The Journal of Pain, Vol 11, No 3 (March), 2010: pp 256-263
Available online at www.sciencedirect.com

Bilateral Mechanical-Pain Sensitivity Over the Trigeminal Region in Patients With Chronic Mechanical Neck Pain

Roy La Touche,*† César Fernández-de-las-Peñas,‡§¶ Josué Fernández-Carnero,‡§¶ Santiago Díaz-Parreño,*† Alba Paris-Alemany,*† and Lars Arendt-Nielsen‡

*Faculty of Medicine, Department of Physical Therapy.
†University Center for Clinical Research of the Craneal-Cervical-Mandibular System, Universidad San Pablo CEU, Madrid, Spain.
‡Department of Physical Therapy, Occupational Therapy, Rehabilitation and Physical Medicine.
§Esthesiology Laboratory, Universidad Rey Juan Carlos, Alcorcón, Madrid, Spain.
¶Centre for Sensory-Motor Interaction (SMI), Department of Health Science and Technology, Aalborg University, Aalborg, Denmark.

Abstract: **The aim of this study was to investigate bilateral pressure-pain sensitivity over the trigeminal region, the cervical spine, and the tibialis anterior muscle in patients with mechanical chronic neck pain. Twenty-three patients with neck pain (56% women), aged 20 to 37 years old, and 23 matched controls (aged 20 to 38 years) were included. Pressure pain thresholds (PPTs) were bilaterally assessed over masseter, temporalis, and upper trapezius muscles, the C5-C6 zygapophyseal joint, and the tibialis anterior muscle in a blinded design. The results showed that PPT levels were significantly decreased bilaterally over the masseter, temporalis, and upper trapezius muscles, and also the C5-C6 zygapophyseal joint ($P < .001$), but not over the tibialis anterior muscle ($P = .4$) in patients with mechanical chronic neck pain when compared to controls. The magnitude of PPT decreases was greater in the cervical region as compared to the trigeminal region ($P < .01$). PPTs over the masseter muscles were negatively correlated to both duration of pain symptoms and neck-pain intensity ($P < .001$). Our findings revealed pressure-pain hyperalgesia in the trigeminal region in patients with mechanical chronic neck pain, suggesting spreading of sensitization to the trigeminal region in this patient population.**

Perspective: ***This article reveals the presence of bilateral pressure-pain hypersensitivity in the trigeminal region in patients with idiopathic neck pain, suggesting a sensitization process of the trigemino-cervical nucleus caudalis in this population. This finding has implications for development of management strategies.***

Key words: *Neck pain, trigeminal sensitization, pressure pain threshold.*

Chronic mechanical neck pain is a significant clinical problem. It seems that the prevalence of neck pain is as high as the prevalence of low back pain. A systematic review reported a 1-year prevalence for neck pain ranging from 16.7 to 75.1%, with a mean of 37.2%.[11] A best-evidence synthesis showed an incidence rate for self-reported neck pain in the general population between 146 and 213 per 1,000 patients per year.[21] Nearly half of neck-pain patients develop chronic symptoms,[4] and many will continue to exhibit moderate disability at long-term follow-up.[17] The economic burden associated with the management of neck pain is second only to low back pain in annual workers' compensation costs in the United States.[44]

Although the aetiology of insidious mechanical neck pain is under debate, it is clear that neck pain is multifactorial in nature, with both physical and psychosocial contributors.[38] In recent years, there has been an increasing interest in the study of nociceptive-pain processing in different musculoskeletal-pain conditions. For instance, pressure pain thresholds[5,32] have been extensively used for investigating mechanical pain hypersensitivity in several chronic pain conditions, eg, whiplash,[36] fibromyalgia,[9] unilateral migraine,[14] repetitive strain injury,[18] tension-type headache,[13] osteoarthritis,[1] low back

Received May 31, 2009; Revised June 29, 2009; Accepted July 22, 2009.
Address reprint requests to César Fernández de las Peñas, Facultad de Ciencias de la Salud, Universidad Rey Juan Carlos, Avenida de Atenas s/n, 28922 Alcorcón, Madrid, Spain. E-mail: cesar.fernandez@urjc.es
1526-5900/$36.00

doi:10.1016/j.jpain.2009.07.003

pain,[27] or carpal tunnel syndrome.[15] Nevertheless, the phenomenon of sensory hypersensitivity has been relatively recently investigated in mechanical nontraumatic neck pain.[37]

Scott et al[33] found that the hypersensitivity present in individuals with idiopathic neck pain seems to be confined to the neck area with little evidence of spread to more remote body regions, eg, the tibialis anterior muscle, as opposite happens in chronic whiplash. The presence of hypersensitivity restricted to the neck region may reflect segmental local sensitization, but not widespread central sensitization, in patients with idiopathic neck pain.

