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Scientific/Clinical Article

## Effect of manual therapy and neurodynamic techniques vs ultrasound and laser on 2PD in patients with CTS: A randomized controlled trial

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### ARTICLE INFO

#### Article history:

Received 8 June 2015

Received in revised form

13 March 2016

Accepted 17 March 2016

Available online 16 April 2016

#### Keywords:

Carpal tunnel syndrome

Manual therapy

Neurodynamic techniques

Discrimination sense

### ABSTRACT

**Study Design:** Randomized controlled trial.

**Introduction:** Two-point discrimination (2PD) test can be used to assess both clinical condition and the effects of therapy in carpal tunnel syndrome (CTS) patients.

**Purpose of the Study:** To determine whether there are specific differences in 2PD between symptomatic and asymptomatic hands in CTS patients and to evaluate the impact of 2 therapy regimes on 2PD in patients with CTS.

**Methods:** Therapy for the neurodynamic mobilization group was based on manual therapy and neurodynamic techniques. Therapy for the electrophysical modalities group was based on red and infrared laser and ultrasound therapy using a contact method applied in the transverse ligament area. Therapeutic cycle consisted of 20 therapy sessions delivered at twice-weekly intervals.

**Results:** After therapy, 2PD in the symptomatic limbs in the neurodynamic mobilization and electrophysical modalities groups significantly improved ( $p < .001$ ). However, there was no statistically significant difference between the treatment groups.

**Conclusions:** Both therapy programs used in this study were beneficial for improving 2PD.

**Level of evidence:** 2.

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### Introduction

Carpal tunnel syndrome (CTS) is the peripheral neuropathy with the highest incidence (1.5%–3.8%), frequently affecting persons of working age.<sup>1–3</sup> Absence from work and a marked decline in performance can produce significant economic impact; therefore, it is important to research effective and inexpensive treatments for this condition.<sup>4</sup>

Several conservative and surgical options are available for the treatment of CTS. At present, the choice of treatment method is

very controversial. Some studies have shown better results for surgical treatment of CTS compared with conservative treatment,<sup>5–7</sup> but surgical treatment tends to be reserved for patients with severe CTS. Conservative interventions are recommended in mild and moderate CTS<sup>4</sup> and can be divided into 2 categories.<sup>8</sup> The first approach includes the use of an orthosis on the wrist at night, oral pharmacotherapy, and local steroid injections.<sup>9</sup> However, there is a wide range of conflicting opinions regarding the efficacy of these procedures in CTS treatment.<sup>9–12</sup> The second approach usually involves electrophysical modalities and/or manual therapy including neurodynamic techniques.<sup>13,14</sup> There are few randomized controlled trials.<sup>13,14</sup> The lack of scientific evidence on the efficacy of physical interventions in the treatment of CTS causes this type of therapy to be often overlooked.<sup>12–14</sup> Consequently, it is necessary to establish the relative efficacy of the various types of hand therapy to establish optimal therapeutic regimens and to discourage the use of techniques shown to be ineffective.

Some studies have shown a positive therapeutic effect using low-level laser or ultrasound therapy in CTS treatment.<sup>15,16</sup> Due to

Source(s) of support: Own source.

Competing interests: None to report.

Ethics approval: Local Ethics Committee. The Jerzy Kukuczka Academy of Physical Education in Katowice Ethics Committee approved this study. Participants gave written informed consent before data collection began.

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**Table 1**  
Between-group baseline comparisons of subjects' characteristics after randomization

Characteristics	NM group (n = 70)	EPM group	P
Women (%)	62 (88.57)	60 (85.71)	.6135 <sup>a</sup>
Men (%)	8 (11.43)	10 (14.29)	
Age (SD; minimum-maximum), y	53.128 (8.7; 26-72)	51.514 (10.348; 28-71)	.1080 <sup>b</sup>
Body mass (SD; minimum-maximum), kg	72.27 (11.0; 50-97)	69.75 (11.84; 43-105)	.5788 <sup>b</sup>
Height (SD; minimum-maximum), cm	164.22 (6.42; 148-180)	164.85 (5.90; 144-182)	.1968 <sup>b</sup>
BMI (SD; minimum-maximum)	26.98 (4.18; 17.8-41.1)	25.53 (3.85; 18.3-39)	.0336 <sup>b,c</sup>
Right dominant hand (%)	65 (92.86)	69 (98.57)	.9509 <sup>a</sup>
Left dominant hand (%)	5 (7.14)	1 (1.43)	
Asymptomatic hand (right) (%)	7 (13.46)	7 (14.58)	.8716 <sup>a</sup>
Asymptomatic hand (left) (%)	45 (86.54)	41 (85.42)	
Symptomatic hand (right) (%)	63 (71.59)	63 (68.48)	.6487 <sup>a</sup>
Symptomatic hand (left) (%)	25 (28.41)	29 (31.52)	

NM = neurodynamic mobilization; EPM = electrophysical modalities; SD = standard deviation; BMI = body mass index.

