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Contents

Evaluation of the effect of MLS® Laser Therapy and Ora-Guard™ splint in the treatment of temporomandibular joint disease

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ABSTRACT

Temporomandibular joint disorders (TMD) comprise all the conditions that are affecting the temporomandibular system, composed of the temporomandibular joint (TMJ) and the associated neuromuscular system. These conditions may range from TMJ pain, to headache, neck pain up to tinnitus and are often associated to bruxism and clenching. The aim of this study is to evaluate the effect of MLS® Laser Therapy combined with Ora-Guard™ splint for the conservative treatment of TMD.

The study involved 40 patients which were divided into 2 groups: 1 – Ora-Guard™ splint alone; 2 – Ora-Guard™ + MLS® Laser Therapy.

At the first visit, patients were clinically evaluated and Electromyography (EMG) testing was performed. Pain was evaluated using Visual Analogue Scale (VAS) scale at days 1st, 3rd, 5th and 21st.

The results demonstrated that all the patients improved in terms of pain. Stronger improvement was reported for group 2, when both Ora-Guard™ splint and MLS® Laser Therapy were applied. No undesired effects have been reported in the study.

The combination of Ora-Guard™ splint and MLS® Laser Therapy represents a well-tolerated conservative approach able to alleviate TMD pain and improve joint Range of Motion (ROM) and mouth opening. This combined approach should be considered a valuable tool in the multimodal clinical management of TMD patients.

INTRODUCTION

Temporomandibular joint disorders (TMD) are conditions related to the temporomandibular joint and the associated stomatognathic system. The temporomandibular joint (TMJ) comprises the bilateral articulation with condyles of the mandible with the glenoid fossa of the inferior border of the temporal bone, separated by the meniscus or interarticular disc [1]. The stomatognathic system includes teeth, jaw and associated neuromuscular tissues. TMD have multifactorial origin [2], which may include occlusal problems, joint laxity, prolonged micro-trauma, joint overuse/arthrosis, parafunctional habits, psychological factors, stress, etc.

Clinical signs of TMD include pain and tenderness in the masticatory muscles or TMJ, clicking or crepitation of the TMJ during condylar movement, limitation on mandibular movement, noise from temporomandibular joint, vertigo and chin, neck and head pain are also common [3,4]. Tinnitus can also be originated by cervical spine or TMJ disorders [5,6]. Pain is commonly reported at the following muscles: masseter, temporalis, trapezius (cervical spine), sternocleidomastoid. TMD is the most relevant cause of non-dental pain in the orofacial region, negatively affecting quality of life [7,8].

These conditions may also affect the function of the TMJ system, such as mastication, swallowing and speech [9,10].

The prevalence of TMDs in the general population varies from 7% to 10% and 79.5% of patients with TMDs are women [11]. Limitation of mouth opening occurs in 21.3% of patients, while muscle pain affects 30.7%, and headaches are reported in 46.7% of the cases [11].

The goal of TMD treatment is to reduce pain associated to these conditions in order to improve mouth function and opening, neck range of motion and general patient quality of life.

Multiple conservative approaches are

currently used to treat this class of diseases, such as therapeutic exercise, manual therapy, behavioural exercise, soft diet, analgesic drugs and physiotherapy [12]. When those approaches fail, surgical intervention, including arthrocentesis, disc repositioning, or discectomy for patients with resistant internal derangement [12] can be an option. The use of splint is a common conservative approach which is used in the clinical management of TMD [13]. It is useful to stabilize the anatomy and to protect the teeth which are commonly damaged by bruxism and clenching [14]. Ora-Guard™ is a splint specifically designed with the aim of creating an optimal spacing of the jaw by placing space between molars, preventing teeth from clenching.

The specific design of Ora-Guard™ allows rotation of the lower jaw down and forward to help relieve pressure on the TMJ.

MLS® Laser Therapy is a valuable treatment able to reduce inflammation [15], alleviate pain, decrease swelling and overall promote tissue healing [16, 17]. Moreover, therapy is safe, non-invasive and well-accepted by the patient. Recent studies have confirmed the efficacy of this therapy in the treatment of a variety of osteoarticular and neuromuscular conditions [18-21]. Preliminary experience on TMD clinical cases treated with MLS® Laser Therapy was recently reported [22,23].

The therapeutic effects of the combination of splinting with Ora-Guard™ with MLS® Laser Therapy in comparison with Ora-Guard™ have been evaluated in a total of 40 patients treated conservatively for TMD, which have been divided into two groups.

MATERIAL AND METHODS

A total of 40 patients seeking for TMD care in Dr. Janke's and Dr. Rosswag's practice have been included in the study. Patients wearing pacemakers, pregnant, subjects with severe comorbidities (such as hypertension, diabetes mellitus, cardiac rhythm), subjects with severe respiratory disease (COPD), outcomes of major traumatic diseases, subjects with chronic encephalopathy and cerebral disorders (i.e. Parkinson's disease, epilepsy) and severe postural conditions (such as congenital torticollis, asymmetry of the lower limbs) were excluded from the study.

At the first visit, clinical evaluation was performed, myofascial pain type was indicated (i.e. masseter/temporal muscle hypertonia, cervicalgia, trapezius muscle hypertonia, sternocleidomastoid muscle hypertonia, TMJ pain or others), trigger points and irradiation areas were recorded by the dentist and the presence of edema, cervical arthrosis, muscle contracture, wound, trigger points, bruxism/clenching and/or other specific conditions was reported.

Additionally, the patient was asked to estimate the number of pain events during the day (1 to 5 hours, 5 to 10 hours or more than 10 hours a day) and during the week (1-3, 3-5 or 5-7 events a week).

At the same visit, electromyograph (BTS TMJoint, BTS Bioengineering, Italy) was used to provide a gnathological examination of dental occlusion by recording electromyographic activity of the masseters and temporalis (left and right).

Clinical evaluation and electromyographic measurement were performed at days 1st, 3rd, 5th and 21st.

At each therapy session, the following assessments were performed:

- pain evaluation using the VAS scale
- muscle contracture and mouth opening
- cervical spine range of motion (left and right)

Additionally, reactions, side effects and further notes were recorded. The patients were divided into 2 groups: Group 1 – treated with Ora-Guard™ splint, Group 2 – treated with MLS® Laser Therapy and Ora-Guard™ splint.

Group 1 – was treated with oral splint (Ora-Guard™, BiteTech Inc., USA) alone.

Group 2 – was treated with oral splint (Ora-Guard™, BiteTech Inc., USA) and received MLS® Laser Therapy with Mphi D (ASA srl, Italy). Patients in this group received 4 sessions of MLS® Laser Therapy on days 1st, 3rd, 5th and 21st. MLS® Laser Therapy was performed using Mphi D device (ASA Srl, Italy). MLS® Laser is a class IV NIR laser with two synchronized sources (laser diodes). One diode emits at 905 nm with 25 W peak optical power. The pulse frequency can be adjusted in the range 1-2000 Hz. The other diode emits at 808 nm and can operate in two modes: continuous (power 1.1 W) or pulsed (repetition rate 1-2000 Hz, 550mW mean optical power, with a 50% duty ratio independently of the repetition rate). Correspondent laser beams are emitted synchronously with coincident propagation axes. The treatment was carried out by treating the patient with a holistic approach consisting in the treatment of muscle contracture and trigger points. The following operating parameters were applied: static protocol for TMJ treatment included treatment of the condyle and masseter area (Energy delivered= 47J) and also of trigger points on the sternocleidomastoid (SCM), if present (Energy delivered=3J for point). Static protocol for shoulder and cervical pain included treatment over paravertebral area from C3 to C7 bilaterally and the upper trapezius (Energy delivered= 41J). If present, trigger points on the upper trapezius area and on SCM area were treated (Energy delivered=3J for point).

RESULTS

A total of 40 patients have been included

in the study, 20 were allocated to Group 1 and 20 were allocated to Group 2. Patients demographics and clinical evaluation are reported in Table 1. Most of the patients were female (69,2%).

