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Systematic review of treatment methods for the carpal tunnel syndrome

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Abstract

The carpal tunnel syndrome is a common condition, localized at the hand and knuckle level, caused by a compression of the median nerve as it travels the rigid structures of the carpal tunnel. This phenomenon is, essentially, a compressive neuropathy.

Aim: The purpose of our research is to comparatively analyze the treatment methods of the carpal tunnel syndrome: treatment by acupuncture, fascial manipulation, low-level laser therapy, cupping treatment, kinesiotaping, surgical treatment, orthosis method, nerve and tendon gliding exercises, and ultrasound therapy, based on the review of specialized articles relevant for the last 10 years.

Methods: The research method consisted of 3 steps. First, we analyzed and selected 160 specialized articles, based on titles and key words; in the second step, we analyzed the summaries of the articles, thus, reducing the number to 50 articles. The third step consisted of selecting 7 relevant articles based on an article content review. *Results:* The results of treatment comparisons have proved that non-invasive therapies are superior to surgical treatments, taking into consideration symptom improvement, the maximum period up to noticeable results, relapse situations, patients' preferences, etc. *Conclusions:* The results of manual, traditional and non-invasive therapies are similar to those of surgical treatments, and even better in a very large number of cases.

Key words: carpal tunnel, carpal tunnel syndrome, treatment of the carpal tunnel syndrome,

Rezumat

Sindromul de tunel carpian este o afecțiune comună, localizată la nivelul mâinii și articulației pumnului, ce presupune o comprimare a nervului median atunci când străbate structurile rigide ale tunelului carpian. Acest fenomen este în esență o neuropatie compresivă,

Scopul cercetării este acela de a face o analiză comparativă între metodele de tratament ale sindromului de tunel carpian: tratamentul prin acupunctură, manipulare fascială, terapia laser de nivel scăzut, tratamentul cu ventuze, kinesiotaping, tratamentul chirurgical, metoda ortezării, exerciții de alunecare a tendoanelor și nervilor și terapia cu ultrasunete, fundamentată pe analiza unor articole de specialitate relevantă din ultimii 10 ani.

Metoda de cercetare a constat în trei etape. În prima etapă au fost analizate și selectate un număr de 160 de articole de specialitate pe baza titlurilor și a cuvintelor cheie, urmată de etapa a doua, în care au fost analizate rezumatele articolelor, ajungând astfel la un număr de 50 de articole. În etapa a treia, au fost selectate un număr de 7 articole relevante pe baza analizei conținutului articolelor. *Rezultatele* comparațiilor tratamentelor au demonstrat o superioritate a terapiilor neinvazive în detrimentul tratamentelor chirurgicale, luând în considerare ameliorarea simptomelor, durata maximă până la rezultate sesizabile, situațiile de recidivă, preferințele pacienților, etc. *Concluziile* acestui studiu sunt că terapiile manuale, tradiționale și neinvazive aduc rezultate asemănătoare tratamentelor chirurgicale, chiar depășindu-le în foarte multe cazuri.

Cuvinte cheie : tunel carpian, sindrom de tunel carpian, , tratament sindrom de tunel carpian,

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Introduction

The carpal tunnel is an osteofibrous canal connecting the profound area of the palm and the forearm.

The carpal tunnel syndrome is a common condition, localized at the hand and knuckle level, caused by a compression of the median nerve as it travels the rigid structures of the carpal tunnel. This phenomenon is, essentially, a compressive neuropathy, which primarily manifests as a demyelination, followed by an axonal degeneration. [9] A quantitative analysis of the published scientific evidence reveals that, from the etiologic point of view, the carpal tunnel syndrome is a structural, genetic and biological pathology. Environmental and professional factors, such as carrying out activities involving mobilization for a long time, by repetitive movements of the hand, usually taking place at the work place, may indeed affect the tendons, thus resulting into inflammations. However, some authors consider that such movements play a minor and questionable role, and they are reluctant to the involvement of this phenomenon in the concept of the condition. [10]

From the physiopathology point of view, the carpal tunnel syndrome presents a large number of factors, its certain causality being unknown. The persistent compression or trauma actively contributes to the development of oedema in the endoneural space of the nerve, thus determining an additional pressure and disrupting the normal endoneural microcirculation. Together, all these changes contribute to the development of the condition, by neurological, sensory and motor disturbances, the onset stages being associated with an intraneural vascular congestion, with endoneural oedema, and focal demyelination. [3, 8]

The influence factors mentioned in the literature are: ergonomic stress factors, endocrine disorders (endocarditis, renal impairment, diabetes mellitus, thyroid disease, hypothyroidism, acromegaly), overweight, pregnancy, acute trauma, physiological factors, psoriatic arthritis and rheumatoid arthritis, gout. [14]

Research purpose

The purpose of our research is to comparatively analyze currently used treatment methods of the carpal tunnel syndrome:

- treatment by acupuncture used with a splint, compared to the administration of anti-inflammatory drugs, i.e. ibuprofen 400 mg.

