LOCAL HYPERTHERMIA: A NEW TREATMENT FOR CARPAL TUNNEL SYNDROME

Sabadini L, *Giannini F, Karadsheh S, *Ravenni R, *Cioni R, Rollo L, Vassalli D, Gelli R, Scola C, Marcolongo R.

Istituto di Reumatologia, Università di Siena, Italy
*Istituto di Clinica delle Malattie Nervose e Mentali, Università di Siena, Italy

INTRODUCTION

Several therapies have been proposed thus far to treat carpal tunnel syndrome (CTS); current management of CTS includes wrist splints, local infiltration with slow-release steroids and hand surgery. However, the treatments mentioned above are not suitable for all patients: splints, which are indicated in the early stages of the disease [6], may not be effective enough in more advanced phases, infiltrations with corticosteroids [2] may increase serum glucose levels in diabetic patients, and surgical treatment is not indicated in the mildest cases; moreover, surgical procedures (including infiltrations and hand surgery) are not accepted by all patients. Finally, the majority of physical treatments currently available have proved uneffective in terms of management of CTS. In this respect, a flow chart to help deal with the diagnostical and therapeutical problems of CTS has been recently proposed by the American Academy of Neurology [6].
Local hyperthermia (LH) is a new physiotherapeutic approach to treat CTS; it is based on the use of microwaves and, compared with standard treatments, is a highly innovative technique. Therefore, we decided to assess the efficacy of LH as treatment of primary CTS.

MATERIALS AND METHODS

We used a microwave appliance with a frequency of 434 mHz. Patients were treated twice weekly with LH; wattage and duration of treatment varied according to the tolerability of the patients studied, but care was taken in order to ensure that the same amount of energy was administered to each patient. Study population included 32 patients with primary CTS; we excluded all cases of secondary CTS due to dismetabolic and thyroid pathologies, systemic diseases and local traumas. In all cases, disease duration was more than 6 months and clinical diagnosis was supported by baseline electroneurographic findings. The group of patients included 2 males and 30 females; the mean age was 46.66 ± 8.66 yrs. Patients were divided into two groups, those treated with 5 applications, and those treated with 10 applications. All patients were evaluated clinically and with instrumental examinations including electroneurography (ENG) [6], ultrasonography (US) [1,4,7] and telethermography (TTG) [3,5]. Clinical evaluation was performed and a score, based on the presence or absence of symptoms in the day or during the night (paresthesia and pain) was given to each patient; the score chosen is validated in the literature [2]. Patients were treated with LH following baseline evaluation (T_n) of the parameters mentioned above; evaluation was repeated at the end of treatment (T_1), whereas clinical score measurement and ENG were repeated 1 month (T_2) and 3 months afterwards (T_3). ENG results were evaluated statistically with Student's two-tailed paired t-test.

RESULTS

Our results demonstrated improvement in the clinical score in 90% out of the patients treated with 5 applications of LH (Tab. 1), and in 86% out of the patients treated with 10 applications (Tab. 2). Instrumental examinations showed different results, depending on the techniques used. ENG demonstrated a significant improvement ($p < 0.05$) in the conduction velocity of the sensory median nerve in the 3rd and in the 4th finger of the patients treated with 5 applications (Tab. 3), whereas no significant improvement was registered in the group of patients treated with 10 applications (Tab. 4). Similarly, US showed different results in the two groups considered (Tab. 5, 6). Finally, the results of TTG (Tab. 7, 8) are only partially in keeping with those obtained using the other techniques.

Tab. 1. Severity distribution of symptoms before (T_0) and after treatment (T_1) in the 10 patients treated with 5 applications of local hyperthermia. Further evaluation of symptoms was performed 1 month (T_2) and 3 months (T_3) after treatment suspension. Clinical score: 0 = no symptoms, 1 = nocturnal and diurnal paresthesias, 2 = nocturnal pain, 3 = nocturnal and diurnal pain.

clinical score	(T_0)		(T_1)		(T_2)		(T_3)	
	n°	%	n°	%	n°	%	n°	%
0	0	0	2	20	2	20	2	20
1	2	20	6	60	7	70	5	50
2	5	50	1	10	1	10	3	30
3	3	30	10	10	0	0	0	0

Tab. 2. Severity distribution of symptoms before (T_0) and after (T_1) treatment in the 22 patients treated with 10 applications of local hyperthermia. Further evaluation of symptoms was performed 1 month (T_2) and 3 months (T_3) after treatment suspension. clinical score: 0 = no symptoms, 1 = nocturnal and diurnal paresthesias, 2 = nocturnal pain, 3 = nocturnal and diurnal pain.