Clinical evaluation revealed the presence of multiple symptoms, as it is typical of TMD conditions, ranging from myofascial pain in TMJ and cervical area, to bruxism and clenching. Hypertonia was common in masseter/temporal muscle, sternocleidomastoid muscle and trapezius muscle. TMJ pain was the most common symptom, and was present in 80% of the total patients (75% of patients in group 1 and 85% of patients in group 2, respectively), followed by trapezius and masseter/temporalis hypertonia (both reported in 47,5% of the total patients). Trigger points were also very commonly reported and were present in all the patients in Group 1 and 90% of patients in Group 2. Quite often, head pain and neck pain were reported (45% of total patients and 30% of total patients respectively). The variety of symptoms found was reflecting the clinical conditions that are commonly found in TMD patients.

Pain events data and VAS before and after treatment are reported in Table 2. The VAS values demonstrated that both groups improved in terms of pain. Improvement was reported in 90% of patients in both groups. The group with the most relevant improvement was Group 2, which started from most severe pain and reached the lowest VAS value.

In group 1, pain decrease corresponded to 53,9% and in group 2 to 75,9%.

All patients with limited mouth opening before entering the study recovered normal mouth opening at the end of the treatment.

Regarding range of motion, all patients, regardless of the group showed an improvement after the treatment.

No side effects have been reported in the study. Two patients in group 1 and two in group 2 did not show any improvement

Table I

	Group 1	Group 2
Sex (M/F)	9/11	3/16+1 NA
Average age (min-max)	40,25 (24-63)	47,4 (27-68)
TMJ pain	15	17
Masseter/temporal muscolar hypertonia	10	9
Cervicalgy	4	4
Trapezius muscle hypertonia	9	10
Sternocleidomastoid muscle hypertonia	1	6
Other	1 (trigeminal neuralgia)	0
Trigger Point	18	20
Bruxism/Clenching	8	3
Muscle contracture	4	1
Arthrosis	0	1
NA	2	0
Headache	9	7
Neck pain	7	5
Limited ROM	1	3
Limited mouth opening	1	3

Table 2

	Group 1	Group 2
Pain events during the day		
1-5h	12	10
5-10h	5	5
>10h	3	5
Pain events during the week		1=NA
1-3	5	6
3-5	11	7
5-7	4	6
VAS before treatment	8,35	8,7
VAS after treatment	3,85	2,1

and the two of them in group 2 were sent to a neurologist for re-evaluation.

DISCUSSION

TMD is recognised as a multifactorial condition and its treatment is currently based on multiple approaches [4, 24, 25], in line with the fact that under the TMD diagnosis, several symptoms with different origins and characteristics are recognised. This study investigated the potential combination of MLS® Laser Therapy and Ora-Guard™ splint in TMD patients, assessing the clinical results of the combined use in comparison with use of Ora-Guard™ splint alone. The study data confirm that when the double approach is carried out, best results in terms of VAS reduction are achieved. This is specifically true as the group treated with the double approach had higher starting VAS compared to the single approach group and reached lowest VAS value at the end of the evaluation.

The MLS® Laser Therapy protocol that was used in this study was in agreement with the static protocol used in our practices in previously reported clinical cases [23], confirming the safety of the device and the good results in terms of pain management.

Previously, Manfredini et al [22] have evaluated the use of MLS® Laser Therapy, oral appliance and counselling comparing them in the treatment of myofascial pain of jaw muscles, demonstrating that on long term (6 months) all the treatments are effective and that oral appliance and MLS® Laser Therapy should be directed to maximize the positive changes in short term. This is why our study took into account early results up to 21 days, revealing the immediate effect on pain, ROM and mouth opening.

MLS® Laser Therapy demonstrated to have a role in cell metabolism, increasing the levels of serine/threonine protein phosphatase activity as well as the expression of ATP-binding proteins and PP1 protein, which is involved in glycogen metabolism regulation and myosin dephosphorylation [15, 16]. Moreover, it has been reported that MLS® Laser Therapy can control of inflammation, by increasing NLRP10 protein, an inflammasome inhibitor [16]. Since both inflammation and muscle contracture are important factors in the aetiology of TMD pain, these effects, combined with the analgesic effect of the MLS® Laser Therapy, are the base of the action on muscle pain that is reported in many musculoskeletal conditions [19, 26] and are likely to be responsible of the effect seen in the study patients.

The use of Ora-Guard™ was supported by the evidence that splint protects the dental structure, promotes pain relief in the masticatory muscles and TMJ, improves the physiological musculoskeletal relationship in the stomatognathic system. [27-29].

When used together, MLS® Laser Therapy and Ora-Guard™ were associated with good tolerance, confirming the feasibility of combining the two approaches in the clinical practice, in line with the increasing attention that the adoption of multimodal approaches in TMD treatment is getting by dentists and physical therapists. In fact, oral exercise therapy including passive and active movements, stretching and strengthening exercises demonstrated to decrease the signs and symptoms related to TMJ dysfunction since they improve the mouth opening and mandibular movements [30, 31], which, along with pain management, are the main goals of TMD treatment.

Additionally, the treatments are non-invasive and well tolerated by the patients.

It has to be underlined that, in the few patients which were not responding to the treatment, psychological and emotional factors could have played a key role [32, 33], as those aspects are known to strongly influence the outcome of TMD therapy, in terms of poor response [34]. In fact, literature reports that muscle hyperactivity, myospasms or myositis and parafunctional activity are associated with increased level of emotional stress [35].

In conclusion, this study underlines that the combination of MLS® Laser Therapy and Ora-Guard™ is an effective and well tolerated dual strategy for the treatment of TMD patients. Further studies on a larger number of patients will be useful to confirm these findings and identify the criteria to select the type of patients that can benefit most from this approach.

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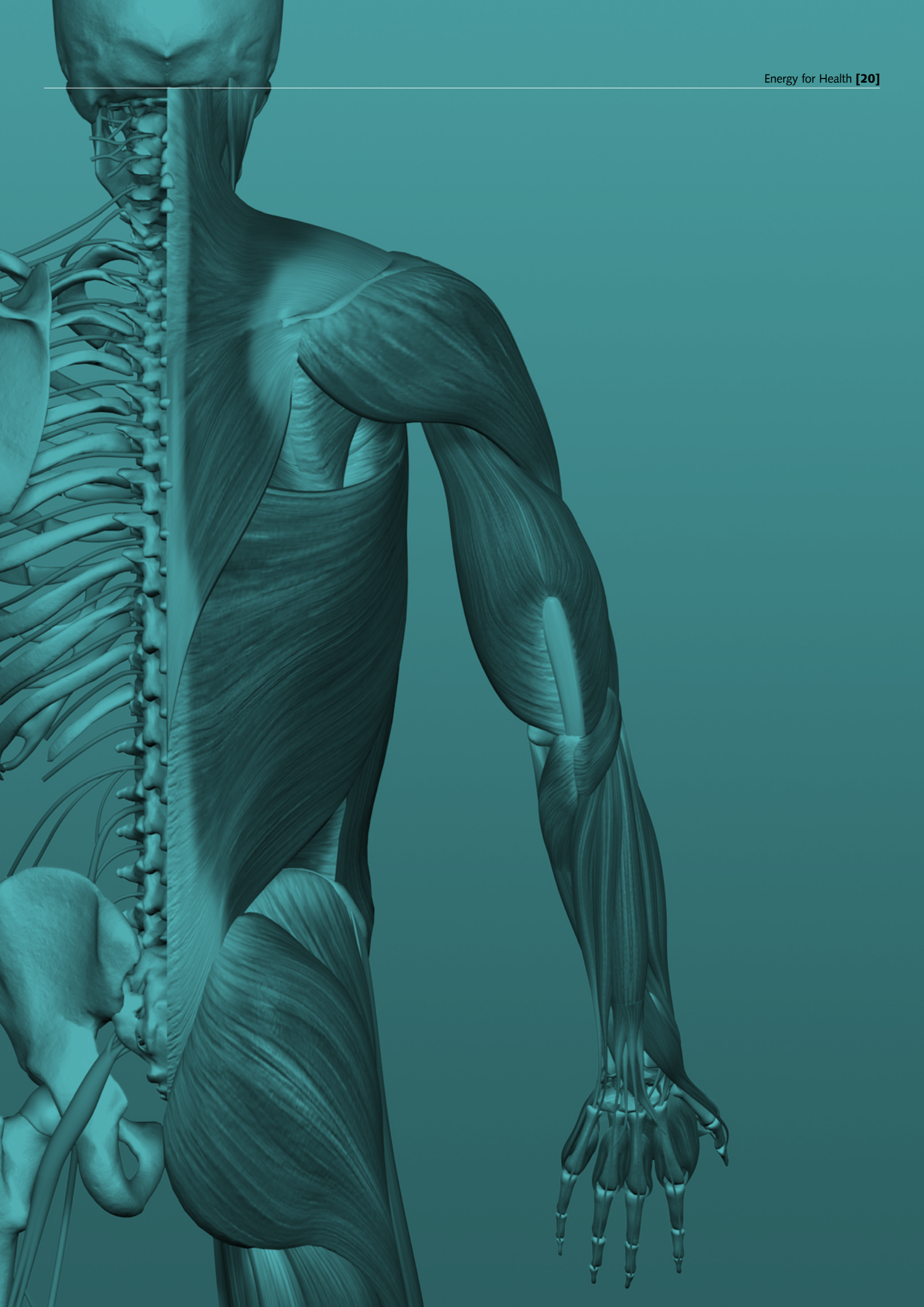

