

Hyperthermia as conservative treatment for carpal tunnel syndrome

G. FRASCA¹, L. MAGGI¹, G. GRANATA², I. MINCIOTTI², A. RABINI¹, P.E. FERRARA¹, D.B. PIAZZINI¹, L. PADUA³, C. BERTOLINI¹

¹*Servizio di Medicina Fisica e Riabilitazione, Università degli Studi Cattolica, Roma;*

²*Istituto di Neurologia, Università degli Studi Cattolica, Roma;*

³*Fondazione Don Carlo Gnocchi (Roma), Istituto di Neurologia, Università degli Studi Cattolica, Roma*

Carpal tunnel syndrome (CTS) is the most frequent entrapment neuropathy.^{1,2} Females, elderly and hand-workers are more frequently affected,³⁻⁵ even if non-occupational factors are more relevant than occupational ones.^{5,6} According to physiopathological mechanisms, CTS is characterized by an increase of intra-carpal canal pressure. Consequently it causes the median nerve distress, expressed as focal nerve conduction decrease. This impairment is partially due to direct effect of mechanic compression by carpal ligament and partially due to local epinevrial blood flow suffering.⁷ CTS is characterized by pain, numbness and tingling in the hand and it is an important cause of work disability.⁸ Moreover, CTS is associated with considerable health care and indemnity costs.⁹ Previous studies regarded conservative and non-invasive treatment. Many of these treatments use heat modality, such as ultrasound and laser therapy. Esenbichler et al. demonstrated that there are satisfying short to medium term effects due to ultrasound treatment in patients with mild to moderate idiopathic carpal tunnel syndrome.¹⁰ Bakhtiary et al comparing ultrasound therapy versus laser therapy efficacy, showed that ultrasounds were more effective than laser therapy, for carpal tunnel syndrome treatment.¹¹ A recent review concludes that laser and ultrasound are effective.¹² Similarly to ultrasounds electromagnetic waves devices (e.g. microwaves) are used to produce deep heating of soft tissues.¹³ Efficacy of electromagnetic wave devices is strictly related to the achievement of the target temperature at the target site, in an effective and safe system.¹⁴ This study uses a recent electromagnetic waves instrument, the hyperthermia (HT), that produces heat effects in soft tissues. Already known in oncologic therapy management in association with radiotherapy and chemotherapy to induce direct cytotoxic effects,¹⁵ in rehabilitation medicine was introduced for both acute and chronic muscle-skeletal injuries management. Many studies reported that 434 MHz microwaves produce beneficial effects such as pain relief, changing mechanical properties of collagen and activating metabolic intracellular reactions useful to remove inflammation elements.¹⁶⁻¹⁸ In rehabilitation, therapeutic effects of HT (with surface cooling) were achieved for range of target temperature between 41.5 °C and 45,8 °C in order to obtain heat in deep tissue.¹⁹

The purpose of this study is to verify hyperthermia (HT) efficacy in pain release and in functional impairment in patients affected by early idiopathic CTS.

Materials and methods

We examined 12 consecutive patients affected by idiopathic CTS, the mean age was 54.5 (±15.81), the male/female ratio was 3/9. Out

of 12 cases, 6 patients were affected by CTS of the right hand, 1 patient by CTS of left hand, 5 patients by bilateral CTS, for a total hands affected by CTS of 17.

All cases were confirmed by clinical and electromyography and nerve conduction velocity tests. All patients were affected by early idiopathic CTS: 1,2,3 classes according to clinical Giannini classification and minimum, mild CTS according to neurophysiological Padua classification.¹⁹ Nobody was affected by motor impairment, diabetes, neoplasia, pregnancy. All patients were randomly allocated in two experimental groups: a) group A: treated with sham; b) group B: treated with HT (SmarTerapia Sigma Hyperthermia system-Easytech srl, Borgo San Lorenzo-FI, Italy). They were evaluated through a multidimensional examination: anamnestic (age, gender, clinical onset), clinical (evaluation of sensibility, Phalen test, muscle strength tests). Pain assessment and patient oriented scale for functional impairment: Visual analogic Scale for pain VAS and Levine scale. All patients were treated for 6 weeks. All patients were evaluated at baseline (T0), after 15 days (T1), and after 6 weeks (T2).

Results

Population descriptive data are resumed in table I.

Comparing pre and post-treatment data, concerning sham-population, it is not possible to evidence any significant difference in neurophysiological data, pain, numbness, tingling and functional impairment.

On the other side, significant differences were noticed, comparing pre and post-treatment data concerning HT-population in neurophysiological data, pain, numbness, tingling and functional impairment. We observed both sensitive and motor neurography data improvement, pain relief and functional impairment improvement.

Conclusion

CTS represents a major part of the occupational upper-extremity disorders, and it is associated with considerable health care and indemnity costs.⁹ Previous studies were conducted about conservative and non-invasive treatment, some of these utilize the heating

Table I. – Simple descriptive data.

| | | Percentage % | Average (DS) |
|----------------------|----------------------------|-----------------|--------------|
| Patients | 12 | | |
| Age | Min 29 Max 85 | | 54,5(±15,81) |
| Gender | 3M 9F | | |
| treated wrists | 17 | | |
| Sham/HT-STC | Sham | | |
| | HT/STC | 4 (25%)13 (75%) | |
| CTS | 6 right 1 left 5 bilateral | | |
| Tingling | | 83% | |
| Affected fingers | I, II e III | 86% | |
| | III | 8% | |
| | Not referred | 8% | |
| Symptoms duration | >5yr | 32% | |
| | 1-5 aa | 40% | |
| | <di1yr | 16% | |
| | Not referred | 8% | |
| Pain | | 92% | |
| Motor impairment | Absent | Absent | |
| Sensitive impairment | Absent | Absent | |
| Phalen test | Positive | 92% | |
| | negative | 8% | |
| Sensitive Test 10/10 | | 100% | |

effects. There are reports of short-term effectiveness and safety of HT in controlled clinical trials.

Analyzing preliminary data, it is possible to suggest that heat produces beneficial effects, reducing nerve distress, acting both on direct compression means of increasing collagen elasticity of carpal ligament and partly improving local regional blood-nurturing increasing nutrients and oxygen in heated region and washing out inflammatory mediators from suffering area. Nevertheless, a larger number of patients, longer-term follow-up and other designed prospective-controlled clinical studies are required to confirm therapeutic effectiveness of hyperthermia.

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