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ROLE OF HIVAMAT® (DEEP OSCILLATION) IN THE TREATMENT FOR THE LYMPHEDEMA OF THE LIMBS

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ABSTRACT

Background. The important goals achieved by biomedical technologies led us to search for new mechanisms for the treatment of the lymphatic pathologies. The aim of this study is to examine a new instrumental physiotherapeutic method which makes use of intermittent electrostatic fields with deep oscillation.

Materials and methods. HIVAMAT® 200 acts on the connective tissue with pulsing electrostatic fields which produce a deep resonant vibration of the tissues involved. By repeating this process in swift succession tissue deformations are caused. This allows fibre and tissue layers to regain motility and flexibility. On the basis of these remarks we conducted a clinical and instrumental study in order to check its efficacy in treating lymphedema of the limbs. From May to December 2005, 20 patients affected by lymphedema of the limbs underwent HIVAMAT® 200 treatment wearing II class compression garments.

Results. The results obtained in 20 patients confirmed that this method can play an important role in the treatment of such a complex disease. We achieved a remarkably significant reduction in the circumference of the limbs and in the subcutis thickness.

Conclusion. The advantage of HIVAMAT® 200 lies in the combination of electricity and several manual massage techniques which improve the treatment quality and efficacy. Moreover, due to its potential for self-treatment, patients can undergo treatment at home.

KEY WORDS: Lymphedema treatment, Intermittent electrostatic fields with deep oscillation.

INTRODUCTION

Lymphedema is a chronic and progressive disease which may lead to disability from a physical, functional and psychological point of view. For this reason, it requires a targeted intervention, an early diagnosis and a comprehensive follow up care. The crucial difference between lymphedema and other vascular edemas is due to its constant fibrosis progression. This is because lymphedemas have a higher protein concentration which is responsible for the inflammation chain activation (1).

From a clinical point of view, the more the inflammation element is present, the more connectivization and therefore fibrosis may occur.

The definition of the causes of the lymphatic disease and its evolution state are also crucial elements to take into account in

order to determine the therapy timing and methods (2,3). From the rehabilitation perspective, this makes use of well-proven physiotherapeutic techniques which have been tested by numerous clinical studies carried out in university departments as well as in the medical field (see guidelines CIF-2004 and CONSENSUS DOCUMENT ISL-2003) (4,5,6,7). These physiotherapeutic techniques are commonly referred to as "Complex Decongestive Physiotherapy (CDP) of the lymphedema which consists of 2 phases and it is based on compression bandages and decongestive exercises (8,9).

The aim of this study is to examine a new instrumental physiotherapeutic method which employs intermittent electrostatic fields with deep oscillation. HIVAMAT® 200 acts on the connective tissue with pulsing electrostatic fields which produce an intense resonant vibration of the tissues involved. The mechanism is made up of a semiconductor layer and a minimal electrostatic field set up between the therapist's hands and the patient's tissue. The repetition of this phenomenon in quick succession generates rhythmical deformations of the tissue which is pumped through in its entire depth. This action allows fibre and tissue layers to regain motility and flexibility and improve tissue nourishment thanks to an increase in ATP production. HIVAMAT® 200 acts mainly on intercellular circulation of the interstitial connective tissue. Treatment results in a normalization of the fluidity of circulation.

MATERIALS AND METHODS

From May to December 2005, 20 patients affected by lymphedema of the limbs underwent treatment by HIVAMAT® 200 combined with II class elastic stockings.

There were 16 females and 4 males aged between 30 and 60. HIVAMAT® 200 was applied following the procedures of manual lymph drainage (MLD). This consists in the preparation of the central and peripheral lymph node stations and then the successive drainage to lymph centres following the ways of lymphatic flow with a specific focus on the areas of major lymph accumulation. Treatment lasted 30 minutes and it was carried out twice a week. Each treatment was subdivided into 2 phases: initial medium-high frequency (25-80 Hz, 80-200 Hz) was aimed at softening the indurated tissue and stimulating the transportation of liquids whereas low frequency (25-80 Hz) acted as a strong pumping effect which allowed an effective interstitial drainage. After treatment the elastic stocking was applied on the affected limb.

The clinical conditions and the ecographic examination made by PHILIPS iu22 were a part of the study inclusion criteria (10). Measurements of the circumference of the limbs were taken at 3 precise levels: above the ankle, at the upper 1/3 of the leg and at the upper 1/3 of the thigh. Such levels were also determined in each patient by considering the height from the ground in order to have a constant and precise level of measurement.

