

Treatment of proprioceptive balance disorders: comparison between kinesitherapy and Hilterapia®.

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ABSTRACT

Proprioceptive vertigo disorders can be caused by several mechanisms, generally of muscle-tendon origin, able to induce an irritant stimulus on vestibular nuclei and on cervical sympathetic nervous system. Such disorders are often associated with pain and functional limitation of the cervical tract. Thirty subjects, subdivided in two groups, have been included in the study. One group was treated with kinesitherapy alone and the other group with kinesitherapy combined with Hilterapia®. Treatment has been administered on a daily basis for the first week and every other day for the following 2 weeks, for a total of 10 sessions. All subjects have undergone a clinical-anamnestic evaluation before treatment (T0), at the end of the first week (T1), at the end of the therapy (T2), and one month later (T3). A computerised stabilometric test, with elaboration of the cervical interference index has also been taken at T0, T2 and T3 time points. Data on semi quantitative scale have been analysed using the Mann-Whitney non parametric test. Data on cervical

interference have been analysed using the parametric Paired Samples T Test.

With regards to the non parametric data, no significant variations between the two groups have emerged. However, both sets of data showed significant variations in the trend over time of the various parameters, within each group, with a more rapid improvement, in terms of pain and functional limitation, in those subjects undergoing a combined kinesitherapy and Hilterapia® treatment. With respect to the cervical interference index, a significant variation between T0 and T3 has been observed only in the combined treatment group.

Hilterapia® has been found to be an effective help to produce faster subjective improvements with kinesitherapy and more importantly, it has been demonstrated to improve proprioceptive balance disorders.

INTRODUCTION

Some essential factors are required for a good balance control. Firstly, the knowledge of the environment static and dynamic conditions moment by moment;

secondly, the ability to rapidly and efficaciously adapt to every status change of the environment and one's body and finally, the ability to adjust biological functions to the different situations and the awareness of the situation itself.

The balance control system is particularly complex and, to date, still partially unknown. A major role is played by the peripheral receptors sensitive to the environmental and somatic inputs (extero- and proprioceptive sensorial receptors), by the nerves designed to carry these afferences, by the central nervous system that is able to deal with peripheral inputs and to programme the right motor outputs, as well as muscles, tendons, and articulations designed to programmed motor adjustments. [1-2]

Proprioceptive vertigo disorders have been linked for many years to the presence of hemodynamic regulation alterations in the vertebrobasilar district, secondary to regional perivascular sympathetic plexus stimulations by external irritating factors, predominantly of cervical tract arthrosic nature. Current knowledge tends to minimize the role of this pathology, mainly on the basis of the frequent presence of its symptomatology in young subjects without reduced cervical motility. The arthrosic factor is therefore no longer recognised as the only element able to induce an irritating stimulus, either intrinsic or extrinsic, on the cervical sympathetic and indirectly on the vestibular nuclei, although an association between arthrosis and balance disorders is often found. The latter can be linked to arthro-muscular alterations, to afferent fibres pathology, or to alterations of the central relays. It is currently believed that cervical pathologies can induce balance disorders by sending altered proprioceptive information to the central nervous system and/or not allowing a normal motor efferent program. Indeed,

proprioceptive efferent signals of muscle-tendon origin, via segmental reflexes or via their modulation at vestibular nuclei level of the cerebellum or of the vestibular cortical area, can affect the balance controlling system. [2]

Balance impairment of such origin is rarely associated with the typical vertigo manifestation. They are more often subjective disorders characterised by unsteadiness and discomfort feeling, frequently associated with migraine, localised pain, stiffness, functional limitation, nausea and tinnitus.

