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Treatment of Shoulder Injuries with Associated Arthrosynovitis Using Horizontal® Therapy

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Phlogistic traumatic shoulder disease must be considered a highly invalidating modern affection, which should be distinguished from real affections of a rheumatological type (osteoarthritis with synovitis). It is caused by repeated microtraumas (through sports or work) or by an occasional single trauma. The painful symptoms are acute and are characterized by the presence of pain with functional invalidity and a state of local tension. These lesions lead to an increase in acid catabolites and the release of enzymes that cause a local hyperemic response, with a build-up of polymorphonucleates.

At the onset of the objectively acute symptoms, the shoulder appears raised, shifted forward, and rotated slightly inwards, with relative flexion of the corresponding elbow.

It is painful when raised, especially as it passes between 40° and 60°, as well as during abduction.

During palpation, we can identify a painful point in front of the angle formed by the long head of the biceps when it leaves the bicipital sulcus to move toward the point of proximal insertion, above the glenoid. This is a sign of the pathological vicariance of the biceps compared to the supraspinous, which runs in parallel, but on a higher, posterior plane. Moreover, by exploring the anterior subcutaneous region corresponding to the bicipital tendon in its intracapsular (extrasynovial) course, we can identify a visible and hyperalgic infiltration.

Referred contracture of the deltoid becomes apparent upon the appearance of the pain, proportionate to the pathological stage, with the patient having a record of complaining of this pain that runs toward the deltoid tuberosity.

A secondary painful point can be found in correspondence to the body of the supraspinous, in the specific fossa.

The patient often experiences posterior pain upon lowering, and especially upon abduction, in correspondence to the posterior bundles of the deltoid. This should be considered as pain referred by the small round muscle that is inserted on the spine of the scapula.

Multidisciplinary Therapy

Particularly painful attacks can benefit from the assumption of particular drugs, such as Salicylates (Acetylsalicylic Acid) or other types of Non-Steroidal Anti-Inflammatory Drugs (NSAIDS), such as Naproxen, Ibuprofen, Ketoprofen, Diclofenac, and Nimesulide, which are excellent at reducing symptoms of pain and swelling.

When the joint is not very painful, gradual exercise is useful to maintain mobility. However, while the problem posed by joint restrictions and muscular recruitment deficit can be tackled by means of the appropriate use of therapeutic exercise, in its various forms, the approach to pain is more complex, especially in relation to the multiple structures in which it may originate and its possible causes.

This characterizes the therapeutic decision-making in terms of a careful and exhaustive assessment.

As already mentioned, pharmacological treatment for the painful symptoms is implemented through the administration of suitable painkillers. However, pharmacological therapy can be assisted, and in some cases even replaced, by the use of specific electric currents with analgesic properties. Numerous studies demonstrate the effectiveness and usefulness of electric therapies in the treatment of the pain typical of acute traumatic diseases. In fact, international literature includes works illustrating the action of new forms of electrotherapy in the biological sphere.

Electrotherapy is considered a branch of physiotherapy that uses electrical currents for therapeutic purposes.

All cells belonging to live tissues, use electricity and chemistry as part of every process, i.e., electrical processes are used in the metabolism, in transmembrane mechanisms during the transmission of pain signals, in inflammatory processes, in muscular contractions, and in the transmission of nerve signals.

All these processes are always accompanied by biochemical processes. Moreover, this is also the case the other way around, meaning that chemical processes are always simultaneously accompanied by electrical ones.

The use of electricity, in the form of an electric current, is thus used for therapeutic purposes, influencing electrical processes in the cells. Horizontal® Therapy is a generation of electrotherapy used in the treatment of shoulder pain, thanks to its

ability to stimulate joint tissues both deep down and on the surface. It produces both bioelectrical effects (deriving from low frequency, variable intensity stimulatory therapy) and biochemical effects (deriving from medium frequency, alternating current, non-stimulatory therapy).
Interferential therapy was developed by combining the action mechanisms discovered in both classes, in order to produce a greater level of communication between the cells (principle of function imitation).