Management of Tietze syndrome pain with Hilterapia® – a case report

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INTRODUCTION

Tietze syndrome is a rare disease of unknown aetiology characterized by painful nonsuppurative swelling over costal cartilages [1]. This condition is differentiated from costochondritis with the presence of tender swelling at the coastal cartilaginous area. The name of the condition is derived by the doctor who first described it in 1921 [2,3].

The signs and symptoms of Tietze syndrome usually develop before age 40 and the condition affects both sexes equally [4].

The most common affected joints are 2nd and 3rd costochondral junctions and the pain ranges from mild to severe. More than 70% of lesions are unilateral and affect one joint. Multiple lesions affect same-side neighbouring joints. Chest pain is the main complaint, which can be increased by coughing, deep breathing, and lying prone. If left untreated, Tietze syndrome can become chronic, deeply affecting the quality of life of patients. The exact cause of Tietze syndrome is still unknown; however, some researchers have speculated that multiple microtrauma to the anterior chest wall may lead to the development of Tietze's syndrome [5,6].

Treatment strategies are usually conservative and comprise manual therapy and administration of anti-inflammatory agents and analgesics either orally, topically, or by injection. Focal local anaesthetic injection alone may also be a useful therapeutic and diagnostic tool [7].

Physical therapies have also been used to treating the inflammation and pain of Tietze syndrome. In this light, Hilterapia® was considered a new therapeutic approach who can be beneficial for the treatment of patients affected by this pathology.

Hilterapia® peculiarity is its ability to transfer highly energetic photonic packages in deep tissues in a non-invasive way. Studies proved the efficacy of Nd:YAG laser in inducing photomechanical and photothermal effects in deep structures [8]. The application of Hilterapia® has showed good results in osteoarticular and neuromuscular diseases [9-11] with consequent improvement of patient quality of life [12,13]. This case report describes the application of Hilterapia® in the treatment of a young patient affected by Tietze syndrome that did not respond to pharmacological and physical therapy with the aim of controlling pain and recovering quality of life.

CASE DESCRIPTION

A 17 years old female patient presented with pain at the level of the left sternum region lasting for 5 months, which had not been resolved by pharmacological anti-inflammatory therapy and that was severely impairing her every day life.

Thoracic and complete spine (in load) RX revealed swelling of the sternoclavicular joint and of the third chondrosternal joint.

The patient received Hilterapia® treatment with SH1 device (ASA Srl, Arcugnano, Italy). SH1 is a Nd:YAG laser, Class IV, with wavelength 1064 nm. Hilterapia® treatment involved 9 daily sessions focused on sternum, clavicle and up to the fourth left ribs. The treatment modality was scanning. The treatment parameters are reported in Table 1:

	Frequency (HZ)	Dose (mJ/cm²)	Total dose for each session (J)
Sessions 1, 2, 8, 9 (2 steps in each session):	15	610	1000
	10	760	
Sessions from 3 to 7 included (4 steps in each session):	35	660	1600
	30	710	
	15	610	
	10	760	

Table 1 – parameter used in the treatment cycle.

Pain evaluation was performed using a Visual Analogue Scale (VAS) . It is a scale comprising 10 grades, with 10 representing 'unbearable pain' and 0 representing 'no pain'. It is a pain scale commonly used in the medical field, and it was shown to be a reliable and valid measure of pain [14,15].

Before starting the Hilterapia® sessions, patient had severe pain (VAS=10), after 2 treatment sessions the pain has been reduced to VAS=5.

Forty days after the last Hilterapia® session the patient remains asymptomatic (VAS=0) and has resumed her life activities without limitations. Specifically, the patient has been able to proceed to postural exercise without any problem.

DISCUSSION

This young patient presented severe pain due to Tietze syndrome which was not responding to the drug anti-inflammatory treatment administered. She had already tried physical therapy which produced no beneficial effects. The pain resulted in a heavy impact on her life and her goal was to find a treatment able to reduce the pain level to an acceptable degree. Given that the Tietze syndrome is not very well known and the pathological mechanism is still not understood, the treatment approach was not focused on illness resolution but on pain and edema reduction to avoid chronicization of the condition in such a young patient.

Hilterapia® was selected due to anti-edema properties and because of its well-known fast action on osteoarticular pain, even in severe acute pain. [11, 16-18]

The result obtained in 9 sessions was a complete elimination of pain, which persisted at 40 days follow up. This therapeutic effect allowed the patient to return to her daily activities, including physical exercise for postural recovery, without impairment, inducing a very valuable improvement in her quality of life.

Based on the reported case, Hilterapia® could be a suitable tool to manage Tietze pain even in patients which received no benefits by pharmacological therapy. Larger studies are needed to confirm this preliminary assessment.

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Report on the use of HIRO TT: validation of practice experience

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ABSTRACT
This paper describes the clinical application of condition-specific practices using HIRO TT, a therapeutic strategy based on the combination of a pulsed Nd:YAG laser, a tissue cooling system and physical exercise. Data derived from 95 treatments carried out in two independent Italian physiotherapy centres. The conditions included in this analysis are: contracture (and trigger points), edema, tendinopathies, trauma and arthrosis. Overall, among the 5 analyzed conditions, the average decrease in reported pain was 90% after treatment completion.

