ORIGINAL ARTICLE
https://doi.org/10.1590/1806-9282.20210170

Correlation between tactile acuity, pain intensity, and functional capacity in individuals with chronic neck pain

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SUMMARY

OBJECTIVE: The aim of this study was to verify the correlation between tactile acuity, intensity of pain at rest, and movement and functional capacity in individuals with chronic neck pain.

METHODS: This was a cross-sectional study composed of two groups: individuals with chronic neck pain and individuals without neck pain. Evaluations were performed using the Numerical Rating Pain Scale at rest and movement, Neck Disability Index, and two-point discrimination test.

RESULTS: The final sample consisted of 100 volunteers, 50 in each group. The groups did not show significant differences (p>0.05) in personal characteristics. It was observed that volunteers with cervical pain presented alterations in tactile care, with a significant and clinical increase in the perceived distance (Median 6.66; 95%CI 6.29–7.02; Cohen's d 7.22; 95%CI 6.15–8.30), and yet, positive, moderate, and significant correlation between two-point discrimination test, intensity of pain at rest and movement, and neck disability index (r=0.778–0.789, p<0.05).

CONCLUSION: Tactile acuity is associated with pain intensity at rest and movement and functional capacity in individuals with chronic neck pain.

KEYWORDS: Chronic pain. Neck pain. Musculoskeletal pain.

INTRODUCTION

Understanding the necessary diversified composition of assessment methods and, even more, preliminary findings indicating cortical changes followed by a decrease in local tactile acuity in individuals diagnosed with chronic neck pain[1,2], it is essential to include the assessment tools of the somatosensory system in these individuals.

The two-point discrimination test (TPDT) is a valid evaluation tool to detect changes in the functional organization of the somatosensory system[1], because it has a good reliability when used in the cervical region[3]. Described as the ability to discriminate between two tactile stimuli, TPDT is performed with a rigid, double-ended instrument positioned at different distances over the region to be evaluated. The shorter the distance detected between two ends, the greater the innervation density of slow-adapting fibers and cutaneous receptors functionally present in the skin. Thus, the greater the perceived distance, the worse the tactile acuity and, consequently, the worse the functional impairment of the somatosensory system[4].

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Conflicts of interest: the authors declare there are no conflicts of interest. Funding: This work was partially supported by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), finance code 001.
Received on March 15, 2021. Accepted on April 27, 2021.

In this context, deficits in functional tactile sensitivity are related to changes in the functional organization of the somatosensory cortex[1]. For this aspect and also because we understood that neck pain is a complex and globally prevalent clinical condition, it is important to investigate the correlation between tactile acuity, other dimensions of chronic pain, and the functional capacity related to the cervical spine in volunteers with chronic neck pain, demonstrating that tactile acuity, which reflects changes in the somatosensory cortex, is related to the sensory, cognitive-behavioral, and functional dimension of chronic pain; one can support the need for the applicability of all these assessments in the clinical environment, favoring better and more complete intervention strategies[1,2].

The aim of this study was to verify the correlation between tactile acuity, intensity of pain at rest and movement, and functional capacity in volunteers diagnosed with chronic neck pain.

METHODS

Study design

A cross-sectional study was carried out. In this way, a physical therapist was in charge of recruiting, diagnosing, and allocating volunteers in two groups: a cervical pain group and a control group. Another physical therapist was in charge of administering the assessments, and a third researcher processed and analyzed the data. All researchers were familiar with the assessment procedures, having an average of five years of training in Physiotherapy. All participants signed an informed consent form, which was approved by the institution's Human Research Ethics Committee under process number 66425417.2.00005511.

Participants

Considering the correlation as the main objective of the study, a previous sample calculation was performed based on the detection of a slight correlation between the variables, considering a confidence coefficient of 0.95 and an amplitude of the confidence interval for the intraclass correlation coefficient (ICC) of 0.30. In addition, the calculation was performed to detect moderate reliability (ICC=0.75)[5], and therefore a sample size of 24 volunteers was estimated. To supply possible sample losses, 30 volunteers per group were defined to carry out this study.

For this, volunteers of both genders should have had neck pain for more than 90 days and be aged between 18–59 years. To identify neck pain, the following diagnostic criteria were used: score on the Neck Disability Index (NDI) ≥5 points and score on the Numerical Rating Pain Scale (NRPS) ≥3 points at rest or during active cervical movement, considering the last seven days as reference; these volunteers were allocated to the cervical pain group[6]. For comparison, volunteers of both genders were recruited without a diagnosis of chronic neck pain, without pain in the neck, aged between 18 and 59 years, and with the following diagnostic criteria being adopted: NDI score ≤5 points and NRPS score ≤3 points at rest or during active cervical movement, considering the last seven days as reference; these volunteers were allocated to the control group[6].