Interferential therapy is applied using four electrodes: by crossing two medium frequency circuits (i.e., 4000 and 4010 Hz), with the two circuits meeting in the center, the frequencies reciprocally neutralize each other, resulting in low frequency, or bioelectrical effects (4010 – 4000 = 10 Hz).
Interferential therapy is unique in that it generates different effects in different treatment areas: live tissue, in the center of the treatment area, receives bioelectrical stimulation deep down;
areas situated outside the meeting point (in the vicinity of the electrodes) experience surface biochemical effects.
Unlike the various forms of traditional electrotherapy, Horizontal® Therapy is able to simultaneously combine all the action mechanisms, horizontally surpassing the stimulation threshold and using a constant electrical intensity setting, with biochemical class frequencies (over 1000 Hz).

According to Wyss, an increase in the frequency should lead to an equal increase in intensity, in order to obtain a physiological effect.

Horizontal® Therapy makes use of this concept, keeping the electrical intensity constant and simply changing the frequency. We are effectively crossing "horizontally" the stimulation threshold, in keeping with the rhythm of the low frequencies, in order to create an action potential, while keeping the intensity constant at the same time in order to produce biochemical effects.
The bioelectrical effects are therefore produced by creating action potentials. Biochemical effects are obtained by keeping the intensity constant. It is clear that Horizontal® Therapy is able to obtain both effects simultaneously, in the same treatment area. We can obtain the various bioelectrical effects by varying the frequency, or rather the number of times we horizontally cross the stimulation threshold per second. With regard to the intercellular effects, chondrocyte energy production primarily takes place through anaerobic glycolysis. Glycolysis begins with glucose phosphorylation via the hexokinase enzyme. The necessary phosphate derives from the adenosine triphosphate (ATP) and creates adenosine diphosphate (ADP). Magnesium is needed in order to activate the hexokinase. The substrata contain one or two phosphoric acid residues during all stages of glycolysis.
In addition to the glucose, fructose, and glycerin sugars, all the substrata in the intermediate products are organic acids. This means that all the substrata are in the form of ions and are therefore directly exposed to the forces of the Horizontal® Therapy electrical fields.

The enzymes, which are at the basis of the various glycolysis reaction phases, are electrically charged. Moreover, the enzyme and substratum molecules react with each other in clearly defined positions, by means of opposing electrical charges. Horizontal® Therapy therefore has an effect that facilitates the metabolism. The probability of the enzyme and substratum coming into contact is increased by the alternating electrical field of Horizontal® Therapy, measuring many thousand oscillations per second. The probability of the substratum molecules and the enzyme molecules meeting, in their specific reaction position, is also improved. These effects primarily take place between cells, boosting the metabolism.

An alternating electrical field in the synovial fluid and the cartilage tissue, rich in water, causes the concentrations to become balanced. Only inorganic and organic ions are found directly exposed to the electrical forces of the alternating field and are made to oscillate. This effect of Horizontal® Therapy encourages the diffusion, and thus the distribution of the pain mediators. Higher intensities, which are well tolerated by the joints, generate a further effect, which blocks the fibers that transmit pain.

Table I. - Patient age

Age	*Number %*
0-20	4
21-40	21
41-60	34
60-69	1

Table II. - Patient gender

Gender	*Number %*
Male	16
Female	44

Table III. - Main symptoms present in patients

Symptoms	%
Pain	100%
Pain with inability to sleep at night	79%
Stiffness	80%
Contractures	100%
Hypotrophy of muscles adjacent to the joint	25%
Effusion	100%
Abduction < 40°	50%

Scope of the Study

To assess the effect of Horizontal® Therapy and, in particular, the two different current emission methods, on shoulder disease with post-traumatic arthrosynovitis in comparison with a treatment using interferential currents accompanied by pharmacological treatment.

Materials and Methods

Following an analysis of the physical characteristics of the tool and the modifications caused on a cellular level, 60 patients were enrolled in the study, of whom 16 were male and 44 female, with an average age of 41.25 (max. 69, min. 19), in the period from February 2004 to July 2005. Patients were selected based on the following criteria:

Case history of acute accidental shoulder disease with X-ray failing to show a fracture of the shoulder joint and ultrasonography showing the presence of post-traumatic shoulder arthrosynovitis without a complete lesion of the rotator cuff.

The application method chosen with regard to both the frequency and position of the electrodes was suggested by the tables in the international user manual.

The 60 cases were monitored closely, especially with regard to pain and the presence of swelling in the joint, as these are the most frequent symptoms. Moreover, the modifications to the elements were assessed vertically for the 60 subjects (at the end of treatment and one month after the end of treatment), studying the progress of the VAS, the ultrasonography scans, and drug administration.