INTRODUCTION
HIRO TT is a new therapeutic strategy for treating painful conditions of the musculoskeletal system, based on the principle of thermal exchange. This therapeutic strategy is based on thermal gradients originated by the association of Hilterapia® (Nd:YAG pulsed laser source, a quite recent solution in the field of physical therapy) with a dedicated cooling system which lowers the temperature of the skin and the underlying tissues, called SmartCooler. Hilterapia® is a form of non-invasive laser therapy that demonstrated to be a valuable tool in the treatment of musculoskeletal disorders [1-4]. *In vitro* studies proved that Hilterapia® is able to induce photothermal and photomechanical effects at cell and extracellular matrix level [5].
The application of the SmartCooler allows a measured decrease of tissue temperature (in the range 28°C-18°C) in the treated area. This triggers a unidirectional cooling chain which first involves subcutaneous layers and then the deep muscle layers.
Tissue cooling is a therapeutic strategy described in the literature for the management of acute and chronic conditions of various type [7-9]. Cooling causes vasoconstriction, reducing blood flow to compromised muscle fibres, decreasing the potential for swelling and producing less catabolic substances [8]. Intramuscular temperature remains below baseline for hours following cooling [10]. Tissue temperature has also an effect on neuromuscular function, as neuroconduction velocity has a direct linear correlation with temperature. Specifically, cooling is related to a reduction of pain sensation and of reflexive spasm thanks to the action on peripheral nerve structure [11].
Overall, the concept of HIRO TT is based on the synergy of the combination of Hilterapia® and SmartCooler. The thermal gradients which are created by the alternated application of SmartCooler and laser determine a thermal exchange process among different tissue layers. Early effects comprise modulation of the local microcirculation, muscle relaxation and reduction of the speed of pain conduction [6].
Additionally, association with stretching exercises is recommended, whenever possible, with the aim to improve functional recovery. Nevertheless, exercises may not be used in patients presenting acute lesion of muscle and tendons or in the first therapeutic sessions of patients reporting very severe pain.
Since its introduction in 2017, HIRO TT is being used by physiotherapy specialists to treat pain due to several causes in a variety of patients. The first experience reported by early users was related to the efficacy of the treatment on 100 consecutive patients treated during routine practice [6]. In that large case series, no side effects were reported and significant improvements were obtained after the treatment in terms of pain decrease, evaluated with VAS scale, and functional recovery. During the collection of that clinical experience, given the fact that those centres were the very first to use the devices, the therapists spontaneously treated patients with highly personalised treatment modalities.
Beside the technical characteristics of the used device, the treatment modality represents a key point to be considered as it can contribute to the final clinical results. Therefore, practice suggestions on how to combine the different therapy elements (namely laser, cooling system and physical exercise) for optimal treatment have been developed and this report collects the clinical experience of two centers which have used HIRO TT on 95 treatments according to these practices with the goal of validating them.
Specific suggestions on treatment modality have been developed for the application on the most common conditions that are treated in physiotherapy centers. HIRO TT users confirmed that they have treated patients presenting a wide range of conditions, some of the most common problems are: cervical and back pain, rotator cuff tendinopathy, muscle strain, tendon

and ligament lesions, hematoma, joint acute and chronic problems. A distinctive feature of HIRO TT involves the possibility, thanks to the effect of the thermal exchange, to apply the therapy immediately in acute conditions, such as trauma, muscle lesions and contusions.
Based on those pieces of information coming from the field, the most common conditions have been grouped in classes and practice suggestions have been developed corresponding to the following categories:

- Contracture
- Edema
- Tendinopathies
- Trauma
- Arthrosis
- Trigger points

Virtually, any physiotherapy center could benefit from the inclusion of HIRO TT in its routine practice, but it is reasonable to think that different therapists may have different levels of experience with physical therapies and, specifically, with laser therapy and a variable confidence in the application of new therapeutic strategies. Therefore, the possibility of using validated treatment modalities which have demonstrated to lead to safe and successful results is an important support to allow early users to implement HIRO TT strategy at its best and reach the highest level of patient satisfaction.
Thus, the aim of this paper is to evaluate the clinical effect of practice protocols for the above clinical conditions. In any case, it is important to note that these practices are not intended to be a substitute for professional medical advice, diagnosis, or treatment.

METHODS

The collected data are coming from the routine practice of two Italian physiotherapy centers: Fisiolab, based in Rosà (Vicenza – Italy) and Mediperson, based in San Martino Siccomario (Pavia – Italy).
Ninety-five patients with different conditions have been treated and assessed. Patients were considered in this report if they have received HIRO TT treatment following the practical steps and tips described above, while patients were not considered if they have received HIRO TT treatments which needed an high level of personalization due to the specific patient conditions or if they presented disorders that could not be included in the categories under the scope of this evaluation.
Patients were assessed for pain intensity using the VAS scale. VAS is a self-reported ordinal scale that provides reliable and consistent clinical measure of pain intensity. The VAS scale uses 11 points (0-10), where 0 represents "no pain" and 10 represents "the worst possible pain". Each patient was asked to indicate the number on the scale that best represents the intensity of pain at baseline and after completing the treatment program.
Change in VAS from baseline to end of treatment cycle was assessed. At the conclusion of the treatment program, therapist's comments on general improvement features were recorded (i.e. functionality, range of motion, quality of life, etc.).
The average percent decrease in pain was calculated by:
(pre-treatment VAS - post treatment VAS) / (pre-treatment VAS) * 100.
Patients were treated with HIRO TT (ASA Srl, Arcugnano). The device gives pulsed emission (λ = 1064 nm), high peak power (>3000 W), high levels of energy density (fluency from 90–1.780 mJ/cm^2), short pulse duration (100 μs), a duty cycle between 0.1% and 0.3%, and frequency in the range 10–30 Hz, maximum energy per pulse (350 mJ), mean power (10.5 W), and power cycle of ~ 0.1%. HIRO TT enables to connect the three handpieces (Ø5 mm, Ø10 mm, DJD) with a single optic fibre and to combine them with the SmartCooler. The SmartCooler system consists in a Peltier plate for skin cooling, that can be regulated in the range 18°C-28°C. The SmartCooler system can be combined with the handpieces in a single applicator. Protective eye goggles were worn by the patient and the therapist.
According to the diagnosed disorder, patients have received the treatments based on pre-set protocols and the practical steps that are reported below:

- Contracture

SmartCooler: the system was set to the temperature of +18/+20°C and the cooled plate was applied to the contracted area. Intermittent applications of 5 seconds each x 3 on each treatment point were performed.
Hilterapia® & Stretching: after applying the SmartCooler, laser treatment was carried out by scanning the contracted area using the appropriate handpiece (Ø 5mm or 10mm) and the pre-set treatment parameters in the "Muscular Contracture" program.
When possible, stretching exercises (muscle stretching) involving the contracted muscle were done simultaneously with the laser treatment.

- Edema

SmartCooler: the system was set to the minimum temperature of +18°C and applied by scanning in the affected edematous area.
Hilterapia®: after applying the SmartCooler, the laser treatment was carried out by scanning the area using the Ø5 mm handpiece and the pre-set treatment parameters in the "Edema" program.
The above procedure was repeated alternating the SmartCooler system and the laser handpiece for two or three cycles.

- Tendinopathies

SmartCooler: the system was applied point by point in the peri-tendinous and possible inflamed areas. Intermittent applications of 5 seconds each x 3 on each treatment point were performed.
Stretching: after applying the SmartCooler, when possible, stretching exercises (muscle

stretching) involving the muscles connected to the tendon were carried out.
Hilterapia®: after applying the SmartCooler, the laser treatment was applied by scanning the area using the Ø5 mm handpiece and the pre-set treatment parameters in the appropriate program for the tendinopathy to be treated.

- Trauma

SmartCooler: the system was set to the minimum temperature of +18°C and applied by continuously scanning the affected area for an adequate period of time in order to convey the temperature drop in a uniform and deeper manner to the affected area.
Hilterapia®: after applying the SmartCooler, the laser treatment was carried out by scanning the area using the Ø10 mm handpiece and the pre-set treatment parameters in the "Trauma/ Contusion" or "Muscle Lesion – Acute Stage" program.

- Arthrosis

SmartCooler: the system was set to the minimum temperature of +18/+20°C and applied by scanning the intra-articular windows.
Functional exercises: when the patient's conditions allowed this, after applying the SmartCooler the patient was encouraged to carry out small joint mobility exercises.
SmartCooler & Hilterapia®: the laser treatment was performed using the DJD handpiece and the "Arthrosis" protocol appropriate for the concerned area. Simultaneously apply the SmartCooler system & the laser handpiece by continuously scanning tissues through the intra-articular windows.

- Trigger points

SmartCooler: the system was set to the temperature of +18/+20°C and the cooled plate was applied to the trigger point. Intermittent applications of 5 seconds each x 3 on each trigger point were performed.
Hilterapia®: after applying the SmartCooler, laser treatment was carried out on the trigger point, using the Ø5 mm handpiece and the pre-set treatment parameters in the "Trigger Point" program.
The aim is to reduce the initial pain by approximately 50-70%. For this purpose, the same step can be carried out one or more times, re-evaluating each time the pain of the treated trigger point through palpation.
Trigger point treatment is not a procedure *per se*, but it is carried out within the treatment of the specific conditions. The protocol suggested is taken by the suggestions for "Contracture" treatment, due to the fact that physiologically, the trigger point is a point of muscle hyper irritation and pain.