The rehabilitation therapy of vestibular balance disorders is aimed at the recovery of an altered function by reprogramming the function itself, promoting adaptive-compensatory activity and inducing the habit to disease. However, in the case of proprioceptive disorders the adjustment of arthromuscular dysfunction could lead to the elimination of the balance disorder cause itself. [2]

The Nd:YAG high energy laser has an analgesic, antiedematous and bio-stimulating effect even on deep tissues, promoting healing processes and shortening recovery times. [3-4]

Therefore, the aim of the present study was to evaluate if Hilterapia® treatment combined with kinesiotherapy could be helpful in improving the symptoms of proprioceptive balance disorders.

MATERIALS AND METHODS

Patients. Thirty subjects suffering from proprioceptive balance disorders, 20 females and 10 males, aged between 25 and 65 (mean age 48.8 years) have been included in this study. Ten of the patients reported a previous cervical sprain trauma and 11 presented cervical spondyloarthrosis X-ray evidence. Nine patients had been reporting symptoms for less than 6 months; 14 between 6 and 12 months and 7 for more than 12 months.

Patients have been randomly divided in two groups: group A was treated with kinesiotherapy combined with Hilterapia® and group B with kinesiotherapy alone.

Methodology. Kinesiotherapy protocol included active and passive mobilizing exercises of the cervical tract, stretching paravertebral exercises, postural rehabilitation and proprioceptive self-analysis. Hilterapia® treatment was carried out with a HIRO 3.0 (ASA S.r.l., Vicenza, Italy) pulsed Nd:YAG laser with peak power of 3 KW, pulse duration > 120 msec, mean power of 10 W, maximal fluence of 1780 mJ/cm², and standard handpiece with 5 mm spot. At each session, 3 manual scans on the cervical-scapular muscles have been performed bilaterally, using an increasing fluence (360 to 510 mJ/cm²) and a decreasing frequency (20 to 15 Hz), for a total of 1500 J. Whenever trigger points were present, an additional treatment with fixed handpiece was also performed on such points.

Treatments were administered every day for the first week and every other day for the following 2 weeks, for a total of 10 sessions. All subjects have undergone a clinical-anamnestic evaluation before treatment (T0), at the end of the first week (T1), after therapy (T2) and a month later (T3). The following parameters were evaluated: pain by visual-analogue score (VAS 0-10), muscle contracture (0 absent, 1 mild, 2 severe), cervical tract global articular limitation with semi quantitative scale (1 < 25%, 2 between 25 and 50%, 3 > 50%), presence of subjective balance disorders and of functional subjective limitation (0 absent, 1 mild, 2 moderate, 3 severe) and, finally, the subjective improvement perception by visual-analogue score (0-10). Computerised stabilometric test with elaboration of the cervical interference index (ellipse area registered with closed eyes and head in upright position, and ellipse area

obtained with head in retroflex position ratio) was also taken at T0, T2 and T3 time points.[5-6] Stabilometric test was performed using a pressure platform (LorAn Engineering srl, Castel Maggiore (Bo), Italy) with resistive sensor, with a standard registration of 52 seconds.

Data analysis. Data on semi quantitative scale have been analysed with the Mann-Whitney non parametric test, while data on cervical interference have been analysed with the parametric Paired Samples T Test.

RESULTS

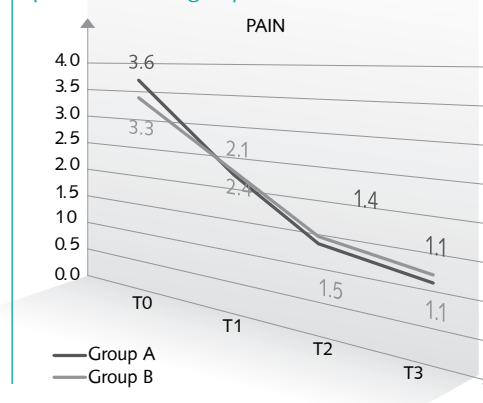
The two groups of patients did not differ significantly for age, sex, symptoms duration, presence of previous traumas at cervical rachis level and X-ray arthrosis evidence.