Ecographic examination was performed at the same levels in order to evaluate subcutis morphology and thickness before and after treatment. This allowed as to evaluate qualitative modifications of the edema such as its state of subcutis connectivization and the presence of fluid lymph accumulation.

Moreover, all patients who were under edema specific or non-specific pharmacological treatment were excluded from the study. On the other hand, patients who had finished complex physical treatment about 40 days earlier were included in order to not evaluate patients that could have had long-term benefits after intensive treatment.

RESULTS

Variations of the circumferences, the subcutaneous thickness as well as qualitative variation in the subcutis layer affected by lymphedema were clinically and ecographically evaluated in these 20 patients after an eight-week course of HIVAMAT® 200 treatment. Treatment was also combined with compression stockings which are known to not influence significantly edema progression.

Before treatment the measurement of the circumference of the lower 1/3 of the leg ranged between 22.0 and 32.0 cm with a 25.9 cm average.

After treatment this average was down to 24.9 cm ranging from 21 to 34 cm.

This 1 cm average reduction was highly significant according to the t student test ($p < 0.001$).

At the upper 1/3 of the leg circumferences ranged between 36 and 45 cm with a 39.3 cm average. At the end of the therapeutic cycle results ranged between 35 and 44 cm with a 38.4 cm average. According to the t student test this difference was remarkably significant

At the upper 1/3 of the thigh circumferences ranged between 57 and 75 cm before treatment with a 63.6 cm average. After an eight-week course of treatment the average was 62 cm ranging between 55.5 and 73.5 cm. (Table I)

Ecography was carried out at the same level where circumferences were measured, that is, in the medial upper and lower 1/3 of the leg and the upper 1/3 of the thigh.

Measurements of the subcutis thickness at the lower 1/3 of the leg ranged between 3.50 and 5.09 with a 4.12 cm average. After treatment this value decreased to 3.97 cm ranging between 5.41 and 3.34 cm. This difference was also significant ($p < 0.001$).

At the upper 1/3 of the leg the subcutis thickness ranged between 5.73 and 7.16 cm with an average of 6.26. After treatment it decreased to 6.14 cm ranging between 5.57 and 7 cm. This difference was not found to be significant.

The final measurement of the subcutaneous thickness was taken at the upper 1/3 of the thigh. The average value of the initial thickness was 9.86 (range 8.83-11.7) and at the end of treatment this was reduced to 9.67 ranging between 7.95 and 11.3 cm. These results were remarkably significant ($p < 0.001$). (Table II)

The aim was to undertake a qualitative evaluation of the subcutaneous layer conditions as well as the dominant feature, such as edema, presence of lymphatic lakes associated with the presence of lymph at the subcutaneous layer, fibrosis and sclerosis. In all cases a substantial reduction of the fibrotic component and the sovrascial edema (if any) was observed. From a clinical perspective, this result revealed the presence of a tender edema. At the end of the study, this allowed us to provide patients with new intensive treatment where no side effects were observed, neither initially nor subsequently in the use of this machine. (Photo 1 - 2).

Table 1 - Measurement of the circumferences of the limb.

SEGMENT	Mean Average before treatment (cm)	Average post treatment (cm)	Range before treatment (cm)	Range post treatment (cm)
Lower 1/3 leg	25,9	24,9	22,0 - 32,0	21,0 - 34,0
Upper 1/3 leg	39,3	38,4	36,0 - 45,0	35,0 - 44,0
Upper 1/3 thigh	63,6	62,0	57,0 - 75,0	55,5 - 73,5

Table 2 - Measurement of the subcutaneous thickness.

SEGMENT	Mean Average before treatment (cm)	Average post treatment (cm)	Range before treatment (cm)	Range post treatment (cm)
Lower 1/3 leg	4,12	3,97	3,50 - 5,09	2,1 - 3,5
Upper 1/3 leg	6,26	6,14	5,73 - 7,16	5,57 - 7,00
Upper 1/3 thigh	9,86	9,67	8,83 - 11,7	7,95 - 11,3