RESULTS

Total treatments that had followed the practices are 95.
Results in terms of VAS changes for the pre- to post- treatment were reported in Table I, along with final therapist's comments.
All the protocols related to the practices guarantee an average decrease in pain >85%.
Overall, among the 5 analyzed conditions, the average decrease in reported pain was 90% after treatment completion. Trigger point treatment is always part of another treatment session, therefore there is no specific VAS evaluation dedicated to TP and therefore it is not included in the calculation. Nevertheless, trigger point treatment is following the same concept of contracture treatment and can be considered validated by contracture protocol experience.

DISCUSSION

HIRO TT is a new therapeutic strategy based on an integrated approach involving laser therapy, a skin cooling system and the execution of appropriate exercises. The effectiveness of this innovative approach has been described in a previous paper [6], where early users have described

Protocol Applied	Number of patients	Average VAS pre	Average VAS post	Average % decrease in pain	Therapist's Comments
Contracture	16	6.8	0.2	91.2%	Optimal results on all kind of patients, from obese sedentary to very active.
Edema	20	6.9	0.6	91.3%	Excellent results in edema reduction, which is the main treatment goal, along with pain decrease and improvement in functionality.
Tendinopathies	22	6.5	1.1	85.1%	Patient physical condition and pathology phase (acute or chronic) may have an impact on treatment results. Best results are associated to active patients and acute phase.
Trauma	13	7.5	0.5	93.3%	Optimal results. In particular, the treatment is useful as first line treatment to manage acute pain and therefore allow the patient to carry out recovery exercise.
Arthrosis	18	6.4	0.4	93.8%	Good results even in patients used to Hyaluronic Acid injections. In some patients, rebound effect was possible after first treatments, but it was anyway solved with treatment progress.
Trigger points	6	NA	NA	NA	Trigger point treatment is always part of another treatment session, therefore there is no specific VAS evaluation dedicated to TP.

Table I - Summary of the VAS changes in the treated patients.

the results of their routine practice using HIRO TT approach. Nevertheless, that patient series was treated with a highly personalized approach, that is typical of physiotherapy centers which have long term experience in laser therapy, and specifically with Hilterapia®. While, with this case collection, the authors have demonstrated that the creation of standardized practices dedicated to the most common conditions (muscle contracture, edema, tendinopathies, trauma/contusion, arthrosis and trigger point) can be a useful tool to share the experience of early users to other colleagues which have less familiarity with Hilterapia®. The suggested practices are describing how to integrate the use of the three components of the therapy and have demonstrated that very good results can be obtained without the need of creating new treatment protocols for each single treated patient.

The use of the practice suggestions allows to reach an average of 90% pain decrease, which is an excellent result. It should be underlined that the use of practices provides guidance that allows early users who treat patients not only to guarantee safety of treatment, but also to leverage on the clinical experience of skilled therapists, providing advantages in terms of confidence, time optimization and homogeneity.

CONCLUSION

The reported clinical experience supports the conclusion that the HIRO TT practice suggestions described in this paper are suitable to be used as general protocol directions for clinical routine practice:

- Contracture
- Edema
- Tendinopathies
- Trauma
- Arthrosis
- Trigger points

Considering that the use of the device is operator dependent, those practical advices have the aim of providing guidance for making immediately available the beneficial effects of HIRO TT since the first treatments carried out by new users which have little or no experience with the device or with laser therapy.

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Laser Acupuncture in behavior problems of dog

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ABSTRACT

The purpose of this paper is to evaluate the effect of laser Acupunture in dog behavioral disorders, such as obsessive-compulsive disorders, phobia, anxiety, aggression. Laser Acupunture can be used as the only therapy or as an add-on therapy to Western behavioral therapies.

Patients were selected based on the presence of behavioral disorders, and assessed both according to an ETEC grid, modified by the Author, and following the Traditional Chinese Medicine directions. The Laser unit used was the Mphi Vet Orange. In every acupoint the following parameters have been applied: Frequency 1168 Hz, Time 10 seconds, Energy 2,059 J, Energy per surface unit 16,39 J/cm^2. In this case series, some fixed acupoints were used for all the patients, other were specifically related to the pathology. Additionally, we used *Shen* and *Gui* points. Every patient underwent four or five sessions on a weekly basis, with the exception of one dog that was treated three times.

The use of laser Acupunture for the treatment of various behavioral disorders in dogs has led to the improvement or disappearing of clinical symptoms in nine out of ten patients. The results of this experimental study show that laser Acupunture represents a valid therapeutic resource for the treatment of behavioral disorders of the dog.

INTRODUCTION

Laser Acupunture is defined as the application of laser therapy in Acupunture points to promote therapeutic effects similar to those of traditional Acupunture together with laser biological benefits.

In the past, laser Acupunture has been applied in humans and animals demonstrating that, compared to traditional Acupunture, it is not painful and non-invasive, being therefore better accepted by the patients. In dogs and horses, laser Acupunture has been used to treat infected wounds and to promote healing of necrotic wounds. In these cases, the following points have been treated: SP2 (*Dadu*), SP4 (*Gong Sun*) and TH5 (*Waiguan*) [1].

Another study took into consideration the use of laser Acupunture for the postoperative management in cats undergoing ovariohysterectomy. Twenty cats were sedated with intramuscular ketamine, midazolam, and tramadol. Prior to induction of anaesthesia, the subjects were randomly distributed into two groups of 10 cats:

- Laser: bilateral ST36 and SP6 acupoints were stimulated with infrared laser;
- Control: no Acupunture was applied.

Despite pain scores did not differ between groups, postoperative supplemental analgesia was required by significantly more cats in the Control (5/10) compared to the Laser group (1/10) (P= 0.038). The Authors concluded that laser Acupunture reduced postoperative analgesic requirements in cats undergoing ovariohysterectomy [2].

Laser Acupunture has been applied in equine medicine to treat a variety of conditions, including poor performance due to anemia and weakness from Babesia Equi infection, traumas of the withers, chronic keratitis declared incurable, cough and bronchospasm and risk of recurrence of myoglobinuria, gastritis and behavioral disorders, for the treatment of cases of dermatitis [3] and the desmitis of the proximal insertion of the suspensory ligament of the fetlock [4]. Moreover, laser Acupunture has been applied in horses to improve sport performance [5]. Recently, a study by Lamontanara [6] has compared Acupunture and laser therapy in the treatment of pathologies of the anterior limb in the dog. Animals were treated with: Acupunture alone, laser therapy alone on acupoints, laser therapy alone on the affected joint or a combination of Acupunture and laser therapy. Results demonstrated that the association of Acupunture and laser therapy in the lameness of the front limb represents the best therapeutic approach, as it combines the analgesic and regenerative effect of the laser with the energy rebalancing effect of Acupunture.

In the field of behavioral and psychiatric conditions, both Acupunture and laser therapy have been applied to human patients. Quah-Smith et al performed a study with MRI [7] and reported that laser and needle Acupunture at LR8 in healthy participants produced different brain patterns. Laser Acupunture activated the praecuneus relevant to mood in the posterior default mode network while needle Acupunture activated the parietal cortical region associated with the primary motor cortex. As a consequence, it is suggested that laser Acupunture in LR8 may be useful for mood disorders,

while traditional Acupunture in LR8 may be more appropriate for function rehabilitation.

Dog behavioral problems include phobia, anxiety, depression, obsessive-compulsive disorders or OCDs, aggression and the hypersensitivity/hyperactivity syndrome.

In the Traditional Chinese Medicine, body and spirit are not considered as separate entities, as it is for occidental medicine: mental activity (*Shen*) and body function are inseparable. The physical and mental aspects are subjected to constant transformation and each physical process has mental implications and vice versa. *Shen* pathologies concern what in the West is the psychic sphere of the person and one can find similarities between these pathologies and the psychiatric pathologies of Western Medicine. It is of primary importance, in the presence of a certain symptomatology, to investigate the pathogenesis, which, while in Western Medicine concerns the identification of the neurotransmitters involved in the pathology, in TCM it is applied through the four phases and the eight rules of the visit.