- fascial manipulation by means of deep friction maneuvers compared to low-level laser therapy,
- cupping treatment, using the wet technique involving the scarification of the tegument, compared to heat application using a heating plate,
- low-level laser therapy compared to using it in combination with the kinesiotaping technique, assessed in parallel with the placebo effect,
- surgical treatment (the open or endoscopic procedure) compared to manual therapy using desensitization manoeuvres and nerve and tendon gliding exercises, and observation of the natural evolution of untreated patients,
- orthosis method compared to using it in combination with nerve and tendon gliding exercises, and with the ultrasound therapy, presented in the literature.

Methods

In order to perform this systematic review, we used the following databases: ResearchGate, ScienceDirect, SCOPUS, PubMed, PEDro and Google Academic, as a source for extracting and reviewing specialized articles published between 2008 and 2018. The articles included in this study are publications that have exclusively investigated the treatment effects and options for the carpal tunnel syndrome, with a focus on those mainly including patients with a positive carpal tunnel syndrome diagnosis.

The searching process was focused on the specialized articles written in English, using as key words: “carpal tunnel syndrome”, “CTS treatment”, “carpal tunnel syndrome therapy”, “recovery”, “comparison” and “effects”.

Search results

After having analyzed the titles, we selected 160 articles, which have been reviewed according to the following research inclusion criteria: articles published in the past decade and written in English. The exclusion criteria were: the study included other pathologies along with the carpal tunnel syndrome, lack of patient groups recruited for the research or lack of comparative review of the treatment methods. After having applied these criteria, we kept for analysis a number of 7 articles.

The study called “*Efficacies of Acupuncture and Anti-inflammatory Treatment for Carpal Tunnel Syndrome*” carried out by the authors M. Hadianfard, et. al., compared the efficiency of acupuncture and anti-

inflammatory treatment in patients with carpal tunnel syndrome. Patients were randomly divided into two groups, an intervention group – where the effects of the acupuncture treatment were monitored, i.e. group A (n=25), and a control group – where the effects of the anti-inflammatory treatment were monitored, i.e. group B (n=25). The patients in group A were treated by unilaterally applied acupuncture therapy (in the case of patients who were bilaterally affected, the most severely affected part was used) in 8 sessions (twice a week for a month), and wrist splints were applied. The patients in group B received 400 mg of ibuprofen three times a day for 10 days, as well as wrist splints, similarly to the patients in group A.

After the treatment period, the values of the visual analogue scale (VAS) were visibly improved in both groups, but with better results in the acupuncture group. Also, electrophysiological parameters decreased in both groups, but with more important improvements in the acupuncture group. The score on the Boston Carpal Tunnel Questionnaire (BCTQ), using the assessment of the functional status (FUNCT) was improved in both groups, while patients treated by acupuncture presented an improved phone usage and better adaptation to housework. The results obtained using the Boston Carpal Tunnel Questionnaire (BCTQ), for the symptom severity scale (SYMPT) were once more in favour of acupuncture; however, it was still difficult for the patients to use small-sized objects, a phenomenon representing an exception to the general results. Another point of view would be that the acupuncture treatment did not result into any complications, while 5 patients in the control group presented gastro-intestinal adverse reactions to the ibuprofen treatment, which means acupuncture is also superior in terms of safety.

The article “*Conservative treatment of carpal tunnel syndrome: Comparison between laser therapy and fascial manipulation*” published by the authors E. Pratelli, et. al, presents a comparison between the efficiency of fascial manipulation and low-level laser therapy, in the treatment of patients suffering from carpal tunnel syndrome. The subjects were randomly distributed into group A (n=35) and group B (n=35); the patients in group A were treated by fascial manipulation, in 45-minute sessions, once per week for 3 weeks, while patients in group B received low-level laser therapy, with a 780-830 nm wavelength and 1000-3000 mW power, administered for 10 minutes, 5

times per day and applied at the level of the median nerve in the carpal area.