<sup>a</sup> Chi-square test.

<sup>b</sup> Student *t* test.

<sup>c</sup> Statistically significant differences.

that, in the present article, we decided to combine laser and ultrasound modalities, looking for a possible cumulative effect on CTS treatment. With regard to neurodynamic techniques, there are relatively new development in manual therapy and hence were only used as self-therapy programs in scientific research.<sup>17–19</sup>

Assessment of the effectiveness of a therapeutic approach involves various diagnostic tools.<sup>17,20,21</sup> Some authors use 2-point discrimination (2PD) sensation to assess both the clinical condition and the effects of therapy in CTS treatment.<sup>18,19,22</sup> The 2PD test is a functional test used to assess the quality of tactile sensibility.<sup>23</sup> This test is also regarded as an integrative test because it requires a high degree of sensory processing. Two-point sensation reflects the density of the innervation of the skin (touch receptors) and somatosensory cortical representation. It is conducted via the dorsal column–medial lemniscus system to the central nervous system. Two-point sensation can be disturbed as a result of damage to this system or to a peripheral nerve.<sup>24</sup> Wolny et al<sup>25</sup> have demonstrated that even in mild CTS there occurs a significant deficit in 2PD sensation as compared with a healthy population. Nowak and Noszczyk<sup>26</sup> showed a high correlation between 2PD and sensory conduction in CTS (greater than in Phalen's test, Durkan's test, or Katz hand diagram). The 2PD test is a cheap, easy-to-use, and sensitive tool<sup>27</sup> that can be used in the everyday clinical practice of hand therapists.

The aim of this work was to answer the following questions: Are there any disturbances in static 2PD in the symptomatic limb compared with the asymptomatic one? What impact do 2 different physical therapy programs (manual therapy including neurodynamic techniques vs ultrasound and laser) have on 2PD sensation in CTS patients?

## Methods

### Ethics

The study was authorized by the Bioethics Committee for Scientific Studies at the Jerzy Kukuczka Academy of Physical Education in Katowice on 31 May 2007 (decision no. 16/2007). All study procedures were performed according to the Helsinki Declaration of Human Rights of 1975, modified in 1983.

### Study design

This was a multicenter, randomized controlled, single-blinded, and parallel-group design study. The study took place in 2

medical clinics in the area of Silesia, Poland, from 2007 to 2012. Participants were randomly allocated to the neurodynamic mobilization (NM) techniques or the electrophysical modalities (EPM) groups. The NM group received 20 treatments of manual therapy including the use of neurodynamic techniques directed at the median nerve, functional massage of the descending part of the trapezius muscle, and wrist mobilization techniques. The EPM group received 20 treatments of laser and ultrasound. Therapy was conducted twice weekly for 10 weeks. All patients were informed about what the study would involve and told that they could withdraw at any stage without giving a reason. Written informed consent was obtained from all participants. The clinical trial registration number is ACTRN12614000367640.

### Participants

Characteristics of the participants along with the division into experimental groups and the results of group homogeneity tests are presented in Table 1. Two examinations were performed to assess 2PD sensation. In the first, the outcome of the therapy was assessed in symptomatic limbs. In this case, 140 patients (180 hands) were examined. In the second examination, a comparison of 2PD sensation in the symptomatic limb in relation to the asymptomatic limb was performed; therefore, the individuals with bilateral CTS were excluded. In this case, 100 of the patients (100 hands) examined were analyzed.

The necessary sample size was assessed based on preliminary results on 20 participants. Calculation of sample size was based on an alpha of 0.05 and a statistical power of 0.80. Based on this calculation, we aimed to recruit 77 patients for each treatment group.

### Diagnostic criteria of CTS

In each case, the CTS was diagnosed by a physician. Clinical diagnoses were primarily based on the data obtained in interviews and the presence of 2 or more positive symptoms:

1. Numbness and tingling in the area of the median nerve;
2. paresthesia at night;
3. positive Phalen's test;
4. positive Tinel's sign; and
5. pain in the wrist area radiating to the shoulder.<sup>28</sup>

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