clinical score	(T_0)		T_1)		T_2)		(T_3)	
	n°	%	n°	%	n°	%	n°	%
0	0	0	4	18	4	18	6	27
1	5	22	17	77	16	73	13	59
2	9	40	1	4	2	1	3	14
3	8	36	0	0	0	0	0	0

Tab.3. Orthodromic ENF (M_3 and M_4) and distal motor latency (DML) of the median nerve in the 10 patients treated with 5 applications of local hyperthermia before (T_0) and after (T_1) treatment. Further assessments were performed 1 month (T_2) and 3 months (T_3) after treatment suspension. Results are expressed as means ± SD. Statistical significance was determined using Student's paired t-test (* = $p < 0.05$).

nerve segment	(T_0)	(T_1)	(T_2)	(T_3)
ENG M_3 (m/sec)	36.8 ± 6.5	39.1 ± 6.7	39.5 ± 6.2*	39.6 ± 6.3
ENG M_4 (m/sec)	29.7 ± 12.8	31.2 ± 12.9	32.5 ± 13.3*	34.4 ± 8.6
DML (msec)	4.1 ± 0.9	3.8 ± 0.9	3.8 ± 0.8	4.1 ± 1.1

Tab. 4. Orthodromic ENG (M_3 and M_4) and distal motor latency (DML) of the median nerve in the 22 patients treated with 10 applications of local hyperthermia before (T_0) and after (T_1) treatment. Further assessments were performed 1 month (T_2) and 3 months (T_3) after treatment suspension. Results are expressed as means ± SD.

nerve segment	(T_0)	(T_1)	(T_2)	(T_3)
ENG M_3 (m/sec)	35.3 ± 6.8	35.1 ± 5.7	35.5 ± 4.5	36.5 ± 6.7
ENG M_4 (m/sec)	32.9 ± 6.1	32.7 ± 7.1	33.1 ± 5.2	32.7 ± 8.7
DML (msec)	4.4 ± 0.7	4.4 ± 0.8	4.5 ± 0.8	4.4 ± 0.9

Tab. 5. Ultrasonographic assessment of the 10 patients treated with 5 applications of local hyperthermia after (T_1) treatment.

number of patients assessed at T_1	unchanged		improved		worsened	
	n°	%	n°	%	n°	%
10	2	20	8	80	0	0

Tab. 6. Ultrasonographic assessment of the 22 patients treated with 10 applications of local hyperthermia after (T_1) treatment.

number of patients assessed at T_1	unchanged		improved		worsened	
	n°	%	n°	%	n°	%
22	14	63.6	8	36.4	0	0

Tab. 7. Telethermographic assessment of the 10 patients treated with 5 applications of local hyperthermia after (T_1) treatment.

number of patients assessed at T_1	unchanged		improved		worsened	
	n°	%	n°	%	n°	%
10	6	60	3	30	1	10

Tab. 8. Telethermographic assessment of the 22 patients treated with 10 applications of local hyperthermia after (T_1) treatment.

number of patients assessed at T_1	unchanged		improved		worsened	
	n°	%	n°	%	n°	%
22	12	54.55	8	36.36	2	9.9

CONCLUSIONS

From this study, we conclude that the clinical outcome (expressed as clinical score) following treatment with local hyperthermia is usually satisfying; however, the clinical response does not correlate very well with the instrumental findings. In our opinion, this could be due to the fact that the techniques used investigate different aspects of the disease. Still, both the clinical score and the instrumental techniques (ENG and US) are able to discriminate between the patients treated with 5 applications and those treated with 10 applications of local hyperthermia, the former improving more than the latter; therefore, it is reasonable to infer that the treatment with 5 applications is more effective than that with 10 applications. ENG investigates sensitive and motor nerve conduction in thick myelinated fibres, but not in dolorific fibres (A delta and C) of small calibre, whilst US can reveal underlying inflammatory process
es and changes in size of anatomic structures, and seems to correlate better with clinical parameters. Finally, TTG can demonstrate changes in body surface temperatures; however, these changes do not show a close correlation with clinical findings.
The indication for local hyperthermia in the management of CTS could be questioned on the grounds that LH is less effective than local infiltrations with slow-release steroids or hand surgery. Nevertheless, as LH is not an invasive procedure, we should like to advocate it use in the early stages of CTS, in particular whenever standard treatments are controindicated.

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