresholds measured over the masseter muscle in healthy participants (Rodriguez-Blanco et al., 2015) and in participants with masseter trigger points (Fernández-de-las-Peñas et al., 2006b) and an increase in active mouth opening.

The hypothesis that a treatment applied to a muscle distant from the temporomandibular joint could have a positive impact on active mouth opening and craniocervical musculoskeletal pain was previously investigated in healthy participants (Bretischwerdt et al., 2010) and in participants with TMD (Maluf et al., 2010; Rodriguez-Blanco et al., 2015). Likewise, the opposite was also investigated, i.e., whether local interventions applied to the masticatory muscles could induce changes at distance (Tecco et al., 2010). Despite this, the number of studies (Maluf et al., 2010; Rodriguez-Blanco et al., 2015) examining the effectiveness of distal interventions on TMD is still limited. This is particularly evident in athletes diagnosed with TMD and hamstrings shortening. Maluf et al. (2010) compared two interventions, global postural reeducation and static stretching exercises for the cervical spine, head, upper limbs, and mandibular muscles (masseter and anterior temporalis), in the treatment of women with temporomandibular disorders. The authors showed that both interventions similarly reduced pain intensity and increased pain thresholds. Rodriguez-Blanco et al. (2015) evaluated the effects of a neuromuscular technique over the masseter muscle and stretching of the hamstring muscles against a group receiving the same intervention plus suboccipital inhibition technique and observed that the addiction of the suboccipital inhibition technique did not have any impact on improving mouth opening, suboccipital and lumbar mobility, and orofacial sensitivity to mechanical pressure.

Hence, the present study aims to assess the immediate effects of a single bilateral stretching of the hamstrings musculature versus bilateral stretching of the hamstrings muscles plus ischemic compression over the trigger points of the masseter muscle on the hamstrings extensibility, maximal amplitude of vertical mouth opening, pressure pain thresholds over the myofascial trigger points of the masseter muscle and pain intensity in athletes diagnosed with TMD and hamstrings shortening.

Methods

Study design, randomization and implementation

A randomized, single-blind, controlled trial was carried out. Participants were randomly (block randomization, 1:1) allocated to 1 of 2 groups. The randomization was performed by allowing the participant to pick up a number out of a hat. The group 1 received a treatment session composed by