In the treatment of behavioral problems of the dog, Acupunture has been successfully applied to treat acral lick dermatitis in a Rottweiler [8] and to treat psychodermatosis in a Greyhound [9].

This paper describes the application of laser Acupunture in the treatment of behavioral problems in a series of dogs. The idea is about integrating the skills of veterinary behavioral medicine with those of Traditional Chinese Medicine and in particular of Acupunture, in order to obtain the greatest therapeutic success with patients suffering from behavioral disorders, meaning the greater well-being of the patient himself and of the whole family group. The choice of the laser puncture method was made for some of its peculiar characteristics, particularly suited to the types of subjects to be treated, such as the total absence of nociceptive stimuli and the speed of execution.

MATERIALS AND METHODS

The case series comprised 10 dogs affected by behaviour problems and treated using the Mphi Vet Orange device (ASA srl, Italy). This is a NIR diode laser belonging to class IV NIR laser and using two synchronized sources with different features (such as wavelength, peak power and emission mode). One source is a pulsed 905nm laser diode (75 W peak power). The pulse frequency can vary in the range 1-2000 Hz. The second source is 808 nm laser diode that can operate in continuous (power 1 W) or frequenced (repetition rate 1-2000 Hz, 550mW mean optical power) mode, with a 50% duty ratio which is independent of the repetition rate. The two sources are synchronised and the propagation axes of the laser beams are coincident. All the cases have been treated with the following parameters for each acupoint: Frequency = 1168 Hz, Time= 10 sec, Energy= 2059J, Dose= 16,39 J/cm^2. Patients were selected based on the presence of behavioral disorders, and assessed both according to an ETEC grid (evaluation scale of emotional and cognitive disorders [10]) modified by the Author, and following the Traditional Chinese Medicine (TCM) directions.

This grid allows to evaluate, through the assignment of a score, the centripetal behaviors of the patient, considering food assumption, dipsic and somesthesic behavior and sleep; and centrifugal behaviors, such as exploratory and aggression behavior, social learning and specific learning. The evaluation ends with the clinical examination, which detects the possible presence of symptoms such as diarrhea, tachypnea, dyspepsia, emotional urination, skin symptoms such as licking granuloma, obesity, polyuria-polydipsia. The score assigned to each patient for each individual item was highlighted in the table with a red color and an asterisk. The table was used, with the assignment of a score, before the beginning of the therapy, at each session and at the end of the Acupunture sessions.

The assignment of a score allows an objective evaluation of the pathology and of any improvements resulting from the Acupunture therapy. A score above 13 indicates the presence of behavioral disorders related to phobia, anxiety, aggression or deficit of self-controls.

Each patient was examined according to the prescriptions of TCM, according to the four diagnostic elements (*Zhen Duan*): inspection, auscultation and olfactory analysis, anamnestic questioning and palpation and according to the Eight Principles (*Ba Gang*): internal-external, cold-heat, empty-full, *yin-yang*.

Acupoints used in this study:

- For all the patients: **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*)
- Specific for the pathology: outer branch of the Bladder channel : **BL44** (*Shentang*), **BL47** (*Hunmen*), **BL49** (*Yishe*), **BL52** (*Zhishi*)
- For the *Shen*: **HT7** (*Shenmen*), **BL62** (*Shenmai*), **LR2** (*Xiang jian*), **KD4** (*Dazhong*), **KD6** (*Zhaohai*)
- *Gui* points (used in triplets in single sessions): **GV26** (*Gui Gong*), **LU11** (*Gui Xin*), **SP1** (*Gui Lei*), **PC7** (*Gui Xing*), **BL62** (*Gui Lu*), **GV16** (*Gui Zhen*), **ST6** (*Gui Chuang*), **CV24** (*Gui Shi*), **PC8** (*Gui Ku*), **GV23** (*Gui Tang*), **CV1** (*Gui Cang*), **LI11** (*Gui Tui*).

Each patient underwent four or five sessions on a weekly basis, with the exception of one dog that was treated three times.

Results have been statistically analyzed by ANOVA test, comparing average scores of the 10 dogs during the first and the last treatment sessions.

RESULTS

CASE #1

Flick, female Border Collie, 8 months old. Initial score=16. Main problem is represented by a compulsive behavior: Flick repeats the same exercise (jumping over a stick) again and again, even if her owner drops the stick and

walks away. Recently, she has also displayed fear of people (known and unknown). According to TCM: optimal *Shen*, dark pink tongue with poor coating, deep and thin pulse, normal *Back Shu*. Wood element, 8 rules: internal, empty, cold, *yin*. Energy level: *Tai Yin*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL49** (*Yishe*), left **LR2** (*Xiang jian*). First Gui triplet: **GV26** (*Gui gong -Renzong*), **LU11** (*Gui xin-Shaoshang*), **SP1** (*Gui lei-Yinbai*).
Second session: pulse is normal, more superficial and fuller. Given the improvement, the therapy is the same without bilateral **KD27** (*Shufu*).
Third session: no changes, same therapy with a different *Gui* triplet: bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*).
Fourth session: no changes, same therapy with a different *Gui* triplet: bilateral **ST6** (*Gui chuang- Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*).
Fifth session: no changes, same therapy with a different *Gui* triplet: **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
During the treatment period, Flick has reduced the compulsive behavior. Final score=13.

CASE #2

Astor, male half-breed, 1 year and 10 months old. Initial score=18. Interspecific territorial aggression, characterized by impulsiveness and absence of self-control. The normal sequence of aggression is not respected: the threat and appeasement phases are absent. Astor attacks visiting men and women as soon as they enter the garden or home. He doesn't growl before attacking. The bite is strong and restrained. Leave the grip only if forced. Presents predatory aggression (predation) towards the feet of guests seated at the table. According to TCM: optimal *Shen*, normal pulse, dark pink tongue with thin fissures on the entire surface. *Back Shu*: empty BL25, BL27, BL28. Fire element, *Ba Gang*: external, hot, full, *yang*. Energy level: *Shao Yang*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL47** (*Yishe*), **HT7** (*Shenmen*).
Second session: the owners refer that Astor has more self-control and his behavior with guests is more acceptable. The therapy is the same (without bilateral **KD27** (*Shufu*) with the addition of the third *GUI* triplet: bilateral **ST6** (*Gui chuang- Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*). This was decided based on the presence of the point **PC8** (*Ben* point), Fire on Fire, Astor's element.
Third session: Astor has acquired an excellent level of self-control and is manageable at the arrival of guests. He no longer "pinches" the feet of people sitting at the table. The therapy is the same, with the fourth *GUI* triplet: **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
For family reasons of owners, Astor was not subjected to further sessions. Contacted by telephone, they report that Astor's aggression towards the guests is frankly reduced and there have been no further attacks.

CASE #3

Zeus, male, Labrador Retriever, 8 years old. Initial score=19. Affected by obsessive-compulsive disorder with licking of the forelimbs, Zeus lives with Elizabethan collar. According to TCM: optimal *Shen*, normal tongue (color, coating and shape), normal *Back Shu*, pulse deep (less on the left). Minister fire element, *Ba Gang*: internal, cold, empty, *yin*. Energy level: *Tai Yin*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL49** (*Yishe*), **HT7** (*Shenmen*). The second *GUI* triplet was used: bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*). This was decided based on the presence of the point **PC7** on the Pericardium channel, Hearth ministry, for the specific action on *Shen*.
Second session: the owners refer that Zeus has improved. The dog doesn't lick his forelimbs even if the collar is removed. The therapy is the same (without bilateral **KD27** (*Shufu*) with the addition of the third *GUI*: bilateral **ST6** (*Gui chuang- Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*).
Third & fourth session: Zeus has not presented any obsessive compulsive disorder ever after the treatment. Pulses are more superficial, thin and quick after the third session. The therapy is the same, with the fourth *GUI* triplet: **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
Fifth session: Zeus has not presented any obsessive compulsive disorder ever after the treatment. Treatment as third/fourth sessions with the first *GUI* triplet: **GV26** (*Gui gong -Renzong*), bilateral **LU 11** (*Gui xin-Shaoshang*), bilateral **SP1** (*Gui lei-Yinbai*).
Zeus has not presented any obsessive-compulsive disorder ever after the treatment. Final score=12.