Based on the research carried out, this study states that the treatment by fascial manipulations received by patients suffering from carpal tunnel syndrome is more efficient than the low-level laser therapy. The results assessed using the Boston Carpal Tunnel Questionnaire (BCTQ), together with the symptom severity scale (SYMPT), the assessment of the functional status (FUNCT), and visual analogue scale for pain (VAS), proved that patients in group A acquired an improved general condition, which persisted in the short term, i.e. after 10 days, and in the medium term, i.e. after 3 months.

A. Michalsen et. al., in their study “*Effects of Traditional Cupping Therapy in Patients with Carpal Tunnel Syndrome: A Randomized Controlled Trial*” analyzes the efficiency of cupping therapy, a traditional Chinese used for musculoskeletal pains, for treating patients suffering from carpal tunnel syndrome. The study included 52 patients diagnosed with carpal tunnel syndrome, which were randomly assigned into group A (n=26) and group B (n=26). The patients in group A were treated by cupping application while patients in group B received a treatment consisting of heat applications using a heating plate.

The cupping therapy proved to be more efficient than the heat therapy, as the values on the Boston Carpal Tunnel Questionnaire (BCTQ), for the symptom severity scale (SYMPT) dropped from 61.5 ± 20.5 to 24.6 ± 22.7 mm on the 7th day for the patients in group A and from 67.1 ± 20.2 to 51.7 ± 23.9 mm for the patients in group B.

The study “*The effectiveness of the low-power laser and kinesiotope in the treatment of carpal tunnel syndrome, a pilot study*” published by A. Guner, et. al., provides a comparison between the Low Level Laser Therapy (LLLT) and a combination between the low-level laser therapy and kinesiotope, in the treatment of patients diagnosed with carpal tunnel syndrome. The participants were divided into three groups; the patients in group A (n=21) received the low-level laser therapy, applied above the wrist, besides laser therapy, the patients in group B (n=22) also received a kinesiotope treatment, while the patients in group C (n=21) were subjected to sham laser therapy, in order to monitor the placebo effects on the subjects.

Although the values of the parameters assessed in different manners (the visual numeric pain scale - VNS at night/during the day, Jamar Pinch Gauge device for

assessing the finger pinch strength - FPS, standard Jamar Pinch Gauge for assessing hand grip strength hand grip strength - HGS, Boston Carpal Tunnel Questionnaire - BCTQ, using the assessment of the functional status - FUNCT and symptom severity scale - SYMPT) changed, both from one group to another, from week to week, and from one therapy method to another, proving that the most efficient option was the combination between the low-level laser therapy - LLLT and kinesiotaping, and that this is a reliable therapy strategy for the patients suffering from carpal tunnel syndrome.

The study *“Manual Physical Therapy Versus Surgery for Carpal Tunnel Syndrome: a Randomized Parallel-Group Trial”* carried out by Cesar Fernandes-de-las Penas, et. al, investigates the efficiency of surgical treatment compared to physical therapy, including manual desensitisation manoeuvres, for the recovery of patients suffering from carpal tunnel syndrome. 120 female patients were randomly divided into two working groups; the patients in group A (n=60) received manual therapy, in half-hour sessions, once per week (for 3 weeks), while the patients in group B (n=60) were subjected to surgery, performed using the open or endoscopic procedure. The evaluation of the patients was realised through Numerical Pain Rating Scale- NPRS, Boston Carpal Tunnel Questionnaire (BCTQ), together with the symptom severity scale (SYMPT) and the assessment of the functional status (FUNCT).

Although the patients in both groups experienced an improvement of symptoms and hand functionality from the beginning of the treatment until its completion, with similar results in the 6th and 12th month, parameters were differently improved in favour of physical therapy, in the 1st and 3rd month.

The study *“Natural evolution of carpal tunnel syndrome in untreated patients”* published by F. Ortiz-Corredor, et. al, monitors the evolution of patients diagnosed with carpal tunnel syndrome who have not undergone any type of treatment. 132 patients who did not follow any kind of treatment were selected for this study. The patients were assessed based on the results obtained using the classification method proposed by Padua et al. (1997).