Several studies have reported that patients with neck pain also suffered from symptoms in the orofacial region,[7,8,23] and headaches.[29] The expansion of symptoms from the neck area to the trigeminal region may be related to the convergence of the nociceptive second-order neurons receiving both trigeminal and cervical inputs into the trigemino-cervical nucleus caudalis in the spinal gray matter of the spinal cord.[25] To the best of our knowledge, no previous study has investigated the pressure hypersensitivity over the trigeminal region in chronic mechanical neck pain. Further, Rhudy and Meagher[31] demonstrated that psychological states, particularly anxiety and depression, induce an increased effect on pressure-pain sensitivity. Therefore, the aim of the present study was to investigate trigeminal sensitization in patients with chronic mechanical neck pain controlling psychological aspects, such as depression and anxiety.

Methods

Subjects

Patients presenting with mechanical insidious neck pain referred by their primary-care physicians to a specialized physical-therapy clinic between September 2007 and February 2008 were screened for possible eligibility criteria. Mechanical neck pain was defined as generalized neck and/or shoulder pain with symptoms provoked by neck postures, neck movement, or palpation of the cervical musculature. Symptoms had to be bilateral and present for at least 6 months. Patients were excluded if they exhibited any of the following: 1) unilateral neck pain; 2) diagnosis of fibromyalgia;[43] 3) previous whiplash; 4) cervical spine surgery; 5) clinical diagnosis of cervical radiculopathy or myelopathy; 6) history of previous physical-therapy intervention for the cervical region; 7) presence of severe degenerative arthritis (confirmed by cervical radiography taken for all patients over the age of 30 years); 8) less than 18 years; 9) diagnosis of any TMD, according to the Research Diagnostic Criteria for TMD (RDC/TMD)[10]; or 10) concomitant diagnosis of primary headache.

Demographic and Clinical Data

Demographic data including age, gender, height, weight, location, and nature of the symptoms was collected. An 11-point numerical point rate scale[22] (NPRS; 0 = no pain, 10 = maximum pain) was used to assess current level of neck pain. Patients also completed the Neck Disability Index (NDI) to measure perceived disability,[42] the Beck Depression Inventory (BDI-II) to assess symptoms of depression,[2] and the State-Trait Anxiety Inventory (STAI) for assessing state and trait anxiety.[34]

The NDI consist of 10 questions measured on a 6-point scale (0 = no disability, 5 = full disability).[42] The numeric score for each item is summed for a score varying from 0 to 50, where higher scores reflect greater disability. The NDI has demonstrated to be a reliable (intraclass correlation coefficients ranging from .50 to .98)[24] and valid self-assessment of disability in chronic neck pain.[19,39]

The BDI-II is a 21-item self-report measure assessing affective, cognitive, and somatic symptoms of depression.[2] Patients choose from a group of sentences that best describe how they have been feeling in the past 2 weeks. Higher scores indicate higher levels of depressive symptoms.[2] The BDI-II showed good internal consistency (alpha coefficient .90) and adequate divergent validity.[41]

The STAI is a self-report assessment device which includes separate measures of state and trait anxiety.[34] In the present study, the trait-anxiety subscale which denotes relatively stable anxiety proneness and refers to a general tendency to respond with anxiety to perceived threats in the environment was used. Participants use a 4-point response scale ranging from "almost never" to "almost always", indicating the extent to which they experience each emotion. The State-Trait questionnaire has shown good internal consistency (α = .83). Higher scores indicate greater trait anxiety.[34]

Finally, healthy controls were recruited from volunteer who responded to a local announcement and were excluded if they exhibited a history of neck, facial, or head pain (infrequent episodic tension-type headache was permitted), any systemic disease or any history of traumatic event (whiplash).

The study was conducted in accordance with the Helsinki Declaration, and all subjects provided informed consent which was approved by the local ethics committee.

Sample Size Determination

The sample-size determination and power calculations were performed with an appropriate software (Tamaño de la Muestra, v.1.1, Universidad de Medicina, Madrid, Spain). The calculations were based on detecting, at the least, significant clinical differences of 20% on pressure pain threshold (PPT) between both groups,[28] with an alpha level of .05 and a desired power of 80%, and an estimated interindividual coefficient of variation for PPT measures of 20%. This generated a sample size of at least 16 participants per group.

PPT Assessment

PPT is defined as the minimal amount of pressure where a sensation of pressure first changes to pain.[40] A mechanical pressure algometer (Pain Diagnosis and Treatment Inc, Great Neck, NY) was used in this study. The device consists of a round rubber disk (1 cm^2) attached to a pressure gauge. The gauge displays values