The value of iontophoresis combined with ultrasound in patients with the carpal tunnel syndrome

Dakowicz A, Latosiewicz R

Department of Rehabilitation Medicine, Medical University of Białystok, Poland

Abstract

Purpose: **The purpose of the study was the evaluation of usefulness of iontophoresis with hydrocortisone combined with ultrasounds in conservative treatment of the carpal tunnel syndrome (CTS).**

Patients and methods: **Forty patients (35 women and 5 men), aged 30-72 years, with unilateral CTS confirmed by electromyographic examination were included. The patients were divided into 3 groups based on clinical symptoms according to Whitley [16]. Subjective complaints and objective symptoms were recorded in all patients. The character of the pain, its frequency and intensity (VAS scale) as well as paresthesies was determined. Physical examination consisted of clinical tests according to Phalen and Tinnel, sensation discriminatory test, pressure test and estimation of muscular atrophy of the thenar. All the patients underwent combined physiotherapeutic procedures: iontophoresis with hydrocortisone acetate (25 mg per procedure; galvanic current up to 5 mA, the active electrode – 50 cm², time – 20 min) and ultrasounds with direct coupling (the dose of 0.5-0.8 W/cm², 1 MHz, PIP 1:4, 48 Hz; the time 3-6 min). The number of procedures was 10 – one per day.**

Results: **Decrease of pain and paresthesia were observed in 36 patients (out of 40) with mild and moderate stage of CTS. Objective parameters (Phalen test, Tinnel test, and sensation discriminatory test) significantly improved only in 24 patients with moderate stage of CTS. There was no improvement in 4 patients with advanced form of CTS.**

Conclusions: **The use of combined procedures of iontophoresis with hydrocortisone and the ultrasound diminishes subjective complaints of patients with the carpal tunnel syndrome. The procedure is most effective in the treatment of mild and moderate stages of the disease.**

Key words: carpal tunnel syndrome, conservative treatment, iontophoresis, ultrasound.

Introduction

Carpal tunnel syndrome (CTS) consists of various clinical symptoms caused by persistent pressure on the median nerve in the region of the wrist [1]. It is a relatively common disorder, in which various possibilities of conservative treatment can be used [2-5]. One of them is the use of physiotherapeutic treatment. There are numerous suggestions concerning this kind of treatment in literature. However, they usually concern single therapeutic methods [5-12]. There are only few publications which report simultaneous using of two methods [13,14].

The purpose of the study was the evaluation of iontophoresis with hydrocortisone combined with ultrasounds in conservative treatment of the carpal tunnel syndrome.

Patients and methods

The examination was performed in the years 2004-2005 in The Department of Rehabilitation Medicine of The Medical University of Białystok after the approval of the local Committee of Bioethics. The examined group consisted of 40 patients (35 women and 5 men) in the age range 30-72 years who presented with unilateral carpal tunnel syndrome. Only patients with diagnosis of the CTS confirmed by EMG examination (performed outside the Department) were qualified for the study.

ADDRESS FOR CORRESPONDENCE:
Agnieszka Dakowicz, M.P.
Department of Rehabilitation Medicine
ul. M. Skłodowskiej-Curie 24a, 15-276 Białystok, Poland
Fax: +48 085 746 88 00
e-mail: agadak@interia.pl

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Table 1. **Demographic data of the patients (n=40).**

Group according to Whitley	Sex	Age in years (mean ± SD)	Dominant hand	Duration of complaint in months (mean ± SD)
Gr. I (n=12)	w – 11, m – 1	52.1±12.3	w – 8, m – 1	7.2±2.5
Gr. II (n=24)	w – 21, m – 3	48.1±8.1	w – 12, m – 2	15.1±6.6
Gr. III (n=4)	w – 3, m – 1	56.5±11.4	w – 2, m –1	21.2±6.6

w – women; m – men; SD – standard deviation

Table 2. **Subjective complaints before and after physiotherapy (n=40)**

Group according to Whitley	VAS scale (mean ± SD)		Night pain (No. of patients)		Day pain (No. of patients)		Day paresthesia (No. of patients)		Night paresthesia (No. of patients)	
	b	a	b	a	b	a	b	a	b	a
Gr. I (n=12)	7.4±0.5	1.8±1.9*	10	4*	12	6*	10	3*	10	4*
Gr. II (n=24)	8.1±1.1	1.8±1.5*	23	5*	24	6*	23	5*	23	4*
Gr. III (n=4)	8.0±1.2	4.2±1.9	4	2	4	4	4	4	4	2

Legend: * – statistical significance; b – before physiotherapy, a – after physiotherapy

Motor latency above 4 ms and sensory latency above 3.5 ms were considered diagnostic of the syndrome [15].