Out of the 132 monitored patients, two years after the beginning of the study, for 31 subjects (23.4%) the values on the historic and objective classification scale - HiOb deteriorated, for 28.8% the values remained stable, while for 47.6% they improved. In the nerve

conduction studies, 10 cases (7.6%) exhibited deterioration, 67.4% remained constant, and 25% were improved.

Another study, entitled *“Short-term clinical outcome of orthosis alone vs combination of orthosis, nerve, and tendon gliding exercises and ultrasound therapy for treatment of carpal tunnel syndrome”* published by Sze En Sim, et. al, monitors the immediate outcomes of the treatment of the carpal tunnel syndrome by conservative methods, comparing the orthosis option to the combination of orthosis, nerve and tendon gliding exercises and ultrasound therapy. The patients were divided into two working groups; the patients in group A (n=20) received custom-made orthoses, applied on the palmar side of the hand, thus immobilizing the affected wrist in a neutral position, while the patients in group B (n=21), besides having received orthoses that were similar to those used for group A, also followed a nerve and tendon gliding exercise program, and 5-minute ultrasound therapy sessions, once per week, for 8 weeks.

The Boston Carpal Tunnel Questionnaire – BCTQ, symptom severity scale – SYMPT indicated the following: for group A, the initial values were 2.26 (0.8), and the final values were 1.72 (0.7), while for group B the initial values were 2.11 (0.6), and the final values were 1.63 (0.7). The assessment of the functional status – FUNCT indicated the following: for group A, the initial values were 2.05 (0.9), and the final values were 1.45 (0.4), while for group B the initial values were 2.18 (0.8), and the final values were 1.48 (0.5).

Discussions

The specialized articles selected for the study herein monitored the effects of the different treatment methods used for the carpal tunnel syndrome, each of them achieving the following results:

According to the study carried out by M. Hadianfard, et. al., the review proved that acupuncture was more efficient for the treatment of patients suffering from carpal tunnel syndrome in a mild or moderate stage, compared to the anti-inflammatory treatment based on ibuprofen, both in terms of symptom improvement, and of treatment safety. [11]

The review carried out by E. Pratelli et.al., proved that fascial manipulations resulted into a greater improvement of the carpal tunnel syndrome (CTS) in the patients who participated in the study, compared to

the results obtained by low-level laser therapy (LLLT). [5]

Moreover, A. Michalsen et.al. demonstrated that cupping treatment resulted into the improvement of pain and paresthesias in the patients selected for the study, while heat application treatment proved to be much less effective. [2]

Several studies carried out by A. Guner, L. Altan and M. Kasapoglu Aksoy, showed that the comparison between low-level laser therapy (LLLT), the combination between LLLT, kinesiotaping, and the placebo effect, the combined treatment using low-level laser therapy - LLLT and kinesiotaping improved the symptoms of patients suffering from carpal tunnel syndrome. [1]

C. Fernandes-de-las Penas et.al. showed that, compared to surgery, the physical therapy approach had better immediate outcomes regarding pain and symptom reduction, although long-term results proved to be similar. [4]

In their study, the authors F. Ortiz-Corredor, et.al., assessed the patients with carpal tunnel syndrome who have not undergone any kind of treatment for two years. At the term of the study, an improvement trend was noticed in most of the cases, as well as a stagnation of the pathology in a significantly large group, while the cases where the pathology aggravated are represented by the smallest group of people that underwent the study. The reasonable outcome of the study can be summarized in the fact that without any type of treatment, the patient's condition regarding carpal tunnel syndrome, may ameliorate or stagnate, while the chances to aggravate are significantly lower. [6]

Another study, conducted by Sze En Sim et. al., demonstrated that the combined treatment using a wrist orthosis, ultrasound applications and manual therapy elements did not indicate any significant differences regarding the improvement of symptoms, compared to the approach of the pathology using the orthosis method alone [15].

Conclusions

In the current context of medicine and therapy, statistics indicate a tendency to approach the carpal tunnel syndrome by surgical treatment, to the detriment of approaching the pathology through a non-invasive technique. The relevant specialized articles selected for this study, and published in the past 10 years, prove that alternative medicine, physical therapy,

electrotherapy, and the natural evolution of untreated patients or of patients exposed to the placebo effect, may significantly improve the symptoms of the carpal tunnel syndrome.

Our study also indicates that the outcomes of the surgical procedure used for treating the carpal tunnel syndrome may be inferior to other treatment methods, either in terms of results, obtained using a large number of tests, or in terms of efficiency, given the time necessary for the results to reach a relevant threshold.

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