CASE #4

Jack, neutered male, Golden Retriever, 7 years old. Initial score=15. Simple post-traumatic phobia, with freezing, tachycardia and tachypnoea, due to firecrackers explosions nearby. Since then Jack is afraid of urban context. According to TCM: optimal *Shen*, red, large and thin tongue with poor coating and protruding on the sides, *Back shu* empty BL23 (*Shenshu*), deep, thin and quick pulse. Earth element, *Ba Gang*: internal, cold, empty, *yin*. Energy level: *Shao Yin*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL52** (*Zhishi*).
For all the following sessions: **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL52** (*Zhishi*), **HT7** (*Shenmen*), with first *GUI* triplet (for the second session): **GV26** (*Gui gong -Renzong*), bilateral **LU 11** (*Gui xin-Shaoshang*), bilateral **SP1** (*Gui lei-Yinbai*), second *GUI* triplet (for the third session): bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*), third *GUI* triplet (for the fourth session): bilateral **ST6** (*Gui chuang- Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*) and fourth

GUI triplet (for the fifth session) **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
No changing during the treatment. Unchanged final score.

CASE #5

Amy, female Border Collie, 4 and ½ years old. Initial score=17. Obsessive-compulsive disorder characterized by afinalistic predation without a phase of spontaneous arrest against lights and carpal licking without lesions. Simple phobia with inhibition in presence of loud noises, such as explosions, storms, crowd. According to TCM: optimal *Shen*, dark red and very wet tongue (thin fissures are present all over) which is very elongated and protruding outside the mouth, *Back Shu* empty and painful BL18 (*Ganshu*), deep and thin pulse (KD *Yin* and KD *Yang* are not well perceivable). Wood element, *Ba gang*: internal, cold, empty, *yin*. Energy level: *Shao Yin*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL49** (*Yishe*), with first *GUI* triplet: **GV26** (*Gui gong -Renzong*), bilateral *LU11* (*Gui xin-Shaoshang*), bilateral **SP1** (*Gui lei-Yinbai*),
From the second session tongue fissures are present on the tip only.
For the following sessions, the therapy is the same without bilateral **KD27** (*Shufu*) with the addition of the second *GUI* triplet (second session): bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*), third *GUI* triplet (for the third session): bilateral **ST6** (*Gui chuang- Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*) and fourth *GUI* triplet (for the fourh session) **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
During the whole period of laser Acupunture therapy, the stereotypies related to licking and lights have resolved. The fear of thunderstorms has been greatly reduced. Amy showed fearful behavior, hiding under the bed, only in the presence of very loud thunder. Final score=12.

CASE #6

Pippo, neutered male, half-breed, 5 years old. Initial score=31. Pippo presents a deficit of self-controls with bulimia; non pathological hyperactivity; intra and extra specific fear aggression, without the threat phase, with not strong bites, when on a leash; resource-related aggression; emotional urination. According to TCM: optimal *Shen*, normal tongue, *Back Shu* empty **BL23** (*Shenshu*), deep and thin pulse (KD *Yang* is not well perceivable). Wood element, *Ba gang*: internal, cold, empty, *yin*. Energy level: *Shao Yin*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL49** (*Yishe*), bilateral **BL52** (*Zhishi*), with the first *GUI* triplet: **GV26** (*Gui gong -Renzong*), bilateral **LU 11** (*Gui xin-Shaoshang*), bilateral **SP1** (*Gui lei-Yinbai*).
For the following sessions: **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL49** (*Yishe*), bilateral **BL52** (*Zhishi*), **HT7** (*Shenmen*), **KD4** (*Dazhong*), **KD6** (*Zhaohai*) with the second *GUI* triplet (second session): bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*), third *GUI* triplet (for the third session): bilateral **ST6** (*Gui chuang- Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*) and fourth *GUI* triplet (for the fourth session) **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
From the second laser session, Pippo does not pull on the leash and does not attack other dogs on a walk. The pulse and back shu have normalized. The owner, decides to continue with the sessions. Final score=24

CASE #7

Bloody, neutered female, Bullmastiff, 5 years old. Initial score=12. Simple phobia with paroxysmal anxiety during travels by car. Bloody started this behaviour two years ago, without an evident cause. Since then she refuses to enter the car and, if forced, reacts displaying freezing, tachycardia and tachypnea. According to TCM: optimal *Shen*, side protruding tongue, *Back Shu* empty BL15 (*Xinshu*) and reactive BL23 (*Shenshu*), normal pulse. Water or Metal movement, *Ba gang*: internal, cold, empty, yin. Energy level: *Shao Yin*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral, **BL44** (*Shentang*), **HT7** (*Shenmen*) with the first *GUI* triplet: **GV26** (*Gui gong -Renzong*), bilateral **LU 11** (*Gui xin-Shaoshang*), bilateral **SP1** (*Gui lei-Yinbai*). During the half-hour

drive home from the clinic, after the first session, Bloody showed no anxiety. In the following days, the pathological behavior returned. Alpha-casozepine (Zylkene®) has been prescribed according to the specific protocol for the fear of car travel, without obtaining any therapeutic effect.
For the following sessions: **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral, **BL44** (*Shentang*), **BL52** (*Zhishi*), **HT7** (*Shenmen*), with the second *GUI* triplet (second session): bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*), third *GUI* triplet (for the third session): bilateral **ST6** (*Gui chuang- Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*) and fourth *GUI* triplet (for the fourth session) **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
From the second laser Acupunture session, Bloody gets into the car without reluctance and shows no signs of fear and anxiety. From the third session, **BL23** (*Shenshu*) is no more reactive. Final score=10.

CASE #8
Sofia, female half-breed, 10 months old. Initial score=24. Main problems are obsessive-compulsive disorder with licking a surgical scar on the thigh two months after surgery and simple phobia of people. According to TCM: optimal *Shen*, normal tongue, deep, quick and thin pulse (KD *Yin* and KD *Yang* are not well perceivable), *Back Shu* empty **BL23** (*Shenshu)*. Likely, wood element, *Ba Gang* internal, empty, cold, *yin*. Energy level: *Tai Yin*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL4**9 (*Yishe*), bilateral **BL52** (*Zhishi*), **KD4** (*Dazhong)*, **KD6** (*Zhaohai*) with the first *GUI* triplet: **GV26** (*Gui gong -Renzong*), bilateral **LU 11** (*Gui xin-Shaoshang*), bilateral **SP1** (*Gui lei-Yinbai*).
For the following sessions, the therapy is the same (without bilateral **KD27** (*Shufu*) with the addition of the second *GUI* triplet (second session): bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*), third *GUI* triplet (for the third session): bilateral **ST6** (*Gui chuang-Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*) and fourth *GUI* triplet (for the fourh session) **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
At the end of the protocol of four sessions with Acupunture laser, Sofia is no longer affected by obsessive compulsive disorder and bulimia, emotional urinations have been reduced. Final score=17.

CASE #9
Nihal, female, Weimaraner cross-breed, 7 months. Initial score=17. Paraphysiological hyperactivity due to age and character. According to TCM: optimal *Shen*, dark pink tongue with fissure all over and poor coating, normal *Back Shu*, deep, quick and thin pulse. Fire element, *Ba gang*: external, hot, full, *yin*. Energy level: *Shao Yin*.
First session: bilateral **KD27** (*Shufu*), **CV15** (*Jiuwei*), **GV**9 (*Zhiyang*), bilateral, **BL44** (*Shentang*).
For the following sessions: **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral, **BL44** (*Shentang*). **HT7** (*Shenmen*), with first *GUI* triplet (second session): **GV26** (*Gui gong -Renzong*), bilateral **LU 11** (*Gui xin-Shaoshang*), bilateral **SP1** (*Gui lei-Yinbai*), the second *GUI* triplet (third session): bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*), third *GUI* triplet (for the fourth session): bilateral **ST6** (*Gui chuang- Jiache*), **CV24** (*Gui shi-Chengjiang*), bilateral **PC8** (*Gui ku-Laogong*) and fourth *GUI* triplet (for the fifth session) **GV23** (*Gui tang-Shangxing*), **CV1** (*Gui cang-Huiyin*), bilateral **LI11** (*Gui tui-Quchi*).
No long-lasting changes. The increased exploratory behavior (hyperactivity, in this case) resolves only for a short period of time, at least twelve hours after the treatment. Probably in this case it would have been useful to increase the frequency of the sessions. Final score=16.