As far as the parametric data are concerned, there are not significant differences between the two groups in the scores at different time points.

We therefore analysed the variations in time for each clinical anamnestic parameter examined (pain, contracture, articular limitation etc.) within each group.

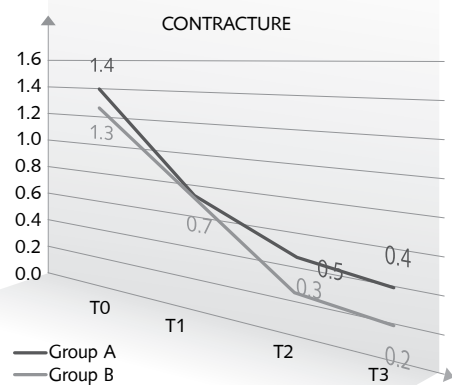
In both groups, the pain reduction between T0 and T3 resulted significant. Also significant was the pain reduction between T0 and T1 in group A only, which included patients treated with Hilterapia® combined with kinesiotherapy. In all other cases the variations observed were not significant (Figure 1).

Figure 1: Variation over time of mean value of pain in the two groups.



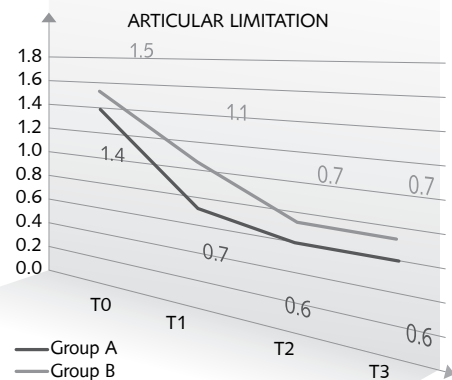
With respect to the contracture degree, there was a significant difference in both groups between T0 and T3, whereas no significant differences were found at intermediate times (Figure 2).

Figure 2: Variation over time of mean value of muscle contracture in the two groups.



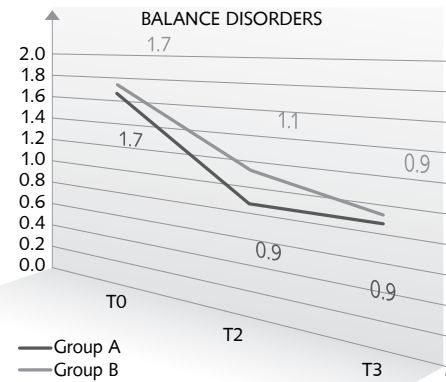
Cervical tract articular limitation has shown very mild variations on the whole. Statistical analysis has shown a significant variation only in group B between T0 and T3. No significant variation was reported for intermediate times (Figure 3).

Figure 3: Variation over time of mean value of articular limitation in the two groups.



As for the subjective balance disorders, variations between T0 - T2 were statistically significant for both groups. If total variations between T0 and T3 are taken into account, a significant difference is present only in group A (Figure 4).

Figure 4: Variation over time of mean value of balance disorders in the two groups.



Subjective improvement felt by patients has been measured by a visual analogical score at T2 and T3. The mean values of improvement have been quantified, on a 0 to 10 scale, at 5.9 and 6.1 for group A at T2 and T3, respectively. In group B, an improvement of 4.1 and 4.3 has been achieved at T2 and T3 respectively. These values remained virtually unchanged between the two control periods and the relative variation was not significant in either of the 2 groups (Figure 5).

The subjective functional limitation, measured at T0, T2 and T3, shows a significant improvement only in group A in the first period (T0-T2), while considering the whole observation period (T0-T3) the functional limitation decreased significantly in both groups (Figure 6).

Figure 5: Variation over time of mean score of improvement reported in the two groups after therapy and one month later.