The patients were divided into 3 groups basing on clinical symptoms according to Whitley [16]. In the majority of cases (65%), the symptoms pertained to the dominant hand (right in the right-handed). Group I (early stage of the disease) included 12 patients with minor complaints like numbness and periodical pain in the region of the innervation of the median nerve. The symptoms most often occurred at night and used to wake the patients up. Group II (moderate stage) consisted of 24 patients with continuous numbness and strong pain, mainly at night, hypoesthesia in the region of the innervation of the median nerve or weakness of short muscles of the hand. Four (4) patients from group III with advanced disease stage suffered from intensive pain, short hand muscle weakening, atrophy of the thenar muscles and significant impairment of hand function. *Tab. 1* presents demographic data of the patients.

Subjective complaints and objective symptoms were recorded in all patients. The character of the pain, its frequency and intensity as well as paresthesia was determined. The intensity of pain was rated on a commonly used 10-point Visual Analog Scale (VAS). Physical examination consisted of clinical tests according to Phalen and Tinnel, sensation discriminatory test, pressure test and estimation of muscular atrophy of the thenar [17-19].

All the patients underwent physiotherapeutic procedures delivered at the region of the wrist. The first procedure was iontophoresis with hydrocortisone acetate in the dose of 25 mg per procedure, which was introduced using galvanic current with the intensity of up to 5 mA and the surface of the active electrode – 50 cm^2. The time was 20 min; the number of procedures was 10, one per day. The second procedure was the ultrasound with direct coupling (gel) in the dose of 0.5-0.8 W/cm^2, 1 MHz, PIP 1:4, 48 Hz. The time varied from 3 to 6 min. Ten procedures were carried out, one per day.

Clinical evaluation was carried out twice: before and after physiotherapy. Continuous variables were expressed as mean ± standard deviation. Statistical hypotheses were tested with independence chi^2 test for counts and with Wilcoxon matched--pairs signed-ranks test for continuous variables. All data were computed using statistical software SPSS 8.0 PL. Probability values of 0.05 were considered to indicate statistically significant differences.

Results

The most distinct decrease in pain (both day and night pain) and paresthesia were observed in group I after completing therapeutic procedure. The change was statistically significant (chi^2 test, $p<0.05$). The pain measured in the VAS scale also decreased in a significant degree (Wilcoxon test, $p<0.05$). Group II revealed similar changes. In group III there was no improvement.

As far as objective parameters are concerned (Phalen test, Tinnel test, discriminatory test), a statistically significant improvement was noted only in group II (chi^2 test, $p<0.05$). There was no improvement in group I and III.

Tab. 2 and *3* present evaluated parameters and their values before and after the treatment.

Discussion

Physiotherapeutic procedures in the treatment of the carpal tunnel syndrome have been reported only by a few reports, which usually consider the use of single physiotherapeutic method [6,8,9,11,12]. The use of combined methods has been mentioned less frequently [13,14].

In our study we have evaluated the usefulness of ionthophoresis combined with ultrasounds which has been not reported so far. We have noted the improvement of mainly subjective symptoms in all but 4 patients. They usually reported decreased pain and paresthesia at night and improvement of function of

Table 3. **Clinical tests before and after physiotherapy (n=40)**

Group according to Whitley	Phalen test (No. of patients)		Tinnel test (No. of patients)		Sensation discriminatory test (>1mm) (No. of patients)		Pressure test (No. of patients)		Athrophy of the thenar muscles (No. of patients)	
	b	a	b	a	b	a	b	a	b	a
Gr. I (n=12)	10	7	8	7	0	0	8	7	0	0
Gr. II (n=24)	23	17*	23	17*	11	6*	23	17*	0	0
Gr. III (n=4)	4	4	4	4	4	3	4	4	2	2

Legend: * – statistically significance; b – before physiotherapy, a – after physiotherapy

the hand during daily activities. Nevertheless, the statistically significant improvement of objective parameters was observed only in patients with moderate symptoms of the disease. Evaluated parameters did not change in the group of patients with severe symptoms of CTS. Despite of this, the patients from this group reported satisfaction with the treatment, though this was difficult to evaluate in an objective way.

Our study again confirmed the usefulness of physiotherapeutic methods in the treatment of non-advanced forms of the carpal tunnel syndrome. Possibly, the synergism of anti-inflammatory action of hydrocortisone and the ultrasound can be mechanism of the improvement. The combination of two methods is thought to decrease edema in the tissues surrounding the median nerve which facilitates nerve conduction.

Our results seem to be at least comparable to those obtained by other authors dealing with similar groups of patients [6-9,11,12]. In our opinion physiotherapeutic procedures should be used in combination. Such arrangement can be suggested for patients with mild and moderate symptoms of CTS. It can be also useful in patients who refuse surgical treatment. Patients with the advanced stage of the carpal tunnel syndrome will not benefit from physiotherapeutic procedures and should be referred for operative treatment.

Conclusions

1. The use of combined procedures of iontophoresis with hydrocortisone and the ultrasound diminishes subjective complaints of patients with the carpal tunnel syndrome.

2. The procedure is most effective in the treatment of mild and intermediate stages of the disease.

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