Volunteers with a history of cervical trauma; head, face, or cervical surgery; having undergone physiotherapeutic treatment for neck pain in the last three months; use of analgesics, anti-inflammatories, or muscle relaxants on the day of the evaluation and/or in the last week; presence of systemic and autonomic diseases; and medical diagnosis of fibromyalgia and neurological diseases were excluded.

Assessments

NRPS was used to assess the intensity of pain in the cervical, at rest, and on movement. Validated for the Portuguese language, simple and easy to measure, it consists of a sequence of numbers from 0–10, in which the number 0 represents "no pain" and the number 10 represents "the worst pain imaginable"[7]. The intensity of pain at rest was assessed based on the seven days prior to the assessment. To check the intensity of pain after movement, pain intensity was taken as a reference after performing the active movement sequence: flexion/extension, right/left inclination, right/left lateral rotation, all performed once for each movement.

To assess functional capacity, the NDI was used. The instrument was adapted and validated for the Brazilian population, with a high degree of internal consistency (r=0.74) and test–retest reliability characterized as acceptable[8]. Thus, the NDI consists of 10 sections that investigate disability related to cervical pain. For each section, it is possible to mark one in six answers, corresponding to the scores from 0–5. Therefore, the score for the classification of disability through pain varies between 0–50 points: with 0–4 points, without disability; 5–14 points, mild disability; 15–24 points, moderate disability; 25–34 points, severe disability; and 35–50 points, complete disability[8].

To determine tactile acuity in the cervical region, TPDT was performed using a digital caliper Starrett Brasil[a]. The points established with measurements ranging from 2–25 mm were used as a measurement reference. A caliper was positioned perpendicularly over the region to be analyzed so that the two tips touched the skin of the cervical region at the same time, only using the weight of the caliper itself, in an anteroposterior direction with the volunteer in sedestation (Figure 1)[4]. The analyzed region was chosen according to the report of the highest pain intensity reported by the volunteer, and for those who did not report local pain, the point between the C2 and C3 vertebrae was previously

established much because it was pointed out as the most symptomatic level, common when neck pain is involved[9,10]. Each distance between the tips was tested three times, in random order, and the response with the least perceived distance between the two points was considered to be the one that presented, at least, two repeated responses every three attempts[4].

Figure 1. Two-point discrimination test.

Statistical analysis

Histograms were created to determine the normality of the data. When non-normal distribution of variables was demonstrated, Spearman's correlation coefficients (rs) were calculated to determine the strength of associations between variables. The magnitude of the correlations was determined based on the classification proposed by Zou et al.[11]: 0=no correlation; 0≥0.20=weak correlation; 0.20≥0.50=moderate correlation; 0.50≥0.80=strong correlation; and 0.80≥1.00=perfect correlation. Statistical analysis was performed using the Statistical Package for Social Sciences, version 17.0 (SPSS Inc., Chicago, Illinois, USA).

RESULTS

This study was composed of two distinct groups: individuals with chronic neck pain (n=50) and individuals without neck pain (n=50). The groups did not show significant differences (p>0.05) in demographic characteristics, as shown in Table 1. With regard to TPDT, it was observed that individuals with pain presented alterations in tactile discrimination, with a significant and clinical increase in perceived distance [Median (MD) 6.66; 95%CI 6.29–7.02; Cohen's d 7.22; 95%CI 6.15–8.30] when compared with the control group.

There was a positive, moderate, and significant correlation between TPDT, pain intensity at rest and movement, and NDI (r=0.778–0.789, p<0.05), as shown in Table 2, so that the greater the intensity of pain and disability, the greater the perceived distance in TPDT.

Table 1. Comparison between the groups of demographic and clinical variables in the study.

	Cervical pain group	Control group	MD (95%CI)	Cohen d (95%CI)
Age (years)[a]	23.64 (2.70)	23.76 (2.31)	-0.12 (-0.88–1.12)	–
Gender (Female %)[b]	46 (92)	42 (84)	–	–
Weight (kg)[a]	73.84 (7.46)	73.24 (7.12)	0.60 (-3.49–2.29)	–
Height (m)[a]	1.72 (0.09)	1.70 (0.08)	0.02 (-0.05–0.01)	–
BMI (kg/m^2)[a]	24.84 (2.71)	25.12 (2.35)	-0.28 (-0.73–1.28)	–
NRPS (escore)[a]				
at rest	4.76 (0.82)	0.10 (0.30)	4.66 (4.41–4.90)[c]	7.40 (6.30–8.50)[d]
after movement	5.44 (0.76)	0.06 (0.23)	5.38 (5.15–5.60)[c]	9.58 (8.19–10.96)[d]
NDI (escore)[a]	16.20 (2.04)	2.18 (1.45)	14.02 (13.31–14.72)[c]	7.92 (6.75–9.08)[d]
TPDT (mm)[a]	10.02 (0.97)	3.36 (0.87)	6.66 (6.29–7.02)[c]	7.22 (6.15–8.30)[d]