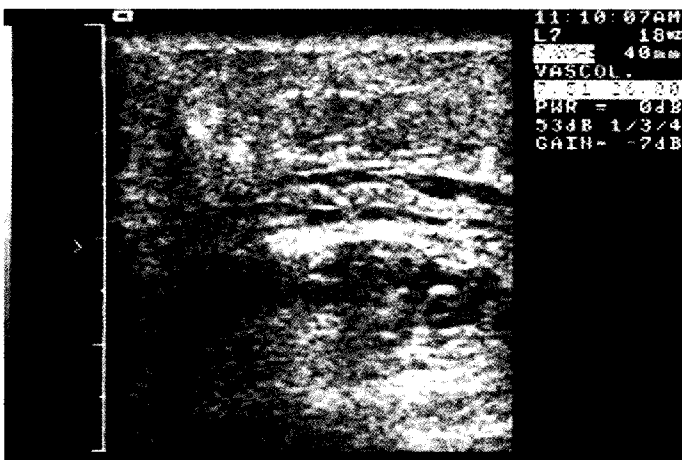


Photo 1. Ecographic window of a limb with lymphedema with evident connectivization and presence of lymphatic lakes.

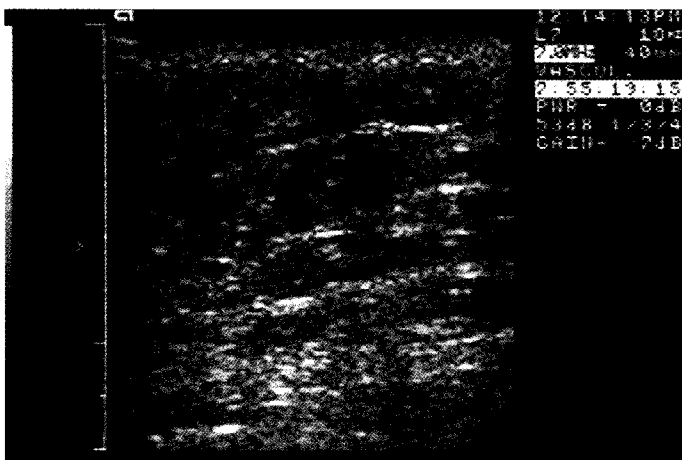


Photo 2. Same "ecographic window": evident reduction in the lymph accumulation and connectivization.

DISCUSSION

Based upon our research results it is evident that in the case of lymphedema, no definite clinical resolution of the disease can be expected. However, there is a clear improvement in the objective and subjective parameters and this aim was accomplished with the application of the deep oscillation method.

Thanks to HIVAMAT® 200 we achieved a remarkably significant reduction in the circumference of the limbs affected. The type of clinical evaluation used, if applied rigorously, is able to confirm the above-mentioned results in any treatment aimed at improving lymphedema.

Both qualitative and quantitative evaluations were carried out in order to monitor the structural aspect of the subcutis. As a result, the ecographic studies have confirmed that the deep oscillation application significantly reduces the subcutis thickness.

There is no scientific literature on the deep oscillation method for treating lymphedema. Nevertheless, our study clearly showed how this treatment can be successful in slowing lymphedema progression down.

CONCLUSIONS

Lymphedema represents a chronic, irreversible and debilitating condition where progression is inevitable. Instrumental tests are useful to confirm the clinical diagnosis, determine residual lymphatic function, select and evaluate therapeutic methods. The treatment goal is to remove stagnating lymph in order to avoid the onset of subcutaneous fibrosis, prevent complications such as lymphangitis, severe functional impairment, cosmetic embarrassment and amputation of the limb. This results in an improvement of the patient's quality of life. Non-invasive conservative therapy represents the best approach to lymphedema. Surgical procedures such as lymphovenous anastomosis, are reserved for specific conditions and they are rarely recommended as primary therapeutic option.

The Complex Decongestive Physiotherapy (CDP) of lymphedema is commonly employed as primary treatment and is based on hygienic measures, skin care, manual lymph drainage (MLD), compression bandages and decongestive exercises.

HIVAMAT® 200 is a new instrumental physiotherapeutic method which employs intermittent electrostatic fields with deep oscillation in order to stimulate the transportation of interstitial liquids and their components and allow fibre and tissue layers to regain motility and flexibility. All these effects are achieved through minimal external pressure.

On the basis of our experience, the optimum treatment for lymphedema of the limbs can be achieved through two or three-week cycles of CDP. Thus, through a combination of CDP and deep oscillation methods, which are able to stimulate transportation of interstitial fluids and their components, we can ensure an improvement of the treatment quality, a reduction in treatment times with positive effects on the patient management costs and an improvement of the patient's quality of life.

Furthermore, thanks to the possibility of self treatment patients are given the chance of undergoing continuous therapy at home.

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