Effects of Deep Cervical Flexor Training on Pressure Pain Thresholds Over Myofascial Trigger Points in Patients With Chronic Neck Pain

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Abstract

Objective: The purpose of this study was to assess the effects of a low-load training program for the deep cervical flexors (DCFs) on pain, disability, and pressure pain threshold (PPT) over cervical myofascial trigger points (MTrPs) in patients with chronic neck pain.

Methods: Thirty patients with chronic idiopathic neck pain participated in a 6-week program of specific training for the DCF, which consisted of active craniocervical flexion performed twice per day (10-20 minutes) for the duration of the trial. Perceived pain and disability (Neck Disability Index, 0-50) and PPT over MTrPs of the upper trapezius, levator scapulae, and splenius capitis muscles were measured at the beginning and end of the training period.

Results: After completion of training, there was a significant reduction in Neck Disability Index values (before, 18.2 ± 12.1; after, 13.5 ± 10.6; $P < .01$). However, no significant changes in PPT were observed over the MTrPs.

Conclusion: Patients performing DCF training for 6 weeks demonstrated reductions in pain and disability but did not show changes in pressure pain sensitivity over MTrPs in the splenius capitis, levator scapulae, or upper trapezius muscles. (J Manipulative Physiol Ther 2013;36:604-611)

Key Indexing Terms: *Neck Pain; Exercise; Neck Muscles; Trigger Points*

It is estimated that 67% of the population will experience neck pain at some point in their life,[1] with a higher prevalence in women (22%) than in men (16%).[2] The estimated annual prevalence of neck pain ranges between 30% and 50% of the adult population.[3] Neck pain tends to become chronic and recurrent; thus, it is not uncommon that an individual experiences periods of remission and exacerbation of symptoms after a first episode of neck pain.[4] These epidemiological data translate into a significant economic and social impact[5]; hence, appropriate management of neck pain to prevent the transition to chronicity has been established as a priority in forums and debates.[6] This trend to chronicity can be attributed in part to an inadequate recovery of cervical muscle function after a first episode of neck pain[7] especially considering that stability of the cervical spine largely depends on adequate muscle control.[8]

Patients with idiopathic and trauma-induced chronic neck pain show dysfunction of the deep cervical flexors (DCFs) (longus colli and longus capitis).[9,10] Studies have confirmed reduced strength and endurance of these muscles,[11,12] reduced activation during a task of craniocervical flexion,[13] and delayed activation in response to postural perturbations.[14] Furthermore, patients with higher reported levels of neck pain were shown to display the greatest dysfunction of the DCF muscles.[15]

Myofascial trigger points (MTrPs) are a clinical entity that can contribute to neck pain. Indeed, the referred pain elicited by active MTrPs in the neck and shoulder muscles has been shown to contribute to symptoms of mechanical neck pain.[16] An *MTrP* is defined as a hyperirritable focus within a taut band of skeletal muscle that is painful on compression and that, when stimulated (usually by compression, percussion, or needling), can evoke a characteristic pattern of referred pain and related autonomic phenomena.[17] In addition, the motor behavior of a muscle with an MTrP may be altered in the form

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of muscular inhibition, increased fatigability, delayed relaxation after activation,[17] or alteration of its physiological motor recruitment pattern.[18] A previous study showed that the presence of latent MTrPs in the scapular rotator muscles decreases the consistency of the motor activation pattern of this muscle group while also affecting muscles more distal in the upper limb chain. Moreover, treatment to remove latent MTrPs normalized the motor activation pattern.[18] However, no studies have investigated the effects of motor control training on MTrPs. Although training of the DCF in patients with neck pain has been shown to reduce pain and disability and enhance the activation of the DCF,[19] whether this training can influence the sensitivity of MTrPs in the superficial muscles of the neck is unknown. Therefore, the purpose of this study was to evaluate the effects of a specific low-load training program for the DCF on the pressure pain threshold (PPT) of MTrPs located in selected superficial neck muscles as well as on perceived pain and disability in patients with chronic neck pain.

