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PREVENTION & REHABILITATION: RANDOMIZED CONTROLLED TRIAL

The effect of dry needling on pain, pressure pain threshold and disability in patients with a myofascial trigger point in the upper trapezius muscle☆

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Summary Dry needling (DN) has been used recently by physical therapists as a therapy of choice for patients with myofascial trigger points (TrP).

The purpose of this randomized controlled trial was to investigate the effect of DN in the treatment of TrPs in the upper trapezius (UT) muscle. A sample of convenience of 33 patients with TrP in the UT muscle participated in this study. Patients were randomly assigned to a standard ($N = 17$) or experimental group ($N = 16$). The treatment protocol for the standard group consisted of trigger point compression technique (TCT) on MTP, while the patients in the experimental group received DN.

Pain intensity and pressure pain thresholds were assessed for both groups before and after the treatment sessions. In addition, the Disability of Arm, Hand, and Shoulder (DASH) was administered.

Statistical analysis (paired *t*-test) revealed a significant improvement in pain, PPT and DASH scores after treatment in the experimental (DN) and standard (TCT) group compared with before treatment ($P < 0.05$). The ANCOVA revealed significant differences between the DN and TCT groups on the post-measurement VAS score ($P = 0.01$). There was, however, no

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significant difference between the two groups on the post-measurement score of the PPT ($P = 0.08$) and DASH ($P = 0.34$). DN produces an improvement in pain intensity, PPT and DASH and may be prescribed for subjects with TrP in UT muscles especially when pain relief is the goal of the treatment.

Introduction

Musculoskeletal pain is a major cause of morbidity in today's societies (Millennium, 2003; Rickards, 2006; Tough et al., 2007; Yap, 2007). About one-third of the patients with musculoskeletal pain meet the diagnostic criteria for myofascial pain syndrome (Rickards, 2006). A myofascial trigger point (TrP) has been described as a hyperirritable spot located in a taut band of muscle; or a small pea or rope-like nodular or crepitant (crackling, grating) area within the muscle, which is painful to palpation or compression and refers pain, tenderness, or an autonomic response to a remote area. Some investigators stated that when pressure is applied to a TrP, a "jump sign" or "jump response" is elicited whereby the patient reacts with facial grimacing or by jumping away from the examiner (Hanten et al., 2000).

Previous studies have indicated that TrPs are a primary source of musculoskeletal pain in 30—85% of patients (Fricton et al., 1985; Fishbain et al., 1986; Rickards, 2009; Tough et al., 2009).

The prevalence of TrP varies from 21% of patients seen in a general orthopedic clinic, to 30% of general medical clinic patients with regional pain, to as high as 85—93% of patients presenting to specialty pain management centers (Gerwin, 1995; Borg-Stein and Simons, 2002; Shah et al., 2008).

Trigger points may have detrimental effects on people's social and work-related activities with a significant impact on the quality of life, causing pain and functional disability in the neck and shoulder areas (Cummings and Baldry, 2007; Tough et al., 2007; Yap, 2007).

TrPs may result from or be provoked by trauma, overuse, mechanical overload, postural faults, or psychological stress (Hanten et al., 2000). Considering the sedentary lifestyle in today's societies with too much time in static postures, phasic muscles become progressively inhibited and lax while postural muscles will gradually become tighter. A muscle imbalance between the dynamic and postural muscles may lead to TrPs in the lumbo-pelvic or cervical region (Yap, 2007).

Trigger points are classified as active or latent, depending on their clinical characteristics. An active trigger point causes pain at rest. It is tender to palpation with a referred pain pattern that is similar to the patient's pain complaint. This referred pain is commonly felt not at the site of the trigger point origin, but remote from it. Referred pain is an important characteristic of an active trigger point (Han and Harrison, 1997; Alvarez and Rockwell, 2002). A latent trigger point does not cause spontaneous pain, but may restrict movement or cause muscle weakness. The patient presenting with muscle restrictions or weakness may become aware of pain originating from a latent trigger point only when pressure is applied directly over the point (Ling and Slocumb, 1993; Alvarez and Rockwell, 2002).

Investigators established that the local oxygen saturation at a TrP site may be less than 5% of normal (Brückle et al., 1990).

Hypoxia leads to a drop in tissue pH and the release of several nociceptive chemicals, including bradykinin, CGRP, and substance P (Shah et al., 2003; Dommerholt, 2004), which have been shown in active TrPs (Mense et al., 2001; Shah, 2008; Shah et al., 2008).

Local tenderness and referred pain are common with TrPs as muscle nociceptors are stimulated in response to reduced oxygen levels and lowered pH and increased inflammatory chemicals (Dommerholt, 2004; Chaitow et al., 2006; Hsieh et al., 2007; Tough et al., 2009).

Histological studies have confirmed the presence of extreme sarcomere contractions, resulting in localized tissue hypoxia (Reitinger et al., 1996; Windisch et al., 1999).

The combination of increased levels of CGRP and lowered pH suggest that the TrP site is too acidic for acetylcholinesterase (AChE) to work efficiently. It has been hypothesized that the injured muscle fibers shorten (making taut bands) either in response to excessive amounts of calcium ions being released from within the damaged fibers, or in response to the corresponding motor endplate releasing excessive amounts of ACh (Dommerholt, 2004; Chaitow et al., 2006; Tough et al., 2009).

The upper trapezius (UT) muscle was found to be often affected by TrPs (Sciotti et al., 2001; Gemmell and Allen, 2008; Sarrafzadeh et al., 2012). The common symptoms and pain patterns in subjects with TrP in the UT muscle are taut and painful muscle, tension headache, neck pain, dizziness or vertigo, limited neck and shoulder ROM (Hanten et al., 2000; Rudin, 2003; Fernández-de-Las-Peñas et al., 2007; Lucas et al., 2009).

Considering the role of the UT muscle in scapulohumeral rhythm during shoulder movement, it is thought that TrPs in the UT muscle can result in an altered scapulohumeral rhythm and shoulder dysfunction and disability.

One of the unique characteristics of a TrP is the local twitch response (LTR) phenomenon, which is an involuntary spinal cord reflex contraction of the contracted muscle fibers in a taut band following palpation or needling of the taut band in TrP (Dommerholt, 2004; Rickards, 2009).

Several treatment protocols have been suggested for TrP. No definitive protocol, however, has been considered as the therapy of choice for individuals with TrPs.

Physical therapy programs play a significant role in treatment and improvement of symptoms in patients with TrP. The trigger point compression technique (TCT) is one of the most common treatment methods currently used for