As far as regards the management aspects, when compared to interferential electrotherapy, HT requires a longer treatment session, with approximately 30 minutes treatment plus 5 minutes of electrode placement.

The patients were randomly divided into three groups, A, B, and C, receiving treatment with Horizontal® Therapy Program 1 (program 6.5) and 2 (program 2,2), with Group C being treated with interferential currents.

In the cases analyzed, Horizontal® Therapy and the interferential therapy were administered by means of 10-day session cycles.

Table I. - Drugs used before starting electrotherapy

Drugs used before	*Number per day*	*Number of patients*
Nimesulide	2/day	34
Diclofenac	1/day	12
Salicylates	1/day	14

Table II. - Drugs used after treatment with Horizontal® Therapy Program A

Drugs used afterwards	*Number per day*	*Number of patients*
Nimesulide		0
Diclofenac		0
Salicylates		0

Table III. - Drugs used after treatment with Horizontal® Therapy Program B

Drugs used afterwards	*Number per day*	*Number of patients*
Nimesulide	1/day	4
Diclofenac	1/day	2
Salicylates	1/day	1

Table IV. - Drugs used after treatment with interferential therapy

Drugs used afterwards	*Number per day*	*Number of patients*
Nimesulide	1/day	3
Diclofenac	1/day	3
Salicylates	1/day	2

Table V. - Initial VAS

Corresponding number	Number %
0-2	0%
3-5	0%
6-8	29%
> 8	79%
10	0%

Table VI. - VAS after Horizontal Treatment Program A

Corresponding number	Number %
0-2	90%
3-5	10%
6-8	0%
> 8	0%
10	0%

Table VII. VAS after Horizontal Treatment Program B

Corresponding number	Number %
0-2	70%
3-5	25%
6-8	5%
> 8	0%
10	0%

Table VIII. - VAS after Interferential Treatment

Corresponding number	Number %
0-2	75%
3-5	15%
6-8	15%
> 8	0%
10	0%

Table IX. - VAS after one month from treatment with Horizontal® Therapy Program A

Corresponding number	Number %
0-2	95%
3-5	5%
6-8	0%
> 8	0%
10	0%

Table X. - VAS after one month from treatment with Horizontal® Therapy Program B

Corresponding number	Number %
0-2	80%
3-5	20%
6-8	0%
> 8	0%
10	0%

Table XI. - VAS after one month from treatment with interferential currents

Corresponding number	Number %
0-2	85%
3-5	10%
6-8	5%
> 8	0%
10	0%

Results

Our main objective in this study was to assess the effectiveness of Horizontal® Therapy in the treatment of shoulder disease. The parameters taken into consideration for assessment purposes were the subjective pain index, by means of the VAS scale, the variation in the assumption of painkillers following treatment, and the reduction in endoarticular effusion assessed by means of ultrasonography. The results are illustrated in the following tables.

As can be seen in the tables, in the brief period following treatment with Horizontal® Therapy Program A, the assumption of non-steroidal anti-inflammatory drugs and painkillers ceased completely, while this was not the case for the other two groups. Throughout the subsequent period, the assumption of non-steroidal anti-inflammatory drugs and painkillers remained at the same level as the end of the treatment cycle, with a statistically significant value (p Q 0.001) at one month.

As can be seen in the tables, in the brief period following treatment with Horizontal® Therapy Program A, the VAS underwent a statistically significant reduction, which continued right through to the end of the assessment period of one month (p Q 0.001), while the other two methods demonstrated a lower significance.

The ultrasonography assessment revealed a complete disappearance in 80% of the twenty Group A patients, while there was a 60% disappearance in Group B, and a 50% disappearance in Group C.

Discussion and Conclusions

An examination of the results obtained in this study demonstrates that treatment with HORIZONTAL THERAPY® Program 1 is effective in a statistically significant fashion in the short term and, after treatment, there is a significant reduction in pain. The stabilization, expressed in terms of the objective VAS and the reduction in anti-inflammatory drugs, is statistically significant up to 30 days for Group A, compared to Groups B and C.

The use of this method is therefore important in terms of therapeutic impact. This must be taken into account in the formulation of the rehabilitation program for patients suffering from shoulder disease, with a certain degree of effusion.

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