CASE #10
Biro, male, Springer Spaniel, 12 years old. Initial score=18. Obsessive Compulsive Disorder with licking and nibbling of the forelimbs. According to TCM: optimal *Shen*, normal tongue (color, shape and coating), *Back Shu* empty BL23 (*Shenshu*), deep, thin pulse (not well perceivable in correspondence of the left "thumb"). Moaning voice. Wood element,) *Ba gang*: internal, cold, empty, *yin*. Energy level: *Tay Yin*.
First, third and fourth sessions: **CV15** (*Jiuwei*), **GV9** (*Zhiyang*), bilateral **BL49** (*Yishe*), **HT7** (*Shenmen*), with the first *GUI* triplet: bilateral **LU11** (*Gui xin-Shaoshang*), bilateral **SP1** (*Gui lei-Yinbai*). **GV26** (*Gui gong -Renzong*) was not used as Biro was annoyed. Licking improves after the session.
For second sessions, the therapy is the same without bilateral **KD27** (*Shufu*) with the addition of the second *GUI* triplet (second session): bilateral **PC7** (*Guixing-Daling*), bilateral **BL62** (*Gui lu-Shenmai*), **GV16** (*Gui zhen-Fengfu*).
From third session, licking is resolved and the fourth is a maintenance session. At the end of the laser therapy cycle, the obsessive-compulsive disorder is resolved. Final score=11.

RESULTS

The series has taken into account the effect of laser therapy on several dog behavioral problems. Specifically, the conditions treated were:

- Compulsive Obsessive Disorders (OCD) at different stages of pathology evolution
- Post traumatic phobia
- Paroxysmal anxiety
- Paraphysiological hyperactivity
- Aggression
- Self-control deficit and fear

All the treated patients, except Jack, have improved (see Figure 1), demonstrating that the application of laser Acupunture therapy on behavioral problems determined clinical resolution or improvement in 9 dogs out of 10.
Considering the overall score, the decrease from the first to the last sessions is statistically significant (test value F=5.417, with p=0.0318). Average score at first session is 18.7 ± 1.67. Average score at last session is 14.3 ± 1.28 (Figure 2).

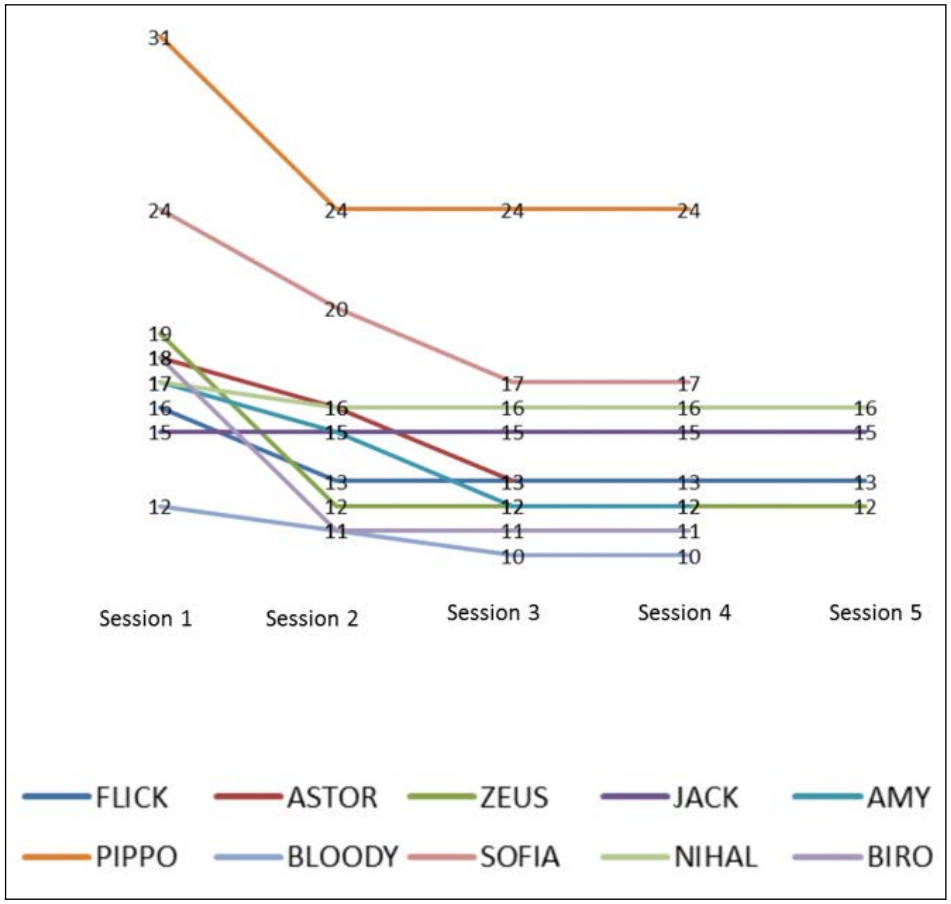

Figure 1 - Results obtained on 10 dogs

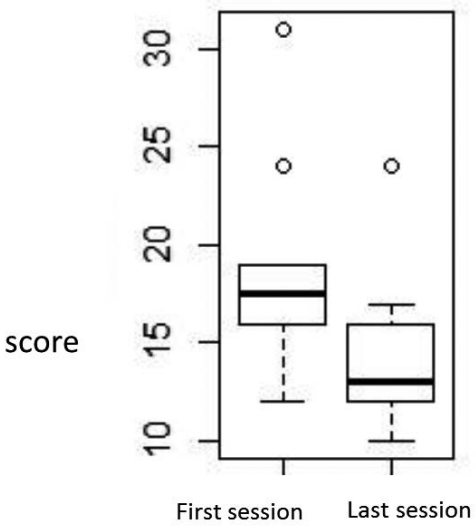

Figure 2 - Comparison between average score value at first and last sessions.

DISCUSSION

In veterinary behavioral medicine, behavioral therapy plays a role of primary importance, although sometimes it is not sufficient to achieve a satisfactory therapeutic result for the well-being of the patient and his family group. Inevitable, therefore, is the use of pharmacological therapies which, in addition to often having side effects, do not always lead to a truly effective therapeutic result, especially in some types of pathologies such as dog obsessive compulsive disorders, sometimes having a genetic etiology. Some of the dogs that have participated in this study had been treated pharmacologically in the past for serious behavioral pathologies, then resolved, with consequent reduction and suspension of the drug, and that years later they presented stereotypies on an anxious basis.

Acupunture, unlike Western Medicine, does not act on the symptom, but on the individual as a whole, as a body-mind unit. From this it is clear that its therapeutic effect acts in a more harmonious and profound way on the patient's well-being. The data collected with this case series confirm that the application of laser Acupunture is an effective tool to manage dog behavioral problems.

CONCLUSIONS

Laser Acupunture is a practical and effective tool for the treatment of dogs with behavioral disorders due to its speed of execution and the total absence of nociceptive stimuli.

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ACKNOWLEDGEMENTS

Concise acknowledgements may be addressed to persons, public and private organizations, companies.

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2. Michaeli W. Extrusion Dies. Hanser Publishers, Munich, Vienna, New York, 1984.

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3. Gmünder FK, Cogoli A. Effect of space flight on lymphocyte function and immunity. In: Fregly MJ, Blatteis CM, eds. Handbook of Physiology. Oxford:University Press, 1996, vol. 2, pp 799-813.

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