Methods

Participants

Subjects between 18 and 60 years old with chronic idiopathic neck pain were invited to participate in the study. Recruitment was performed by notices distributed in different universities and hospitals. Besides presenting with a history of neck pain lasting 3 months or more over the last year, subjects who were included in the study were required to have a score of 5/50 or higher in the Neck Disability Index (NDI)[20] and have active or latent MTrPs in at least one of the following muscles: upper trapezius, levator scapulae, or splenius capitis. The testing sites for PPT were chosen as they are known clinically to be sensitive in patients with chronic nonspecific neck pain,[21] have shown increased tenderness to local mechanical pressure,[22] and have been used in trials to assess reliability of pressure algometry and outcomes after treatment.[23] Both active and latent MTrPs were considered because latent MTrPs have been associated to the development of sensory-motor dysfunction and can contribute to different chronic musculoskeletal pain disorders.[24,25]

Subjects were excluded if they had previous cervical spine surgery, cervical radiculopathy, presence of a severe systemic disease (ie, diabetes), fibromyalgia, or other widespread musculoskeletal pain syndromes (ie, chronic fatigue syndrome) or had participated in an exercise program for the neck muscles in the 6 months preceding the study.

Ethical approval for the study was granted by the Institutional Ethics Committee (University CEU Cardenal Herrera, Valencia, Spain), and the procedures were conducted according to the Declaration of Helsinki.

Study Design

This study was a single-group design with repeated measures. Earlier studies have demonstrated the efficacy of the training intervention applied in the current study in randomized controlled trials.[19,26,27] The outcome measurements for the study were patient-reported levels of pain and disability rated on the NDI and PPT over active/latent MTrPs of the upper trapezius, levator scapulae, and splenius capitis, bilaterally. All were assessed at baseline and in the week immediately after the 6-week intervention period (week 7).

Procedure

Patients were initially examined by a researcher who assessed compliance with the inclusion and exclusion criteria. In addition, demographic and anthropometric data of each patient were recorded. Subjects who met the study requirements completed the NDI and were then examined for the presence of active/latent MTrPs in the upper trapezius, levator scapulae, and splenius capitis muscles, and PPT was measured at these points. Finally, the craniocervical flexion test (CCFT) was carried out to identify the starting level of exercise for each patient. During week 7, measures of the NDI and PPT of the MTrPs were repeated.

Neck Disability Index. The NDI questionnaire is a clinical tool designed to assess perceived pain and disability in patients with neck pain.[20,28] It consists of a total of 10 items each with 6 possible choices. The NDI is a valid, reliable, and sensitive tool for measuring changes in pain and disability in patients with neck pain.[28] This study used the Spanish version of the NDI validated by Andrade et al.[29]

Pressure Pain Threshold Measurement and MTrPs. Pressure pain threshold of active and latent MTrPs of the upper trapezius ($MTrP_2$ according to Simons et al[17]), levator scapulae (insertional MTrP[17]), and splenius capitis[17] was recorded bilaterally (Fig 1). To ensure repeatability in location, the distance to the MTrPs from the spinous process of C7 (for the upper trapezius and levator scapulae MTrPs) and the mastoid process (for the splenius capitis MTrP) was measured. Testing sites were also marked and photographed as this has been shown to improve the reliability of PPT measurements.[30]

The presence of a MTrP was performed using the following diagnostic criteria described by Simons et al[17]: (1) presence of a palpable taut band in a skeletal muscle, (2) presence of a hypersensitive tender spot in the taut band, (3) local twitch response elicited by snapping palpation of the taut band, and (4) reproduction of the typical referred pain pattern of the MTrP in response to compression. Myofascial trigger point was considered latent if these 4 criteria were satisfied. If the patient additionally recognized the referred pain as familiar, then the MTrP was considered to be active.[17]

Pressure pain threshold was measured with an analog algometer (Force Dial model FDK 20; Wagner Instruments, Greenwich, CT) with a surface area at the round tip of 1 cm^2. The algometer probe tip was applied perpendicularly to the