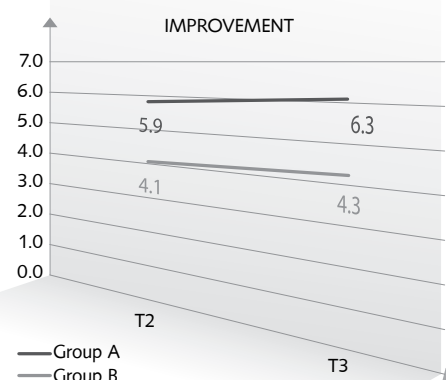
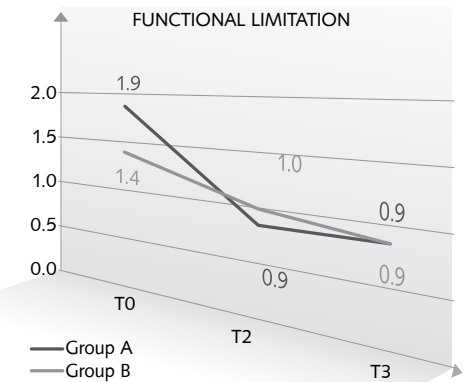
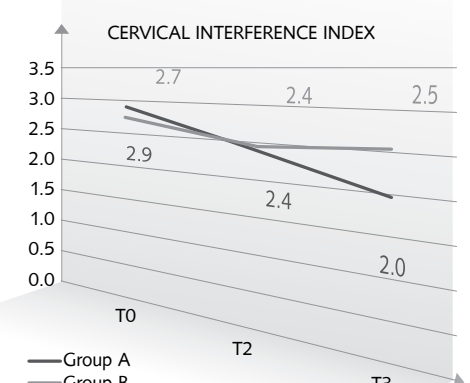


Figure 6: Variation over time of mean value of functional limitation in the two groups.



The cervical interference index has been calculated at T0, T2 and T3, and parametric test comparing the two groups could be applied. The variations observed resulted statistically significant only for group A in the T0-T3 period. In all other cases were not significant (Figure 7).

Figure 7: Variation over time of mean value of cervical interference index in the two groups.



DISCUSSION

The aim of this study was to evaluate the effect of Hilterapia® in proprioceptive balance disorders. For this scope we used a computerised stabilometric test to determine the cervical interference index. Unfortunately, no data is available in literature on this subject. Data obtained

from our study, although limited by the small sample size, showed that only in the group of patient treated with Hilterapia combined with kinesiotherapy there was a significant variation of cervical interference between T0 and T3.

No significant variations were observed in the group treated with kinesiotherapy alone. Even though, positive results were obtained in both groups with regard to pain reduction, in the Hilterapia® group a faster and statistically significant result, highlighted by the comparison between T0 and T1 data, was obtained. A similar trend was obtained for contracture and functional limitation variations, where is evident how a better and faster result is obtained combining the two therapies, even if at the end of the observation period, data do not differ significantly.

Positive results in both groups have been obtained for balance disorders measured with subjective evaluation scale, for the improvement reported by the patient and for the functional limitation. However, when single patients were analysed, in the Hilterapia® group some subjects reported a clear improvement, remarkably more appreciable than the mean improvement in the control group, even though other patients did not report significant variations. Another relevant observation was that parameters improving in the comparison before and after therapy, have always maintained such improvement or even increased it, like in the case of cervical interference in group A, even one month after therapy was ended.

This appears to confirm indirectly the initial hypothesis of efficacy on the pathogenic mechanism: balance disorders have a proprioceptive origin, and once this is removed, it would abolish symptoms as well.

CONCLUSIONS

We believe that our study could give interesting insights on a yet unexplored area. Although data need to be confirmed on larger sample groups and longer observation periods, we can assert that the combination of traditional kinesiotherapy with pulsed Nd:YAG laser at high intensity (Hilterapia®) provides a more rapid clinical symptomatology and computerised stabilometric data improvement.

Therefore, Hilterapia® demonstrated to be an effective aid in the treatment of cervical proprioceptive balance disorders.

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