BMI: body mass index; NRPS: numerical rating pain scale; NDI: neck disability index; TPDT: two-point discrimination test; MD: mean difference; CI: confidence interval. [a]Values shown as mean (standard deviation); [b]Values presented in absolute number (percentage); [c]Significant difference (p<0.05, independent *t*-test); [d]Clinical relevance.

Table 2. Correlation between tactile acuity and pain measurement variables in patients with chronic neck pain (n=50).

	TPDT (mm)
NRPS at rest (escore)	rs 0.785, p<0,001[a]
NRPS after moviment (escore)	rs 0.789, p<0,001[a]
NDI (escore)	rs 0.778, p<0,001[a]

NRPS: numerical rating pain scale; NDI: neck disability index; TPDT: two-point discrimination test; [a]Significant correlation (p<0.05, Spearman's correlation coefficient).

DISCUSSION

The current level of evidence suggests that deficits in tactile acuity are present in several chronic pain conditions including neck pain[3]. At least seven studies have been involved in the direct analysis of tactile acuity using TPDT in chronic neck pain. Our study differs from the others by trying to relate and expand the analysis of tactile acuity in the different dimensions of chronic pain.

The first dated study on the relationship between tactile acuity and chronic pain was carried out with a group of individuals characterized with chronic polyarticular pain, with only five individuals having pain exclusively in the cervical region; of these, one had pain in other regions of the body[12]. Even with this great difference, we found results similar to Seltzer et al.[12], attesting to the reduction in tactile acuity in the presence of chronic pain. However, we presented more clearly defined and specific criteria for the diagnosis of chronic neck pain, obtaining a more reliable and homogeneous sample to analyze this relationship.

Thus, our results reinforce previous findings regarding the presence of reduced tactile sensitivity in individuals with chronic neck pain when compared with individuals without a diagnosis of chronic neck pain[1,13]. The greater the presence of pain intensity, the greater the interruption of sensory feedback, manifesting itself in the reduction of tactile acuity. We believed this to be a real clinical trend in patients with chronic neck pain, even when the intensity of the pain is related to movement, as performed in our study.

It is quite true that the relationship between musculoskeletal pain intensity and tactile acuity has not been shown to be consistent in the literature[3]. Heerkens et al.[13] attested that this relationship is incipient. However, the criteria used to characterize the sample are totally different from those used in our study and in the study by Harvie et al.[1] as we actually included individuals diagnosed with chronic neck pain with pain intensity ≥3 points on a scale of 10.

There is much to understand regarding how the imprecision or interruption in the processing of information is related to various areas of the body in individuals with chronic pain[14]; however, we hypothesized that the state of chronicity and intensity of pain impacts the somatosensory reorganization with a notable impairment of tactile acuity. We further reinforced our hypothesis when we observed the results obtained from the studies by Adamczyk et al.[15] and López-de-Uralde-Villaneuva et al.[16], who found that acute experimental neck pain did not promote changes in tactile acuity. López-de-Uralde-Villaneuva et al.[16] continued further showing greater somatosensory impairment, through TPDT, in individuals with chronic neck pain, especially when neuropathic features are present.

This study has its limitations and opens opportunities for future research mainly because it was a cross-sectional study and the results were descriptive, had no predictive character, and could not be used to establish direct causal relationships.

CONCLUSIONS

Our data suggest that tactile acuity is associated with pain intensity at rest and with movement and functional capacity in individuals with chronic neck pain.

AUTHORS' CONTRIBUTIONS

AVDF: Conceptualization, Data curation, Formal Analysis, Methodology, Writing – original draft. **CAFPG:** Conceptualization, Data curation, Formal Analysis, Methodology, Writing – original draft. **DBG:** Conceptualization, Data curation, Formal Analysis, Methodology, Writing – original draft. **CSBF:** Conceptualization, Data curation, Formal Analysis, Methodology, and writing and editing the review. **FP:** Conceptualization, data curation, formal analysis, methodology, Writing – review & editing. **CAFPG:** Conceptualization, Data curation, Formal Analysis, Methodology, Writing – review & editing. **AVDF:** Conceptualization, Data curation, Formal Analysis, Methodology, Writing – review & editing. **CSS:** Conceptualization, Data curation, Formal Analysis, Methodology, Writing – review & editing.

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